Technische Universität Braunschweig

Research

Technische Universität Braunschweig

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Preface

welcome

Historic central building of the university

Technische Universität Braunschweig

Welcome to a short compilation of Technische Universität Braunschweig's scientific activities. Founded in 1745, our university is the oldest technical institute in Germany and pertains to the German Institutes of Technology e. V. (TU9). With close to 20,000 students, 5,700 employees and 225 professors, Technische Universität Braunschweig is a mid-sized public university. Our 120 institutes are organized in 6 departments and provide 71 different Bachelor's and Master's degree programs.

Our departments:

1. Carl-Friedrich Gauß Department:
   Mathematics, Computer Science, Business Sciences, Social Sciences
2. Department of Life Sciences:
   Biology, Chemistry, Pharmacy, Psychology
3. Department of Architecture, Civil Engineering and Environmental Sciences
4. Department of Mechanical Engineering
5. Department of Electrical Engineering, Information Technology and Physics
6. Department of Humanities and Educational Sciences

Collegium Carolinum around the year 1746

Our curricula are highly research-oriented. Consequently, teaching and leveraging world-class science go hand in hand. As a technical university, we also co-operate with numerous industry partners from around the world. Several new research centres facilitate this science-oriented educational process. The newly-established graduate academy Grad[TUBS] provides tailor-made training courses for our doctoral students, as well as contacts to potential employers.

The Braunschweig Research Region

This research compilation lists scientists and their research interests in a compact form. If you look carefully, you will find that several colleagues from local research institutions are an integral part of our scientific network in Braunschweig, with our university as the integrative heart.

The Braunschweig/Wolfsburg region is one the most active research regions in Europe, with more than 15,000 researchers living and working in the area. Many of the local research institutions listed below are linked to our university through cooperation agreements, facilitating joint research and the coordination human resources development.

Special issue stamp on the occasion of the 250th birthday of our university

Our research partners:

Braunschweig University of Art
Federal Research Institute for Rural Areas, Forestry and Fisheries (Thünen Institute)
Federal Research Centre for Cultivated Plants (Julius Kühn Institute)
Fraunhofer Institute for Wood Research (WKI)
Fraunhofer Institute for Surface Engineering and Thin Films (IST)
Georg Eckert Institute for International Textbook Research (GEI)
Helmholtz Centre for Infection Research (HZI)
Leibniz Institute German Collection of Microorganisms and Cell Cultures (DSMZ)
German Aeronautics and Space Research Centre (DLR)
National Metrology Institute of Germany (PTB)
Ostfalia – University of Applied Sciences
Volkswagen AG and many other companies

Our research strategy as part of our mission statement

Integrating partners from regional research institutions into the university's scientific activities is part of our overall strategy at TU Braunschweig. This strategy was developed starting in 2012 as part of a general concept and mission statement building process that involved all members of the university. Not only did we define our aims in research, teaching, governance and personal management; we also agreed on the values that we share at TU Braunschweig, such as a strong commitment to respecting people irrespective of where they come from, participative leadership, and transparency. Please have a look at our website to find out more about TU Braunschweig's aims and values.

The process also resulted in the definition of four strategic research fields:

Mobility (automotive, aircraft, railway)

City of the future

Infections and therapeutics

Metrology

These focal areas of research are of course complemented by numerous other excellent scientific activities.

Our research centres

To facilitate the speedy and active implementation of our research strategy, various joint research centres have been established that host scientific working groups from Technische Universität Braunschweig and its partners under one roof. These centres provide a basis for joint research within the framework of publicly- and commercially-financed consortia.

The following research centres have been established within the last few years or are currently under construction:

- *BRICS – Braunschweig Integrated Centre of Systems Biology*
- *LENA – Laboratory for Emerging Nanometrology*
- *NFF – Automotive Research Centre Niedersachsen with Battery LabFactory (BLB) and Open Hybrid LabFactory (OHLF)*
- *NFL – Aeronautics Research Centre Niedersachsen*
- *PVZ – Center of Pharmaceutical Engineering*

In cooperation with Leibniz University Hannover, TU Braunschweig maintains the coastal research centre

- *FZK – Forschungszentrum Küste*

And last but not least, our computer science and information technology activities are bundled in

- *tubs.city – Centre for Informatics and Information Technology*

Our internationalisation strategy

Research is international by nature. In order to attract excellent researchers from abroad and give our students and scientists the chance to study and do research outside of Germany, a new internationalisation strategy has been established. TU Braunschweig used the Internationalisation Audit offered by the German Rectors' Conference (HRK) to organize and validate this process. Both our International Office and our Language Centre were restructured and equipped with the necessary resources to master the new challenges. Various new processes and measures were initiated and are already showing success – the percentage of incoming and outgoing students and scientists, for example, has clearly increased over the last two years. The process is steered by TU Braunschweig's newly-established Internationalisation Committee.

Final Conclusion

During the last few years, Technische Universität Braunschweig has undergone a significant transformation to establish an even more innovative, inspiring and strongly competitive research environment. Four focal areas in research have been defined during a comprehensive strategic process. Several new research centres have been established and have started to conduct joint research with local research partners and the industry. The university's infrastructure and our internationalisation strategy have been adapted to match the new requirements. The newly-established research infrastructure is instrumental to educating students in a unique science- and practice-oriented way. We are convinced that Technische Universität Braunschweig is an attractive place to live, study and do research. It is also a competent partner to national and international academia and the industry. Come to Braunschweig and find out for yourself!

Prof. Dr.-Ing. Dr. h.c. Jürgen Hesselbach
President

Prof. Dr. Dieter Jahn
Vice President for Research and International Affairs

Prof. Dr.-Ing. Ulrich Reimers
Vice President for Strategic Development and Technology Transfer

1

Carl-Friedrich-Gauß Factorial

Institute of Management Control & Business Accounting (ICU)

Prof. Dr. Heinz Ahn

- TU Braunschweig: Full Professor and CEO of the Institute of Management Control & Business Accounting

Researcher's Career

RWTH Aachen University:

- Teacher at the Chair of Technology and Innovation Management
- Research Assistant at the Chair of Environment Economy and Industrial Control
- Stand-In Professor for Operations Research and Logistic Management
- PhD and Postdoc at the Chair of Environment Economy and Industrial Control
- Study of Business Administration

Funding

DFG, BMBF, industry

Contact

Technische Universität Braunschweig
ICU – Institute of Management Control & Business Accounting
Fallersleber-Tor-Wall 23
38100 Braunschweig
Phone: +49 531 391–3610
hw.ahn@tu-braunschweig.de
www.controlling-tubs.de

Mission Statement

Our group focuses on instruments for planning, measuring and managing the performance of companies, their subunits and their actions. The respective research comprises the following three topics and exemplary problems:

Research

Cost accounting and cost management:

- cost analysis in research & development
- cost-oriented process analysis and optimization
- customization of cost accounting systems

KPI-based planning concepts:

- strategic planning with Balanced Scorecard – BSC
- operationalization of objectives in complex decision scenarios
- implementation of value-based management concepts

Performance control:

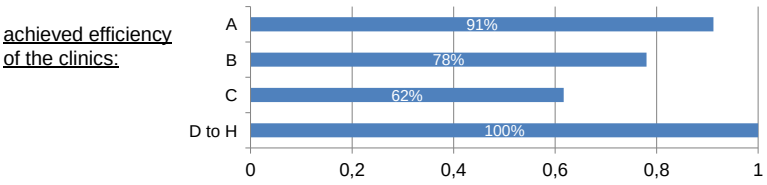
- multidimensional measurement of effectiveness and efficiency
- benchmarking with Data Envelopment Analysis – DEA
- behavioral effects of performance control mechanisms

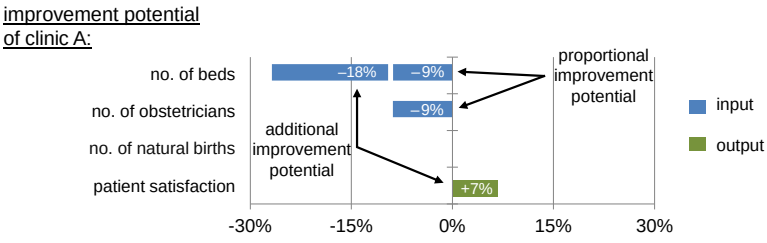
Benchmarking with DEA: An Example from the Health Sector

Comparison of the effiency of 8 maternity clinics

performance criteria

input 1: number of beds
input 2: number of obstetricians
→
output 1: number of natural births
output 2: patient satisfaction





Publications

- Afsharian, M./Ahn, H./Neumann, L. (2016): Generalized DEA – An approach for supporting input/output factor determination in DEA, accepted by: Benchmarking: An International Journal.
- Ahn, H./Vazquez Novoa, N. (2016): The decoy effect in relative performance evaluation and the debiasing role of DEA, in: European Journal of Operational Research 249, No. 3, pp. 959-967.
- Afsharian, M./Ahn, H. (2015): The overall Malmquist index – A new approach for measuring productivity changes over time, in: Annals of Operations Research 226, No. 1, pp. 1-27.
- Afsharian, M./Ahn, H./Alirezaee, M. (2015): Developing selective proportionality on the FDH models – New insight on the proportionality axiom, in: International Journal of Information and Decision Sciences 7, No. 2, pp. 99-114.
- Ahn, H./Le, M. H. (2015): DEA efficiency of German savings banks – Evidence from a goal-oriented perspective, in: Journal of Business Economics 85, No. 9, pp. 953-975.

Department of Social Sciences

Prof. Dr. Nils C. Bandelow

- Chair of Governance and Public Policy, Department of Social Sciences
- Spokesman of the Lower Saxon Research Project "Eskalationsforschung zur Kommunikation großer Infrastruktur- und Bauvorhaben"
- Editor of European Policy Analysis (EPA)
- Editor of the series "Policy Analysis" (Nomos publishing)

Researcher's Career

- Full Professor, Chair of Governance and Public Policy, TU Braunschweig
- Acting Professor at the Heinrich-Heine-Universität Düsseldorf
- DFG Research Fellow and Honorary Research Fellow at the University of Birmingham
- PhD at the Ruhr University Bochum

Funding

BMBF, Lower Saxony, Volkswagen Foundation, Hans Böckler Foundation, Bertelsmann Foundation

Contact

Technische Universität Braunschweig
Department of Social Sciences
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8900
nils.bandelow@tu-braunschweig.de
www.tu-braunschweig.de/innenpolitik

Mission Statement

Understanding public policies, their effects and underlying governance processes is at the core of policy analysis. We undertake empirical studies in different sectors and for societal transitions (e. g. towards sustainability), innovations and new technologies, placing emphasis on inter- and transdisciplinary approaches which combine qualitative and quantitative research methodology.

Research

Mobility and Transport: Since our inception we have specialised in the field of Mobility and Transport politics. Today, research inter alia focuses on conflict escalation in transport and energy infrastructure decision-making and implementation (project: Eskalationsforschung zur Kommunikation großer Infrastruktur- und Bauvorhaben, 2014-2017). We provide scientific analyses and policy advice for all levels of governance: local, regional, and national levels and for the European Union.

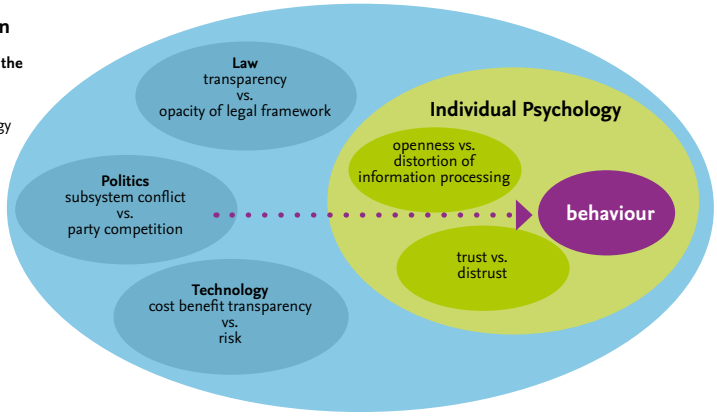
Regional Governance: METAPOLIS is a new inter- and transdisciplinary platform for urban-rural relations which the chair contributes to. Different projects and co-operations in the region of Lower Saxony, with partners from industry or trade unions, for instance, who complement this major research project in which social and natural sciences collaborate.

Public Health Policy: With different partners we collect and analyse representative data in the field of public health (e. g.,"Gesundheitsmonitor"). Our studies also adopt cross-country perspectives.

Policy Evaluation: Research projects equally address the evaluation of policy-making and policies. The chair co-ordinates the development of "Sustainable Governance Indicators" for different European countries and it inter alia conceptualises indicators in the sector of education policy. A transdisciplinary project "Science meets Politics" brings together students, scientists and practitioners in local policy.

Conflict Escalation

Different disciplines of the research consortium:
- social psychology
- educational psychology
- law
- engineering science
- social sciences



Publications

- Bandelow, N./ Lindloff, K./ Sikatzki, S. (2016). Governance im Politikfeld Verkehr: Steuerungsmuster und Handlungsmodi in der Verkehrspolitik. In: Schwedes, O./ Canzler, W./ Knie, A. (eds.). Handbuch Verkehrspolitik. 2. Auflage. Wiesbaden: Springer VS.
- Bandelow, N./ Thies, B. (2014). Gerechtigkeitsempfindungen bei Großprojekten als Ursache von Konflikteskalationen? Vertrauen und Legitimität als moderierende Faktoren illustriert am Beispiel der Konflikte um die Erweiterung des Frankfurter Flughafens. Politische Psychologie 3 (1): 24-37.
- Bandelow, N./ Hartmann, A. (2015). Gesundheitspolitik unter gelb-schwarzer Führung: begrenzte Erklärungskraft der Parteiendifferenz in einem vermachteten Politikfeld. In: Zohlnhöfer, R./ Saalfeld, T. (eds.): Politik im Schatten der Krise. Eine Bilanz der Regierung Merkel 2009-2013. Wiesbaden: Springer VS, 427-449.
- Bandelow, N./ Kundolf, S./ Lindloff, K. (2014). Agenda Setting für eine nachhaltige EU-Verkehrspolitik: Akteurskonstellationen, Machtverhältnisse und Erfolgsstrategien. Berlin: edition sigma.
- Schubert, K./ Bandelow, N. (eds.) (2014). Lehrbuch der Politikfeldanalyse. München: De Gruyter Oldenbourg.

Institute Computational Mathematics – AG Numerik

Prof. Dr. Matthias Bollhöfer

Researcher's Career

- Associate Professor for numerical mathematics, TU Braunschweig, 2006
- Habilitation: TU Berlin, 2003
- Ph.D: (advisor V. Mehrmann), Chemnitz University of Technology, 1998
- Diploma in Mathematics: University of Bielefeld, (advisor A. Bunse-Gerstner), 1992

Employments

- Associate Professor at TU Braunschweig
- Senior Research Assistant, Institute of Mathematics, TU Berlin
- Temporary acting as professor for Numerical Mathematics at TU Braunschweig
- Research Assistant, Institute of Mathematics, TU Berlin
- Research Fellow at the University of Minnesota supported by the DFG
- Research Assistant, Department of Mathematics, Chemnitz University of Technology

Funding

DFG, BMBF, DAAD, ABB

Contact

Technische Universität Braunschweig
Institute Computational Mathematics – AG Numerik
Pockelsstraße 14
38106 Braunschweig
Phone: +49 531 391–7536
m.bollhoefer@tu-braunschweig.de
www.tu-braunschweig.de/icm/numerik/

Mission Statement

The focus of the work of the AG Numerik in research and teaching is on state-of-the art numerical mathematics. It is devoted to the development of novel numerical techniques for the simulation of, for example, physical, engineering and economic processes. We cover all aspects, from basic research to easy-to-use software. Our research and development activities are application driven. We cooperate with many different national and international researchers to foster interdisciplinary exchange and scientific advance.

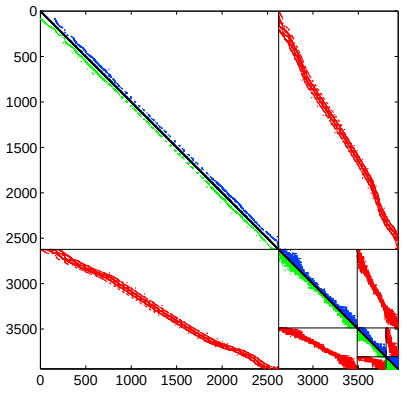
Research

Numerical Analysis, in Particular Fast Solvers for Systems Equations and Eigenvalue Problems, Particulary for Partial Differential Equations: The focus of our research here is the development and theoretical analysis of scalable solvers that allow for efficient solutions for the underlying equations. The solvers are typically based on preconditioning techniques, particulary algebraic multilevel techniques, hierarchical methods.

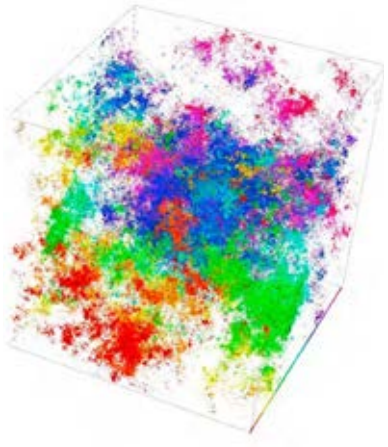
Model Order Reduction for Maxwell Equations: For the large-scale equations reduced-roder models are developped. Our focus lies on moment-matching type approach.
Scientific Parallel Computing: The design of efficient numerical algorithms often requires parallelization and efficient cache-optimized versions of the underlying numerical methods.

Numerical Linear Algebra: As a general approach for many applications, numerical linear algebra techniques are at the heart of most numerical methods.

Development of Numerical Software: Several mathematical challenges require not only the theoretical analysis and model implemenation of numerical methods, but also the development of numerical software. Here two software packackes **ILUPACK** and **JADAMILU** have been developped and further numerical software will be developed as by-products for other research topics.



multilevel factorization



wave function probabilities

Publications

- M. Bebendorf, M. Bollhöfer, and M. Bratsch. On the spectral equivalence of hierarchical matrix preconditioners for elliptic problems. Mathematics of Computation, 2016.
- J.I. Aliaga, R.M. Badia, M. Barreda, M. Bollhöfer, E. Dufrechou, P. Ezzatti, E.S. Quintana-Orti. Exploiting task and data parallelism in ILUPACK's preconditioned CG solver on NUMA architectures and many-core accelerators. Parallel Computing 54:97-107, 2016.
- Andre Bodendiek and Matthias Bollhöfer. Adaptive expansion point selection for rational Arnoldi-type methods in model order reduction of Maxwell's equations. BIT Numerical Mathematics 54(2):357-380, 2014.
- O. Schenk and M. Bollhöfer and R.A. Römer. On Large Scale Diagonalization Techniques for the Anderson Model of Localization. SIAM Review, 50(1):91-112, 2008.
- M. Bollhöfer and Y. Saad. Multilevel preconditioners constructed from inverse-based ILUs. SIAM J. Sci. Comput., 27(5):1627-1650, 2006.

Institute Computational Mathematics – AG Algebra und Diskrete Mathematik

Prof. Dr. Bettina Eick

Researcher's Career

- Professor for Mathematics, TU Braunschweig
- Scientific Assistent, University of Kassel
- Scientific Assistent, University of Würzburg
- Scientific Assistent, RWTH Aachen
- PhD at the RWTH Aachen
- Diplom at the RWTH Aachen
- Studies of Mathematics and Computer Science at the RWTH Aachen and the University of London

- Feodor-Lynen Fellow of the Alexander von Humboldt Foundation
- Member of the Council of the computer algebra system GAP
- Member of the 'Leitung der Fachgruppe Computeralgebra'

Funding

DFG, DAAD, Lower Saxony, Alexander von Humboldt Stiftung

Contact

Technische Universität Braunschweig
Institute Computational Mathematics
Pockelsstraße 14
38106 Braunschweig
Phone: +49 531 391-7525
beick@tu-braunschweig.de
www.icm.tu-bs.de/~beick

Mission Statement

Algebra is one of the oldest and most central disciplines in mathematics. Our work combines the methods of formal abstract algebra with modern computational methods to advance the research in algebra and its applications.

Research

Group Theory: Groups are the mathematical formalization of symmetries. They play a central role in algebra and have various applications in other areas, as, for example, cryptography or crystallography. We develop new theory and new algorithms to investigate and classify groups. In particular, our research team is well known for the explicit classification of groups of small order.

Computer algebra: Computer algebra is a modern branch of algebra. It seeks to combine the methods of formal abstract algebra with modern tools from computer science to develop efficient algorithms for the investigation of algebraic objects. Our group is a well-established German center for computer algebra. It takes part in the development of the international computer algebra system GAP.

Cryptography: Crytography has been used for thousands of years to transmit secret information. In modern times it is used in many places of our daily life: for example, cryptography is used in ATM cards, computer passwords and electronic commerce. Many crytosystems are based on algebraic concepts and it is a branch of applied algebra to design new cryptosystems and to investigate the established ones. Our work includes the design of new cryptosystems based on group theory.

Cystallography: Crystallographic groups are the symmetry groups of crystals. Their investigation and classification has applications in crystallography. Our work includes the design of algorithms to investigate crystallographic groups with a view towards possible applications in crystallography.

Publications

some selected publications (see www.ams.org/mathscinet for a complete publication list)

- D.F. Holt, B. Eick, E. O'Brien. Handbook of computational group theory. Chapman & Hall 2005 (514 pages)
- H.U. Besche, B. Eick, E. O'Brien. A millenium project: constructing small groups. Internat. J. Algebra Comput. 12, 623-644 (2002)
- B. Eick, Metabelian p-groups and coclass theory. J. Algebra 421, 102-118 (2015)
- B. Eick, A. Hulpke. Computing Hall subgroups of finite groups. LMS J. Comput. Math. 15, 205-218 (2012)
- B. Eick. Computing nilpotent quotients of associative algebras satisfying a polynomial identity. Internat. J. Algebra Comput. 21, 1339-1355 (2011)

Institute Computational Mathematics – AG Numerik

Prof. Dr. Heike Faßbender

Researcher's Career

- Head of AG Numerik, Institut Computational Mathematics
- Former Vice President for Teaching, Studies and Further Studies at TU Braunschweig
- Former Dean of Carl-Friedrich-Gauß-Fakultät at TU Braunschweig
- Full Professor for Numerical Mathematics, TU Braunschweig
- Full Professor for Numerical Mathematics, TU München
- Scientific Assistant at University of Bremen
- Habilitation in Mathematics at University of Bremen
- PostDoc at University of Bremen
- Dr. rer.nat. in Mathematics at University of Bremen
- Master of Science in Computer Science at SUNY at Buffalo, NY, USA
- Diplom in Mathematics at University of Bielefeld

Funding

BMBF, DFG, BMWi, Fulbright, industry

Contact

Technische Universität Braunschweig
Institute Computational Mathematics – AG Numerik
Pockelsstraße 14
38106 Braunschweig
Phone: +49 531 391–7535
h.fassbender@tu-braunschweig.de
www.tu-braunschweig.de/icm/numerik/personal/fassbender

Mission Statement

The focus of the work of the AG Numerik in research and teaching is on state-of-the art numerical mathematics. It is devoted to the development of novel numerical techniques for the simulation of, for example, physical, engineering and economic processes. We cover all aspects from basic research to easy-to-use software. Our research and development activities are application driven. We cooperate with many different national and international researchers to foster the interdisciplinary exchange and scientific advance.

Research

The common theme of our research is "Numerical Linear Algebra": The following problems are considered to be the standard problems of numerical linear algebra:

- Linear systems of equations: Solve $Ax=b$, where A is a given n-by-n nonsingular real or complex matrix, b is a given column vector of length n, and x is a column vector with n entries that we wish to compute.
- Least squares problems: Compute the vector x that minimizes $\| Ax - b\|_2$ where A is a given m-by-n matrix, b is a given vector of length m, x is of length n, and $\| y\|_2$ is the two-norm of the vector y.
- Eigenvalue Problems: Given an n-by-n matrix A find an n-by-1 vector x and a scalar λ such that $Ax = \lambda x$.

These standard problems often arise in engineering and scientific practise, they are at the heart of most calculations in scientific computing. There are also many variations of these standard problems, e.g.

- Nonlinear eigenvalue problems: $f(\lambda)x = 0$, where f is a given function which depends on some coefficient matrices, e.g., a quadratic eigenvalue problem $f(\lambda) = \lambda^2 M + \lambda C + K$, where the stiffness matrix K and the mass matrix M are real symmetric and positive (semi-)definite and the damping matrix C is real.
- Nonlinear equations $F(x) = 0$ for $F: \mathbb{R}^n \to \mathbb{R}^n$.
- Nonlinear least-squares problem $\|F(x)\| = \min$ for $F: F: \mathbb{R}^n \to \mathbb{R}^n$.
- Matrix equations, like the linear Sylvester equation $AX - XB = C$ or the nonlinear rational discrete-time Riccati equation $X = A^TXA - A^TXB(R + B^TXB)^{-1}B^TXA + Q$.

The applications from which these problems stem come from all kinds of applied sciences; mechanical and electrical engineering as well as medical, pharmaceutical and biological problems. The ever increasing complexity and size of the problems to be solved require a steady progress in developing new algorithms and/or implementations. Especially, the availability of advanced-architecture computers has a significant impact on all fields of scientific computations including algorithm research and software development in numerical linear algebra. New implementations of known algorithms or new algorithms are needed for each new architecture in order to exploit its features.

Publications

- T. Bonin, H. Faßbender, A. Soppa, M. Zäh. A fully adaptive rational global Arnoldi method for the model-order reduction of second-order MIMO systems with proportional damping. Mathematics and Computers in Simulation, Volume 22, pp. 1-19, 2016.
- A. Bunse-Gerstner, H. Faßbender. Breaking Van Loan's Curse: A Quest for Structure-Preserving Algorithms for Dense Structured Eigenvalue Problems in Benner, Bollhöfer, Kressner, Mehl, Stykel (Eds.), Numerical Algebra, Matrix Theory, Differential-Algebraic Equations and Control Theory, Springer ISBN 978-3-319-15259-2, pp. 3-23, 2015.
- P. Benner, H. Faßbender. Model Order Reduction: Techniques and Tools in Baillieul, Samad (Eds.), Encyclopedia of Systems and Control, Springer ISBN 978-1-4471-5057-2 (Print), ISBN 978-1-4471-5102-9 (Online), pp. 1-10, 2014.
- H. Faßbender. Structured Eigenvalue Problems - Structure-Preserving Algorithms, Structured Error Analysis in Handbook of Linear Algebra, Second Edition, CRC Press, Taylor and Francis Group, Chapter 63, 22 Seiten, 2014.
- A. Vendl, H. Faßbender, S. Görtz, R. Zimmermann, M. Mifsut. Model Order Reduction for Steady Aerodynamics of High-Lift Configurations. CEAS Aeronautical Journal, Volume 5, Issue 4, pp. 487-500, 2014.

Institute of Operating Systems and Computer Networks

Prof. Dr. Sándor Fekete

- CEO, TU Braunschweig Center for Informatics and Information Sciences
- Chair, Department of Computer Science

Researcher's Career

- Full Professor for Computer Science, TU Braunschweig
- Associate Professor for Mathematics, TU Braunschweig
- Associate Professor for Mathematics, TU Berlin
- Scientific Assistant at the Center for Parallel Computing, University of Cologne
- Postdoc at Stony Brook University, USA
- Ph.D. at the University of Waterloo, Canada, Department of Combinatorics and Optimization
- Studies of Mathematics and Physics, University of Cologne

Funding

DFG, BMBF, EU, industry

Contact

Technische Universität Braunschweig
Institute of Operating Systems and Computer Networks (IBR)
Mühlenpfordtstr. 23
38106 Braunschweig
Phone: +49 531 391-3110
s.fekete@tu-braunschweig.de
www.ibr.cs.tu-bs.de

Mission Statement

Algorithms and optimization are the core of our modern digital world. Our work combines state-of-the-art fundamental research in theoretical computer science with a wide range of interdisciplinary cooperations with areas such as robotics, distributed systems, electrical engineering, traffic management, biology and economics.

Research

Computational geometry: Our group has grown into one of the leading German centers for computational geometry, a branch of computer science devoted to the study of algorithms dealing with geometry. This includes problems arising from explicitly geometric settings, such as motion planning, geographic information systems, or computer graphics. Our specialty are approximation algorithms for NP-hard geometric problems, as well as exact methods.

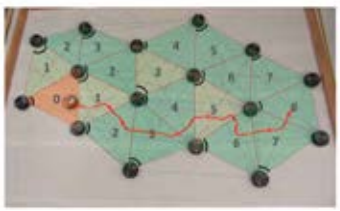
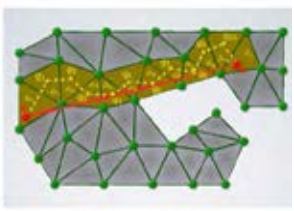
Robot navigation: An algorithmic application area with particularly strong interaction between theory and practice arises from exploring, searching or mapping of a geometric region by one or many autonomous devices. We have developed a range of new algorithmic approaches for a wide spectrum of challenges.

Graph algorithms: Many optimization problems can be formulated in a discrete setting, often by generalizing geometric problems to more abstract scenarios. On the other hand, discretizing continuous geometric setups often leads to a simplified problem. We have made a number of significant contributions to the relationship between geometric and graph problems, in particular to the theory of algorithmic complexity.

Distributed algorithms: While traditional algorithms consider single processors, many new challenges in our modern world arise from combining the local information and local actions of many processors. We continue to make contributions to many related areas, e.g., to distributed sensor networks, which combine the limited capabilities of numerous sensors and actors.

Algorithmics of self-organization: Dealing with many small collaborating agents ultimately leads to the algorithmic theory of programmable matter. We have made a number of contributions to the theory of tile self-assembly, which is based on using DNA as building material. Other recent work considers programming huge particle swarms.

Game theory: How can we understand and improve collaboration between selfish agents? This is a recent research area.

Publications

- S.P. Fekete, J. Hendricks, M. J. Patitz, T. Rogers, R. T. Schweller. Universal computation with arbitrary polyomino tiles in non-cooperative self-assembly. In: Proceedings of the Twenty-Sixth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), pp. 148-167, 2015.
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- G. Coulson, B. Porter, I. Chatzigiannakis, C. Koninis, S. Fischer, D. Pfisterer, D. Bimschas, T. Braun, P. Hurni, M. Anwander, G. Wagenknecht, S.P. Fekete, A. Kröller, T. Baumgartner. Flexible experimentation in wireless sensor networks. Commun. ACM 55(1): 82-90, 2012.
- A. Kröller, T. Baumgartner, S.P. Fekete, C Schmidt. Exact solutions and bounds for general art gallery problems. Journal of Experimental Algorithmics (JEA) 17, 2.3, 2012.
- S.P. Fekete, C. Schmidt, A. Wegener, H. Hellbrück, S. Fischer. Empowered by wireless communication: Distributed methods for self-organizing traffic collectives. ACM Transactions on Autonomous and Adaptive Systems, 5(3), pp. 11:1-30, 2010.

Institute of Marketing

Prof. Dr. Wolfgang Fritz

- Director of the Institute of Marketing at TU Braunschweig
- Head of the Department of Business Administration and Economics at TU Braunschweig
- Director of the international dual degree master program "MiBA/ToM – Braunschweig-St. Petersburg, Russia" at TU Braunschweig

Researcher's Career

- Full Professor of Marketing at TU Braunschweig
- Honorary Professor at University of Vienna, Austria
- Associate Professor of Marketing at Hamburg University of Economics and Politics
- Ph.D., Habilitation, and Venia Legendi for Business Administration at University of Mannheim
- Research Assistant and Lecturer at the Marketing Department, University of Mannheim
- Studies of Business Administration and Economics at University of Mannheim

Funding

DAAD, BMBF, industry

Contact

Technische Universität Braunschweig
Institute of Marketing
Abt-Jerusalem-Straße 4
38106 Braunschweig
Phone: +49 531 391-3203
w.fritz@tu-braunschweig.de
www.tu-braunschweig.de/marketing

Mission Statement

Our mission is to research empirically relevant perspectives of market-oriented management of firms that are of scientific as well as practical importance. Our research is internationally oriented and uses advanced data analysis techniques.

Research

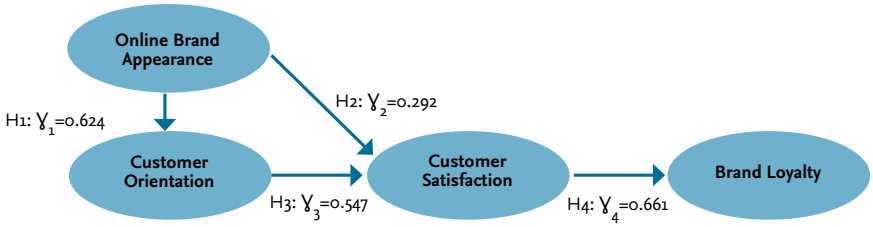
Brand Management: Our large-scale empirical research on brand relationships in the Business-to-Consumer (B2C) area shows four generic types of consumer-brand relationships: "Best friendship", "unemotional purpose-based relationship", "loose contact", and "happy partnership". Against this background, the brand-positioning strategies of firms can be evaluated. Another subject is the online brand communication in Business-to-Business (B2B) settings. According to our findings, online brand communication supports the positive impact of customer satisfaction on brand loyalty of industrial customers.

Online and Mobile Marketing: Since 1997, many topics of Internet marketing have been researched empirically. Currently we are analyzing the satisfaction of consumers within multi-channel marketing systems of retailers during the steps of the consumers' decision process. In addition, research on mobile marketing activities on smartphones and tablets are carried out. We address research questions involving topics like mobile shopping, mobile advertising, and mobile market research. In particular, the impact of mobile online shop atmospherics and complexity on consumers' behavior are analyzed by using experimental designs.

Sustainability: Sustainability represents an important guideline for future-oriented marketing and management. We have introduced and empirically validated a multidimensional concept and scale of sustainable consumption. Furthermore, we have empirically identified important drivers as well as consequences of sustainable consumption for firms, consumers (e.g., anti-consumption), and society as a whole.

Intercultural Communications: Intercultural challenges for business communications between German and Chinese managers are empirically researched in cooperation with international partners, as well as the impact of global educational tools on intercultural awareness and sensitivity of business students in Germany, USA, Russia, and China.

B2B Online Brand Communication and Brand Loyalty (Fritz & Will-Baumkauff, 2016)



Publications

- W. Fritz, B. Seegebarth, & S. Sohn (Eds.), "Mobile Marketing", Special Issue, Psychology & Marketing, Hoboken, NJ, Wiley, USA, 2016.
- W. Fritz & B. Wille-Baumkauff, "B2B Online Brand Communication and Brand Loyalty", Proceedings of the 2016 Global Marketing Conference, Hong Kong, China, 2016.
- W. Fritz, I. O. Trushnikova, & N. Mundorf, "Improving Intercultural Awareness via International Online Debates between Russia and the U.S.", Proceedings of the 6th EMAC Reginal Conference, Vienna, Austria, 2015.
- I. O. Trushnikova, W. Fritz, N. Mundorf, & W. Lu, "Online Debates as a Tool to Promote Global Awareness of Culture and Sustainability in Business and Communication", China Media Research, Vol 11 (4), pp. 100-109, East Lansing, MI, USA, and Hangzhou, Zhejiang, China, 2015.
- I. O. Trushnikova, W. Fritz, & R. Nataraajan, "Holistic Brand Management in B2B Settings", Marketing in the Digital Economy, No. 1, pp. 1-22, St. Petersburg, Russia, 2015.

Institute of Finance

Prof. Dr. Marc Gürtler

Researcher's Career
- Full Professor of Finance, TU Braunschweig
- Habilitation, RWTH Aachen University
- Assistant Professor at the School of Business and Economics, RWTH Aachen University
- Assistant Professor at the Department of Economics, University of Bonn
- Dr. rer. pol., University of Bonn
- Scientific Assistant at the Department of Economics, University of Bonn
- Scientific Assistant at the Mathematical Institute Cologne, University of Cologne
- Studies of Mathematics, University of Cologne

Funding
State Lower Saxony, industry, DFG

Contact
Technische Universität Braunschweig
Institute of Finance
Abt-Jerusalem-Straße 7
38106 Braunschweig
Phone: +49 531 391–2896
marc.guertler@tu-braunschweig.de
www.fiwi.tu-bs.de

Mission Statement

Our mission is to expand knowledge and understanding of financial risks. We investigate potential risk drivers as well as market behavior and develop methods to assess and control risks in financial institutions.

Research

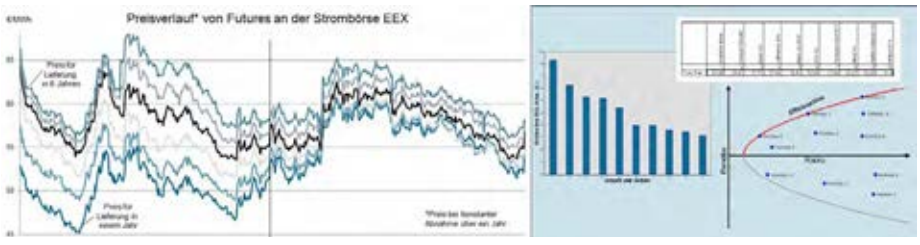
Credit Risk: The consequences of the financial crisis and the increase in regulatory requirements are of particular interest in Banking and Finance. Against this background, we have made a number of significant contributions to the analysis of credit risk parameters in banks and concentration risk in credit portfolios. Currently, we are focusing on informational synergies between different sources of bank information to manage credit risks and customer relationships.

Catastrophe Risk: In the aftermath of a natural disaster, there is increased demand for skilled re-construction labor, which leads to significant increases in reconstruction labor wages. Such inflation effects are known as "Demand Surge" effects. It is important for insurance companies and their investors, governments as well as building companies to properly account for Demand Surge. We develop approaches to quantify Demand Surge effects and analyze drivers of these effects.

Portfolio Management: This research field deals with the allocation and management of investment opportunities taking into account the risk reducing effects of combining assets that are not perfectly correlated, which is known as portfolio diversification. An important aspect within the scope of this research area is an adequate risk assessment of different asset classes. Therefore, we focus our research on the empirical analyses of factors influencing risk premiums of covered bonds and catastrophe bonds as instruments of alternative risk transfer.

Incentive Design: A central question in labor economics is how workers can be incentivized to choose a desirable level of effort. In several contributions, we study promotion tournaments and their effects on competing workers' effort choices. We also investigate the behavior of workers with other-regarding preferences and compare their effort choices to those of selfish workers.

Energy Markets: The modeling of electricity price behavior is a fairly young research area. Power markets are subject to specific characteristics due to technical restrictions like non-storability of electricity. Current challenges are to analyze the effects of renewable energy sources, negative prices and price jumps.



Publications

- Gürtler, M., Hibbeln, M., Winkelvos, C. (2016): The Impact of the Financial Crisis and Natural Catastrophes on CAT Bonds, Journal of Risk and Insurance, Vol. 83, 2016, forthcoming.
- Gürtler, M., Gürtler, O. (2015): The Optimality of Heterogeneous Tournaments, Journal of Labor Economics, Vol. 33, No. 4, pp. 1007-1042.
- Gürtler, M., Hibbeln, M., Becker, F. (2015): Markowitz versus Michaud: Portfolio Optimization Strategies Reconsidered, European Journal of Finance, Vol. 21, pp. 269-291.
- Gürtler, M., Gürtler, O. (2014): The Interaction of Explicit and Implicit Contracts: A Signaling Approach, Journal of Economic Behavior and Organization, Vol. 108, pp. 135-146.
- Gürtler, M., Hibbeln, M. (2013): Improvements in Loss Given Default Forecasts for Bank Loans, Journal of Banking & Finance, Vol. 37, pp. 2354-2366.

Peter L. Reichertz Institute for Medical Informatics (PLRI)

Prof. Dr. Reinhold Haux

- Director, PLRI
- Adjunct Faculty, Hannover Medical School
- Honorary Fellow, International Medical Informatics Association
- Honorary Professor, University of Heidelberg
- International Associate, American College of Medical Informatics
- Member, Braunschweig Scientific Society

Researcher's Career

- Full Professor of Medical Informatics, Department of Computer Science, TU Braunschweig
- Full Professor of Medical Informatics at UMIT, Hall in Tyrol, President of UMIT
- Full Professor of Medical informatics, Medical Faculty, University of Heidelberg
- Associate Professor of Medical informatics, Medical Faculty, University of Tübingen
- Ph.D. at the University of Ulm
- Studies of Medical Informatics, University of Heidelberg and University of Applied Sciences Heilbronn

Funding

BMBF, DFG, EU, industry,
State Lower Saxony

Contact

Technische Universität Braunschweig
Peter L. Reichertz Institute for
Medical Informatics
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-9500
reinhold.haux@plri.de
www.plri.de

Mission Statement

Informatics in medicine and health care contributes significantly to high-quality as well as affordability of healthcare for people worldwide. PLRI, a joint institute of TU Braunschweig and Hannover Medical School, carries out research and education in this key and exciting field.

Research

We collaborate in interdisciplinary projects with health care centers, research institutes, enterprises and public organizations in order to shape the future of healthcare and medicine. Our activities range from the local level, as with institutions in Braunschweig and Hannover, to regional, national, and global levels involving the World Health Organization.

Main research fields at PLRI location TU Braunschweig are:

Health-enabling technologies: We are engaged in the development and analysis of information and communication technologies for creating sustainable conditions for self-sufficient and self-determined lifestyles. Health-enabling and ambient assistive technologies (AAL technologies) for new methods of living and health care play a major role. Research includes methods for pervasive computing for prevention, diagnosis and therapy, development and investigation of sensor technology as well as their appropriate embedding in health information systems.

Health information systems and management: We are working on information system architectures and infrastructures as well as information management strategies for trans-institutional health information systems. Research includes the analysis, application and further development of information management principles for planning, monitoring, analysis and evaluation of cooperative structures and processes in health care, design and implementation of applications for patient-centered shared care as well as for management of health care networks, analysis and further development of methods for the strategic management of information systems (e.g. ehealth strategies).

h^3m^2 data analysis: We are doing research on nomenclatures and methods for the analysis of health-related data, in particular in complex 'big data' situations, i.e. when data is heterogeneous, highly intensive, multilocal and multimodal (h^3m^2 data analysis).

For more information on PLRI's research fields please visit www.plri.de.

Publications

- Haux, R., Koch, S., Lovell, N.H., Marschollek, M., Nakashima, N., Wolf, K.-H (2016). Health-Enabling and Ambient Assistive Technologies: Past, Present, Future. Yearb. Med. Inform. 11.
- Haux, R., Hein, A., Kolb, G., Künemund, H., Eichelberg, M. et al.; Lower Saxony Research Network GAL (2014). Information and Communication Technologies for Promoting and Sustaining Quality of Life, Health and Self-sufficiency in Ageing Societies. Outcomes of the Lower Saxony Research Network Design of Environments for Ageing (GAL). Inf. Health Soc. Care 39, 176-187.
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- Haux, R. (2010). Medical Informatics: Past, Present, Future. Int. J. Med. Inform. 49, 599-610.

Chair of International Relations – Institute for the Social Sciences

Prof. Dr. Anja P. Jakobi

- Chair of International Relations

Researcher's Career
- Professor of International Relations, TU Braunschweig
- Senior Lecturer/Associate Professor, Royal Holloway, University of London, UK
- Senior Researcher, Leibniz-Institute Peace Research Institute Frankfurt
- Research and teaching positions at the universities of Bielefeld, Bremen, Darmstadt, Frankfurt, Giessen
- Visiting researcher at the universities of Bristol, UK, and Stanford, US

- Higher Doctorate (Habilitation) TU Darmstadt
- PhD University of Bielefeld
- MA (Dipl.-Pol.) Free University of Berlin

Funding
DAAD, DFG, ISA, ECPR, EU, ZIF Bielefeld

Contact
Technische Universität Braunschweig
Institute for the Social Sciences
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391–8915
a.jakobi@tu-braunschweig.de
www.tu-braunschweig.de/ib

Mission Statement
We analyze international institutions, organizations and norms and how they relate to state and non-state actors. Our specialization is the governance of global crime, of non-traditional security threats and of illegal markets. We develop novel theoretical explanations with an empirical focus, including interdisciplinary perspectives and links to policy and application.

Research
Global Crime Governance: Global crime governance is today manifested in national and international agendas, the proliferation of global regulations, growing international budgets, and the enlarged mandates of international organizations. Analyzing cases like human trafficking, corruption, cybercrime or money laundering, this research strand examines the conditions under which global crime governance emerges, the institutional design it takes and the impact it has.

The Governance of Global Illegal Markets: Illegal markets show commonalities with legal market mechanisms and a significant overlap, making the prevention of transactions across legal and illegal market spheres a central task of governance. Yet, we face huge institutional variance from completely state-based forms of governance to completely private regulations. By comparing different cases of illegal markets and the public-private interplay in governing them, we aim to resolve the question of why specific forms are established and how this impacts on the overall governance aim**.**

Non-Traditional Security Threats: Criminals and gangs, rebels or hackers are increasingly defined as new types of security threat and have become a central concern in world politics. At the same time, issues like climate change, water scarcity or weak governance capabilities have been identified as potential triggers of conflict. Our research in this field analyses the impact of these actors and issues on the societal, national and international order.

Global Governance, International Institutions and Policy Diffusion in World Society: Our different research strands feed into research on the current state of international affairs and world society. We are interested in the systematic exploration of norms and policies on the international level and of the actors involved in promoting or implementing them. This includes research on global governance and international organizations, transnational governance, global norms and policy diffusion.



Publications

- AP Jakobi 2016. Non-state Actors in Global Crime Governance. Explaining the Variance in Public-Private Interaction. In: British Journal of Politics and International Relations, 18(1).
- AP Jakobi & J Haunschild 2016. Global crime governance: Perspektiven und Grenzen transnationaler Kooperation In: Zeitschrift für Außen- und Sicherheitspolitik; 9(1).
- AP Jakobi & J Haunschild 2016. Internationale Politik und Transnational Organisierte Kriminalität. In: F Sauer & C Masala (eds) Handbuch Internationale Politik, Heidelberg: Springer.
- AP Jakobi 2015. Global Networks against Crime: Using the Financial Action Taskforce as a Model? In: International Journal 70(3).
- AP Jakobi 2013. Common goods and evils? The formation of global crime governance. Oxford: Oxford University Press.

Department of Social Sciences – Sociology

Prof. Dr. Dirk Konietzka

- Chair Social Structure and Empirical Research Methods

Researcher's Career
- Full Professor of Sociology, TU Braunschweig
- Habilitation, Bremen University
- Senior Lecturer at Bielefeld University
- Researcher at Max Planck Institute for Demographic Research, Rostock
- Research Assistant at Rostock University
- Dr. phil., FU Berlin
- Doctoral Student at Max Planck Institute for Human Development, Berlin
- Study of Sociology at Hamburg University

Funding
DFG, BMUB, BMVI

Contact
Technische Universität Braunschweig
Department of Social Sciences
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8948
d.konietzka@tu-bs.de
www.tu-braunschweig.de/soziologie/schwerpunkte/sozialstruktur

Mission Statement

Studying life course dynamics and cohort change is crucial to understand social inequality in contemporary society. We focus on educational transitions, labor market careers and family dynamics, applying a wide range of research methods. Our research primarily rests on large-scale longitudinal survey data and official microdata.

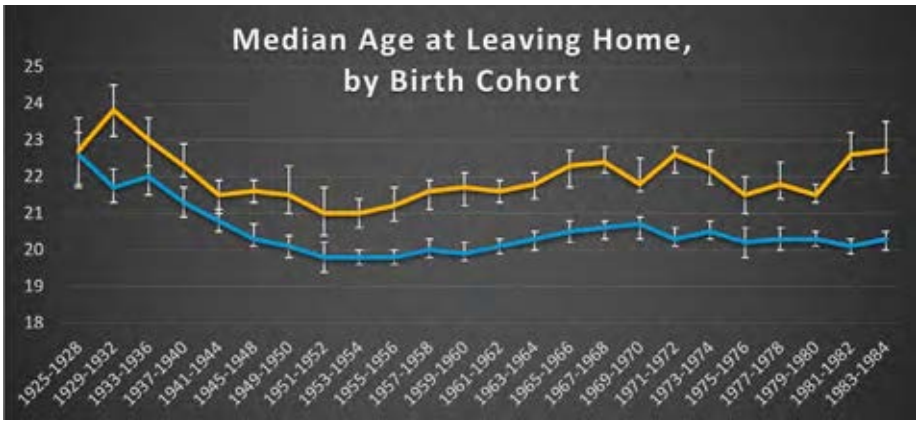
Research

Family Dynamics in Germany and Europe: We analyze family dynamics, living arrangements and the socio-economic backgrounds of family behavior in contemporary Germany and Europe. We focus on demographic processes, such as leaving home, family formation and childlessness in the life course. We analyze long-term cohort change as well as persisting differences in demographic behavior between East and West Germany.

Standardization and De-Standardization of the Life Course: Life Courses in contemporary society are structured by complex patterns of states and transitions in different life domains. While most empirical research is concerned with single transitions, our research focuses on sequence patterns and pathways within the life course. We review and further develop methods of sequence data analysis, which we apply to analyze social change of life course patterns in European societies.

Occupational and Class Mobility: We use micro-census data to assess social discrepancies in labor market opportunities for women and men, natives and migrants from the 1970s to present in Germany.

Chains of Mobility in Everyday Life: An aging society and increasing social discrepancies between and within regions make it necessary to develop new concepts of intermodal mobility that help to improve social participation over the life course. Our research focuses on modes of integration of public transport with pedestrian and bicycle traffic. We analyze patterns of mobility in private households, particularly focusing on how elderly integrate different modes of transport in their daily lives.



Publications

- Kreyenfeld, M, Konietzka, D. (Eds), 2016: Childlessness in Europe. Contexts, Causes, and Consequences. Springer.
- Konietzka, D., Tatjes, A., 2014: Two steps of union formation: first intimate relationships and first coresidential unions in the life courses of the German Cohorts 1971-1973 and 1981-1983. Journal of Youth Studies 17, 1077-1096.
- Konietzka, D., Kreyenfeld, M. (Eds), 2013: Ein Leben ohne Kinder. Ausmaß, Strukturen und Ursachen von Kinderlosigkeit. 2nd Edition, Springer VS.
- Konietzka, D., Kreyenfeld, M., 2013: Familie und Lebensformen. In: S. Mau, N. Schöneck (Eds): Handwörterbuch zur Gesellschaft Deutschlands, Springer VS, 257-271.
- Herwig, A., Konietzka, D., 2012: Zwischen Integration und Ausschluss. Die Klassenpositionen von Migranten im Zeit- und Generationenvergleich. Zeitschrift für Soziologie 41, 295-315.

Institute Computational Mathematics – AG PDE

Prof. Dr. Dirk Langemann

Researcher's Career

- Professor for Mathematical Modeling and Applied Analysis, TU Braunschweig
- Postdoc, University of Lübeck
- Scientific Assistant, Universitary Clinic Schleswig-Holstein
- Dr. habil. Rostock University, University of Lübeck
- Dr. rer. nat. Rostock University
- Study of Mathematics, Rostock University, Université de Rennes, France

Funding

DFG, EU, industry

Contact

Technische Universität Braunschweig
Institute Computational Mathematics – AG PDE
Pockelsstraße 14
38106 Braunschweig
Phone: +49 531 391–7403
d.langemann@tu-braunschweig.de
www.tu-bs.de/icm/pde/personal/langemann

Mission Statement

Mathematical modeling is the bridge between theoretical research and applied problems. Particularly, the life sciences look forward to gaining insight into complex mechanisms by means of mathematical methods. The intrinsic uncertainty of life-science applications feeds back to the development of appropriate mathematical methods.

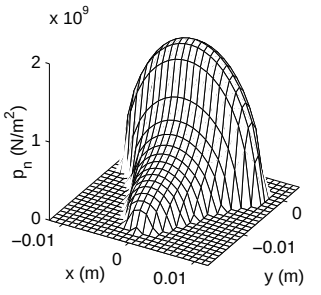
Research

Modeling of the chronification of liver infections: The interaction between pathogens and the immune response can be described as locally resolved predator-prey systems. Mathematical properties of the resulting reactions-diffusions equations mirror medical properties, e.g. the chronification of infections is related to the existence of non-trivial stationary solutions. The mathematical model allows in-silico experiments for the development of therapeutic approaches.

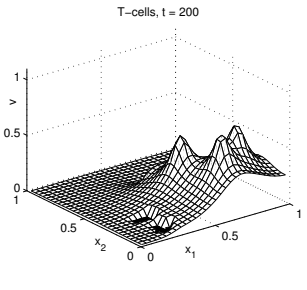
Multi-gene loci models of metabolic resistance: Resistant pathogens and resistant weeds are severe problems in agriculture and medicine. Modeling the development of metabolic resistances requires the combined description of population growth and inheritance. Our tensor product approach allows the automated generation of ordinary differential equations for the population size of each biotype depending on arbitrary many gene-loci and opens the door for a mathematical analysis of this combined process.

Models of mathematical modeling: Mathematical modeling itself is widely applied as a process but rarely analyzed. Particularly, life science applications lead to questions of model selection, robust model components and hierarchical model families. Beside epistemological questions, models of the mathematical modeling process help to discuss and evaluate models and augment their acceptance in new areas.

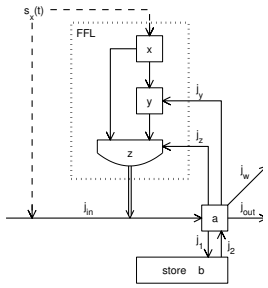
Communicative aspects of teaching: Teaching in lectures with a large number of students leads to the discussion of its communicative aspects. The analysis of present individual conceptions allows an adaptation in, and improvement of, the communication with the heterogeneous students.



normal pressure in a rail-wheel contact



T-cell population in a chronic infection



supply chain with aerobic and anaerobic metabolisation

Publications

- L. Roselius, D. Langemann, J. Müller, B. Hense, S. Filges, D. Jahn, R. Münch, Modeling and analysis of gene-regulatory feed-forward loop with basal expression of the second regulator, J. Theor. Biol. 363, 290-299, 2014
- D. Langemann, O. Richter, A. Vollrath, Multi-gene-loci inheritance in resistance modeling, Math. Biosci. 242, 17-24, 2013
- B. Kubera, A. Bosy-Westphal, A. Peters, W. Braun, D. Langemann, S. Neugebohren, M. Heller, M.J. Müller, Energy allocation between brain and body during ontogenetic development, Am. J. Hum. Biol. 25, 725-732, 2013
- H.-J. Kerl, D. Langemann, A. Vollrath, Reaction-diffusion equations and the chronification of liver infections, Math. Comput. Simulat. 82, 2145-2156, 2012
- K. Frischmuth, D. Langemann, Numerical calculation of wear in mechanical systems, Math. Comput. Simulat. 81, 2688-2701, 2011

Institute of Economics

Prof. Dr. Christian Leßmann

- Professor of Economics, TU Braunschweig
- Research Professor, Ifo Institute – Leibniz Institute for Economic Research at the University of Munich
- Member, CESifo Research Network

Researcher's Career

- Professor of Economics, in particular Development Economics, FAU Erlangen-Nuremberg
- Dr. rer. pol. habil., TU Dresden
- Visiting Researcher, Simon Fraser University, B.C.
- Dr. rer. pol., TU Dresden
- Junior Researcher and PhD candidate, Ifo Institute Dresden Branch
- Studies of Economics, Leibniz University Hanover

Funding

MWK, DFG, DAAD, Deutsche Bundesbank Regional Office Bremen, Lower Saxony, and Saxony-Anhalt, Braunschweiger Landessparkasse

Contact

Technische Universität Braunschweig
Institute of Economics
Spielmannstraße 9
38106 Braunschweig
Phone: +49 531 391-2578
c.lessmann@tu-braunschweig.de
www.tu-braunschweig.de/vwl

Mission Statement

Economic theory is useful for a better understanding of global, national and local issues that confront our societies. We aim to contribute to the scientific discussion on the fundamental determinants of long-run economic and human development. Our ultimate goal is to give evidence-based scientific policy advice.

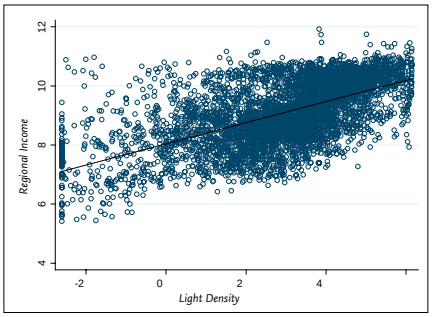
Research

The Institute of Economics employs theory-based empirical research on several topics related to economic development. We use state-of-the-art econometric methods to investigate the fundamental determinants of economic and human development. We focus on, amongst others, the development of units smaller than national states suchs as regions or ethnicities.

One main innovation of our research is to use physical data such as satellite night-time lights, energy network load or traffic data on ships, airplanes, and trucking to construct objective indicators for economic development. We aim to investigate economic issues at levels of disaggregation, where reliable statistical data does not exist.

Our research interests are:

- Development Economics
- Public Economics
- Political Economy
- Environmental and Resource Economics
- Economic Geography



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Publications

- Lessmann, C. & Markwardt, G. (2016) Aid, Growth, and Devolution: Considering Aid Modality and Different Types of Decentralization, World Development 84, 118-130
- Lessmann, C. (2016) Regional Inequality and Internal Conflict, German Economic Review 17(2), 157-191
- Lessmann, C. & Seidel, A. (2015) Regional Inequality, Convergence, and its Determinants – A View from Outer Space, CESifo Working Paper 5322
- Lessmann, C. (2014) Spatial Inequality and Development – Is there an inverted U Relationship?, Journal of Development Economics 106, 35-51
- Lessmann, C. (2013) Foreign Direct Investment and Regional Inequality – A Panel Data Analysis, China Economic Review 24, 129-149
- Buehn, A. Marktwardt, G. & Lessmann, C. (2013) Decentralization and the Shadow Economy: Oates meets Allingham-Sandmo, Applied Economics 45 (18), 2013, 2567-2578

Institute for Analysis and Algebra – AG Inverse Problems and Imaging

Prof. Dr. Dirk Lorenz

Researcher's Career

- Full Professor for Applied Analysis, TU Braunschweig
- Research Fellow at the Institute for Pure and Applied Mathematics, Los Angeles
- Assitant Professor for Applied Analysis, TU Braunschweig
- Post-Doctoral researcher at the Center for Industrial Mathematics, University of Bremen
- Phd in Mathematics, University of Bremen

Contact

Technische Universität Braunschweig
Institute for Analysis and Algebra
Pockelsstraße 14
38106 Braunschweig
Phone: +49 531 391–7423
d.lorenz@tu-braunschweig.de
www.tu-braunschweig.de/iaa

Mission Statement

In inverse problems one tries to obtain reliable information from indirect observations. We analyze inverse problems and develop mathematical models to overcome their inherent instability. We use and develop large scale optimization methods and apply our techniques to problems from imaging, engineering and life science.

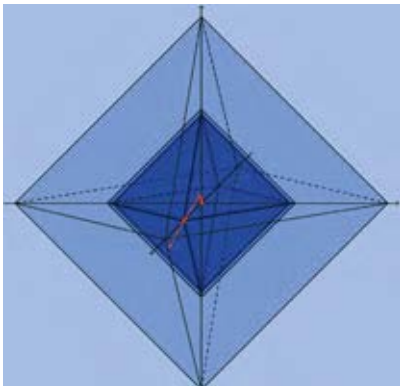
Research

Regularization of inverse ill-posed problems: Inverse problems often have annoying properties: solutions need not exist or may be unstable with respect to perturbations in the data. This calls for new notions of "solutions" and also for "regularization". We develop and analyze such methods to obtain solution algorithms that even come with error estimates in the case of ill-posedness. Recent fields of research include sparse regularization and regularization in measure spaces.

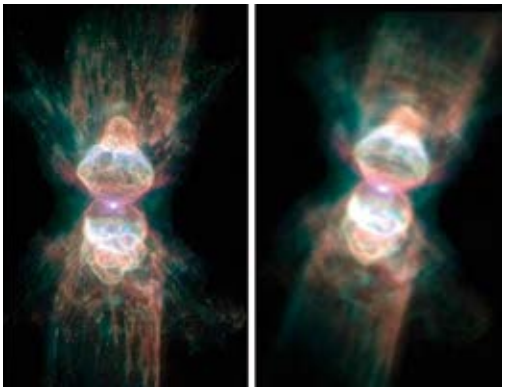
Mathematical imaging: We use mathematics to describe and develop methods to manipulate images. We are primarily concerned with low level vision, e.g. with methods for noise removal, deblurring, image decomposition or inpainting. We use, for example, variational methods and tools from optimal transport.

Convex optimization: Inverse problems and problems in imaging often lead to convex optimization problems with millions of variables. We develop computational methods that can scale up to these large numbers and can run with low memory demands.

Applications in life science and engineering: We are curious to apply our methods in other sciences. This has been done successfully in computer graphics, measurement technology, pharmacology or astronomy, for example.



The solution path of a convex optimization problem.



Three dimensional reconstruction of a planetary nebula (joint work with the Computer Graphics Lab, TU Braunschweig).

Publications and Patents

- An inertial forward-backward method for monotone inclusions, Dirk A. Lorenz and Thomas Pock, Journal of Mathematical Imaging and Vision, 51(2): 311-325, 2015.
- Testable uniqueness conditions for empirical assessment of undersampling levels in total variation-regularized x-ray CT, Jakob S. Jørgensen, Christian Kruschel and Dirk A. Lorenz, Inverse Problems in Science and Engineering, 23(8): 1283-1305, 2014.
- Data fusion of surface normals and point coordinates for deflectometric measurements, Birgit Komander, Dirk A. Lorenz, Marc Fischer, Marcus Petz und Rainer Tutsch, Journal of Sensors and Sensor Systems, 3: 281-290, 2014.
- Imaging with Kantorovich-Rubinstein discrepancy, Jan Lellmann, Dirk A. Lorenz, Carola Schönlieb and Tuomo Valkonen, SIAM Journal on Imaging Sciences, 7(4): 2833-2859, 2014.
- The linearized Bregman method via split feasibility problems, Dirk A. Lorenz, Frank Schöpfer and Stephan Wenger, SIAM Journal on Imaging Sciences, 7(2), 2014.

Computer Graphics Lab

Prof. Dr.-Ing. Marcus Magnor

- Department Chair
- IEEE Senior Member
- Braunschweigische Wissenschaftliche Gesellschaft
- Wissenschaftspreis Niedersachsen
- ERC Starting Grant
- Fulbright Scholar
- Feodor Lynen Scholar – Alexander von Humboldt Foundation

Researcher's Career

- Adjunct Professor for Physics and Astronomy, University of New Mexico, USA
- Full Professor for Computer Science, TU Braunschweig
- Habilitation in Computer Science, Saarland University
- Independent Research Group Leader, MPI Informatik
- Research Associate, Stanford University, USA
- Ph.D. in Electrical Engineering, Erlangen University

Funding

DFG, EU, industry

Contact
Technische Universität Braunschweig
Institut für Computergraphik
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-2102
m.magnor@tu-bs.de
http://graphics.tu-bs.de

Mission Statement

We pursue interdisciplinary research that draws on computer graphics, computer vision, applied optics, and visual perception. Our goal is to find answers to fundamental scientific questions that help us devise practical, new visual processing algorithms.

Research

Digital image processing, analysis, and synthesis are driving research and innovation in many domains. Our group develops practical solutions for visual computing challenges.

Measuring & Modeling: A photo is a physical measurement, a digital camera is a measuring device: by taking a picture, millions of samples are being measured simultaneously, from a distance and without interference. In our lab we research new imaging techniques in conjunction with advanced image processing and analysis algorithms to measure and model real-world objects, scenes and phenomena, in space and in time.

Fast & Realistic Image Synthesis: Pictures are the most intuitive means to communicate information. At the same time, we have a keen eye for what is real and what is not. Our group devises fast algorithms to create photo-realistic renderings of virtual as well as real-world scenes, for display on screen and in immersive environments.

Perception and Cognition: Any visual impression is the result of our brain's interpretation of what we see. From perceptual psychology, we know the rules by which our brain interprets visual information. We make use of these rules to develop quantitative perceptual models that allow us to enhance the quality of computer-generated images and videos.

Digital Gauss: 3D digital model from conventional photos

Moonshot: reconstruction of the Apollo 15 landing site from vintage lunar probe images

Publications

- M Stengel, S Grogorick, M Eisemann, E Eisemann, M Magnor, "An Affordable Solution for Binocular Eye Tracking and Calibration in Head-mounted Displays", in Proc. ACM Multimedia, 15-24, October 2015
- B Hell, M Kassubeck, P Bauszat, M Eisemann, M Magnor, "An Approach Towards Fast Gradient-based Image Segmentation", IEEE Transactions on Image Processing, 24 (9), 2633-2645, September 2015
- F Klose, O Wang, J-C Bazin, M Magnor, A Sorkine-Hornung, "Sampling based Scene-Space Video Processing", ACM Transactions on Graphics (Proc. ACM Siggraph), 34 (4), 67:1-67:11, August 2015
- P Bauszat, M Eisemann, E Eisemann, M Magnor, "General and Robust Error Estimation and Reconstruction for Monte Carlo Rendering", Computer Graphics Forum (Proc. Eurographics), 34(2), 597-608, May 2015
- M Stengel, P Bauszat, M Eisemann, E Eisemann, M Magnor, "Temporal Video Filtering and Exposure Control for Perceptual Motion Blur", IEEE Trans. Visualization and Computer Graphics 21(5), 663-671, May 2015

Institute of Business Information Systems – Decision Support Group

Prof. Dr. Dirk C. Mattfeld

- Vice president of Braunschweiger Hochschulbund (BHB)
- Coordinator of the student exchange program of the University of Nebraska at Omaha and TU Braunschweig

Researcher's Career

- Full Professor of Business Information Systems and Decision Support, Technische Universität Braunschweig
- Associate Professor at Institut für Logistik und Transport, Universität Hamburg
- Assistant Professor at Chair of Logistics, Methods of OR and Information Systems, Universität Bremen, Germany
- PhD at the Universität Bremen
- Study of economics, Universität Bremen

Funding

DFG, State of Lower Saxony, DAAD, Volkswagen Research, Volkswagen Financial Services AG

Contact

Technische Universität Braunschweig
Institute of Business Information Systems – Decision Support Group
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-3210
d.mattfeld@tu-braunschweig.de,
www.tu-braunschweig.de/winfo

Mission Statement

The Decision Support Group works on models, methods and systems for planning and control of processes. The work focuses the application domain of logistics, transportation and traffic.

Research

Information systems in logistics, transportation and traffic are analyzed with regard to strategic, tactical and operative aspects. Decision Support in logistics and transportation requires the modeling of the domain-specific tasks and processes as well as the support of these models by means of integrated information systems. Methods from the field of Business Intelligence and Data Mining provide information models. These serve the derivation of optimal decision-making through Operations Research.
Working fields include anticipatory planning in vehicle routing, control of city logistics processes, fleet management and management of shared mobility systems.

Anticipatory Planning in Vehicle Routing: Road networks, especially in urban areas, are characterized by high uncertainties resulting from the dynamics of traffic. Advanced traveler information systems acquire, analyze and present information about the road network traffic system in order to assist travelers in moving from their starting location to a desired target location (routing). To improve routing, future traffic conditions must be anticipated. A reliable and efficient anticipation considers the uncertainties for the optimization of routing. Stochastic and dynamic routing explicitly models uncertainties and incorporates them for the optimization of routing.

Control of City Logistics Processes: City logistic providers face several challenges due to increasing importance of e-commerce and rising customer expectations as well as high uncertainties of urban traffic systems. The control of city logistics processes significantly contributes to the efficiency of city logistic providers, since it deals with the optimization of the most important and expensive parts of the supply chain. Optimizing the control of city logistics processes enables the providers to improve the efficiency in these parts of the supply chain. This requires the derivation of efficient information models and their integration into optimization models.

Fleet Management: Increasing digitalization and propagation of telematics enables the management of fleets with regard to microscopic and macroscopic aspects. The former includes supporting the driver with respect to future activities such as personalized navigation and improved infotainment systems. The latter includes remote prescriptive maintenance of vehicles. In order to do so, various data sources (e.g. extended floating car data, social media data) are fused and analyzed using models from business intelligence and data mining.

Management of Shared Mobility Systems: Shared mobility gains in importance due to growing environmental as well as economic concerns and due to technological advances in electronic and wireless technology, which enables easier sharing of assets. Especially bike-sharing systems receive increasing attention in shared city transportation, because they allow individual transportation. A common issue observed in modern bike-sharing systems is imbalance in the spatial distribution of bikes over time caused by varying mobility demand. Understanding the imbalances allows derivation of information models that enable efficient and appropriate measures alleviating these imbalances.

Publications

- L. Douglas Smith, Robert M. Nauss, Jan Fabian Ehmke, Dirk Christian Mattfeld (2012): Analytical Modeling for the Strategic Design of Service Systems. International Journal of Strategic Information Technology and Applications, vol. 3, issue 4, 1-15
- Jan F. Ehmke, Stephan Meisel, Dirk C. Mattfeld (2012): Floating Car Based Travel Times for City Logistics. Transportation Research - Part C: Emerging Technologies, vol. 21, no. 1, 338-352
- Jan F. Ehmke, Daniel Großhans, Dirk C. Mattfeld, L. Douglas Smith (2011): Interactive Analysis of Discrete-Event Logistics Systems with Support of a Data Warehouse. Computers In Industry, vol. 62, no. 6, 578-586
- L. Douglas Smith, Robert M. Nauss, Dirk C. Mattfeld, Jian Li, Jan F. Ehmke, Matthias Reindl (2011): Scheduling operations at system choke points with sequence-dependent delays and processing Times. Transportation Research - Part E: Logistics and Transportation Review, vol. 47, no. 5, 669-680
- Thomas Huth, Dirk C. Mattfeld (2011): Myopic and Anticipated Planning in Stochastic Swap Container Management. International Journal of Operations Research, vol. 8, no. 1, 3-22

Institute of Scientific Computing

Prof. Dr. Hermann G. Matthies

- Chair, Department of Computer Science
- Head of Institute of Scientific Computing

Researcher's Career

- Full Professor for Scientific Computing, TU Braunschweig
- Director of University Computing Centre, TU Braunschweig
- Research Coordinator, Germanischer Lloyd, Hamburg
- Head of Offshore Structures Group, Germanischer Lloyd, Hamburg
- Director of Engineering Consultancy WMI GmbH, Hamburg
- Research Analyst, Germanischer Lloyd, Hamburg
- Ph.D. at the Massachusetts Institute of Technology (MIT), Cambridge, (MA), USA, Department of Mathematics
- Studies of Mathematics, Physics, and Engineering, TU Berlin

Funding

DFG, BMBF, State of Lower Saxony, EU, industry

Contact

Technische Universität Braunschweig
Institute of Scientific Computing
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-3000
wire@tu-braunschweig.de
www.tu-braunschweig.de/wire

Mission Statement

Computational science – which may be seen as computer experiments – has become a "third pillar" besides theory and experiment. Such computational models have become indispensable in the modern world.

Research

Multi-physics problems: Many mathematical and computational models have been developed for separate domains. Often one has to treat phenomena where several such models interact: the area of multi-physics. We look at the theoretic-mathematical, numerical, algorithmic, and software-engineering aspects of such coupled problems. This includes the execution of such collections of software components in distributed environments.

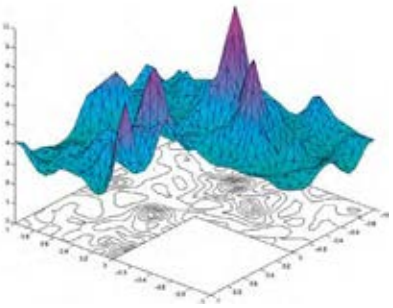
Uncertainty Quantification: The input data to many mathematical/computational models are uncertain and are hence often modelled probabilistically. We develop and analyse methods and algorithms to treat random fields, stochastic processes, and high-dimensional random variables to describe the probabilistic content of the output of these models.

Distributed and parallel algorithms: Compute-intensive tasks can only efficiently be perfomed on parallel and/or distributed hardware, including massively parallel graphical processing units (GPUs). We develop and analyse algorithms for this fields.

Inverse problems: This term means the determination or identification of properties of systems, described through mathematical/computational models, by only observing certain inputs and outputs of the system. Our work here relies on a Bayesian probabilistic setting and this is closely linked to uncertainty quantification.

Irreversible material models and measure-valued states: The description and computation of irreversible material processes such as plasticity, damage, and cracking leads to algorithms that entangle solvers for partial differential equations with optimisation algorithms. Non-unique solutions lead to descriptions as probability-measure valued solutions, requiring mathematical and numerical methods from the area of uncertainty quantification.

Multi-scale problems: This entails the mathematical description and computational treatment of phenomena which occur at vastly different temporal or spatial scales. It leads to coupled problems of the multi-physics type combined with uncertainty quantification, as the small scales are often described probabilistically.



Realisation of a random field

Publications

- Hermann G. Matthies and Andreas Keese: Galerkin methods for linear and nonlinear elliptic stochastic partial differential equations. Comp. Meth. Appl. Mech. Engrng. 194 (2005) 1295-1331
- Bojana V. Rosić, Alexander Litvinenko, Oliver Pajonk and Hermann G. Matthies: Sampling-free linear Bayesian update of polynomial chaos representations. J. Comp. Phys. 231 (2012) 5761-5787
- Loïc Giraldi, Dishi Liu, Hermann G. Matthies, Anthony Nouy: To be or not to be intrusive? The solution of parametric and stochastic equations - Proper Generalized Decomposition. SIAM Journal of Scientific Computing 37, (2015) A347-A368.
- Adnan Ibrahimbegović, Rainer Niekamp, Christophe Kassiotis, Damijan Marković and Hermann G. Matthies: Code-coupling strategy for efficient development of computer software in multiscale and multi-physics nonlinear evolution problems in computational mechanics. Advances in Engineering Software 72 (2014), 8-17
- Mike Espig, Wolfgang Hackbusch, Alexander Litvinenko, Hermann G. Matthies and Elmar Zander: Efficient Analysis of High Dimensional Data in Tensor Formats. In: Jochen Garcke and Michael Griebel (eds.): Sparse Grids and its Applications, Lecture Notes in Computational Sciences and Engineering (LNCSE), 88 (2013) 31-56. Springer-Verlag, Berlin.

Department of Social Sciences

Prof. Dr. Herbert Oberbeck

- Full professor for sociology of work and organizational studies, TU Braunschweig, Germany
- Head of the Department of Social Sciences, TU Braunschweig, Germany
- Coordinator of excellent mobile further education project for engineering

Researcher's Career

- Dean of the faculty of Economic and Social Sciences, TU Braunschweig
- Research Director of the Sociological Research Institute (SOFI) Göttingen, Germany
- Dr. rer. pol., University of Göttingen, Germany
- Study of law, social sciences and social economy, University of Göttingen, Germany

Funding
BMBF, EU, Volkswagen-Stiftung

Contact
Technische Universität Braunschweig
Department of Social Sciences
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8935
h.oberbeck@tu-braunschweig.de
www.tu-braunschweig.de/soziologie

Mission Statement

In the sociology of work and employment, we aim to understand social relations between people during their working lives. We analyze human behavior within organizational structures in modern societies with sociologically well-informed organizational theories.

Research

Future of Work: The future of work is related to some major questions which developed and developing societies have to deal with as emerging challenges in the 21st century. These challenges are connected to major industrial and economic changes. While availability of work stays important, the quality of work, as well as work-life-balance become fundamentally important to employees. Meanwhile rationalization of the self becomes a general demand. Individual skills are of more importance than ever, because a shortage of skills leads to a lack of productivity within companies and/or to unemployment.

Automotive Industries: There are major challenges caused by consequences of economic, social and environmental changes. Reorganization, rationalization processes and practices as well as technological innovations lead to shifts of sectors and to new job profiles and requirements for employees as well as companies. With a changing global environment, transportation and organization challenges, accompanied by emancipated customers, automotive industries need to adjust their strategies.

Service Industries: More than two-thirds of all employees in Germany work in the service sector. Continually, we provide research knowledge concerning the developmental perspectives of relevant service industries. In addition, we focus our research on business-to-business services, which are, as innovators, strongly related to the industrial sector in Germany and its productivity.

Corporate Governance: In Corporate Governance research, we analyse structures, processes and institutions networks, and organization cultures within and between organizations. Main questions in organizations are how power and control are shared, distributed and fulfilled, as well as how organizations deal with challenges and dynamics in a globalized world.

Further Education in Universities: In this field we try to understand and help to shape the organization of the contemporary university. In the 21st century universities have to deal with new education markets and new structural situations. They have to adjust their services and open to concepts of lifelong learning.

Publications

- Oberbeck, H.; Geisler, G. (2016, i.E.) Effizienz von Aufsichtsräten: bisherige und künftige Schwerpunkte in der Arbeit von Unternehmenskontrolleuren. Braunschweig
- Oberbeck, H. (2006) Die komplizierte Suche nach Produktivität bei Dienstleistern. (The complicated Search for Productivity in Services.) In: Moderne Dienstleistungen 307-314.
- D'Alessio, N.; Oberbeck, H. (2002) Call centres as organizational crystallization of new labour relations, working conditions and a new service culture? Holgrewe, U., Kerst, C., Shire, K.A. (eds.), Re-Organizing Service Work Call Centres in Germany and Britain. Aldershot: Ashgate, 86-101.
- Oberbeck, H. (2000) Rationalisierung in Eigenregie. Ansatzpunkte für den Bruch mit dem Taylorismus bei VW, Hamburg: VSA.
- D'Alessio, N.; Oberbeck, H. (1999) The end of institutional stability? The German banking industry in transition. In: Regini, Kitay, Baethge (eds.) From Tellers to Sellers. Changing Employment Relations in Banks. Cambridge (Mass.)/London, 287-316.

Institute of System Security

Prof. Dr. Konrad Rieck

Researcher's Career

- Full Professor of Computer Science, TU Braunschweig
- Associate Professor of Computer Science, University of Göttingen
- Junior Professor of Computer Science, University of Göttingen
- Research Associate (Postdoc), TU Berlin
- PhD at TU Berlin
- Research Associate, Fraunhofer Institute FIRST
- Study of Computer Science and Biology, FU Berlin

Awards

- CAST/GI Dissertation Award IT-Security 2010
- Google Faculty Research Award 2014
- RAID Outstanding Reviewer Award 2015

Funding

BMBF, DFG, BSI, industry

Contact

Technische Universität Braunschweig
Institute of System Security
Rebenring 56
38106 Braunschweig
Phone: +49 531 391-55120
k.rieck@tu-braunschweig.de
www.tu-braunschweig.de/sec

Mission Statement

Our research revolves around the security of computer systems. We develop novel methods for protecting computers from attacks, understanding malicious code and finding security vulnerabilities in software.

Research

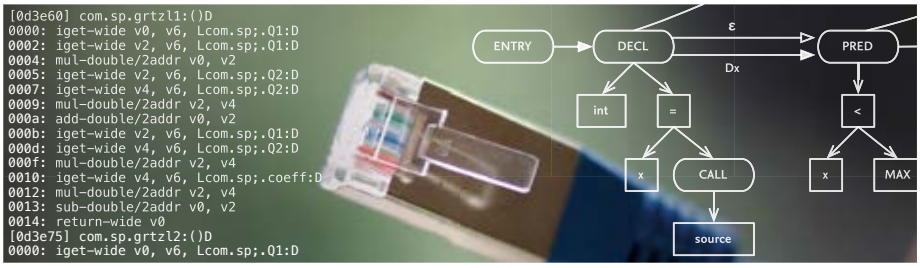
A special focus of our research is the combination of machine learning and security, which enables us to construct intelligent systems that adapt to changing threats. We are one of the leading research groups in this area.

Attack detection: Most security products identify attacks using manually created detection patterns. While such patterns are available for the majority of known attacks, novel threats cannot be spotted with this approach. We develop self-learning methods that analyze program and network behavior to infer detection patterns automatically. The resulting methods can be employed to protect mobile devices, desktop computers and even industrial control systems.

Malware analysis: Malicious software is an enduring problem in the Internet. Numerous variants of worms, trojans and backdoor plague users on a daily basis. The sheer amount and diversity of this malicious code renders its analysis very demanding. We thus develop methods for analyzing, understanding and categorizing malicious code. Our approaches accelerate the day-to-day analysis of malware and help to develop defenses more efficiently.

Vulnerability discovery: The security of computer systems critically depends on the quality of the underlying software. A single flaw suffices to undermine the security of an entire system, as for example in the case of Heartbleed. To identify such vulnerabilities early on, we develop semi-automatic methods for analysis of software that spot indications of insecure programming and pinpoint the corresponding regions for further auditing.

Privacy defenses: With the increasing use of computer systems in our daily life, the privacy of data is gaining in importance. While several strong techniques exist for protecting personal information, such as encryption and anonymization, in practice sensitive data often slips through the protection and weakens the users' privacy. We study such privacy leaks and develop methods for quantifying and limiting their impact in practice.



Publications

- F. Yamaguchi, A. Maier, H. Gascon, and K. Rieck. Automatic Inference of Search Patterns for Taint-Style Vulnerabilities. In: Proc. of 36th IEEE Symposium on Security and Privacy (S&P), 2015.
- H. Perl, D. Arp, S. Dechand, S. Fahl, Y. Acar, F. Yamaguchi, K. Rieck, and M. Smith. VCCFinder: Finding Potential Vulnerabilities in Open-Source Projects to Assist Code Audits. In: Proc. of 22nd ACM Conference on Computer and Communications Security (CCS), 2015.
- F. Yamaguchi, N. Golde, D. Arp, and K. Rieck. Modeling and Discovering Vulnerabilities with Code Property Graphs. In: Proc. of 35th IEEE Symposium on Security and Privacy (S&P), 2014.
- D. Arp, M. Spreitzenbarth, M. Hübner, H. Gascon, and K. Rieck. Drebin: Efficient and Explainable Detection of Android Malware in Your Pocket. In: Proc. of 21st Network and Distributed System Security Symposium (NDSS), 2014.
- C. Wressnegger, F. Boldewin, and K. Rieck. Deobfuscating Embedded Malware using Probable-Plaintext Attacks. Proc. of 16th Symposium on Research in Attacks, Intrusions, and Defenses (RAID), 2013

Institute of Business Information Systems

Prof. Dr. Susanne Robra-Bissantz

- Vicepresident of Study Affairs and Collaboration
- Chair Business Information Systems / Information Management

Researcher's Career

- Full Professor for Information Systems Research, TU Braunschweig
- Habilitation at University Erlangen-Nürnberg
- Research Assistant (Postdoc), University Erlangen-Nürnberg
- Ph.D. at University Erlangen-Nürnberg (summa cum laude)
- Studies of Business Administration at University Erlangen-Nürnberg

Funding

Bundesministerium für Bildung und Forschung (BMBF), Volkswagen Foundation, Industry

Contact

Technische Universität Braunschweig
Institute of Business Information Systems,
Chair Information Management (wi2)
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-3120
s.robra-bissantz@tu-braunschweig.de
www.blog.wi2-tubs.de

Mission Statement

Information Technology (Hardware, Software and Systems) is one critical success factor in today's companies and markets. wi2 works on scientific basics, artefacts and hands-on concepts for successful information systems in organizations, on markets and in long lasting relationships with customers and other business partners.

Research

wi2 follows the typical approach of research in business information systems. Empirical explanation leads to new theoretical insights into human acceptance, satisfaction or, in general, success of Information Systems. Combined with concepts of Design Science we build artefacts and prototypes in our focus areas of research. As information systems increasingly affect societal developments, we add typical research methodologies of social sciences, such as action research.

Our basic paradigm is the view of software, websites, apps as user-centric e-Services. We work on innovative Product-(e-)Service-Systems – from creation to innovation and design, to engineering, implementation and test. This includes new concepts for customer interaction as well as business models and design methodologies. As enabler of innovative information systems, we focus on new information technologies – social media collaboration and context sensitivity. Here especially mechanisms and platforms for collaboration in companies and beyond lead to new forms of customer relationships, innovation processes and knowledge management.

Typical research areas:

- Business-IT-Alignment and Information Systems Success
- Design and engineering of customer oriented e-services
- Situated, context-oriented, individualized, mobile and automotive e-Services
- Collaboration (Social) Mechanisms and Platforms
- Gamification, Nudging and Citizen Science
- Collaborative Creativity, Innovation and Knowledge Management
- New Models of Consumption, Learning and (Co-)Working
- Sharing-/Maker-Economy and Support-/Web-Society

Publications

- Siemon, D.; Rarog, T.; Robra-Bissantz, S. (2016). Semi-Automated Questions as a Cognitive Stimulus in Idea Generation. In: Proceedings of the 49th Hawaii International Conference on System Sciences (HICSS), 2016, pp. 257-266.
- Siemon, D.; Robra-Bissantz, S. (2016). Design Guidelines for Context-Aware Creativity Support Systems. Journal of Creativity and Business Innovation, Vol. 2, 2016, pp. 5-19
- Helmholz, P., Vetter, S., Robra-Bissantz, S. (2014). AmbiTune: Bringing Context-Awareness to Music Playlists while Driving. In: Proceedings of the 9th International Conference on Design Science Research in Information Systems and Technology (DESRIST) 2014, Miami, Florida International University, USA.
- Perl, A., Helmholz, P., Siemon, D., Busse, S., Robra-Bissantz, S. (2014). Situation-oriented ubiquitous information systems innovation - leveraging user integration. Proceedings of the 22nd European Conference on Information Systems (ECIS) 2014, Tel Aviv, Israel
- Weinmann, M., Schneider, C., Robra-Bissantz, S. (2013). A taxonomy of web personalization. Proceedings of the 19th Americas Conference on Information Systems (AMCIS) 2013 - Hyperconnected World: Anything, Anywhere, Anytime, 1 218-226

Institute of Software Engineering and Automotive Informatics (ISF)

Prof. Dr.-Ing. Ina Schaefer

Researcher's Career

- Dean of Studies in Computer Science
- Head of Research Area "Intelligent Vehicles and Connected Driving"
- at Automotive Research Center Lower-Saxony (NFF)

- Full Professor for Computer Science, TU Braunschweig
- Acting Chair for Computer Science, TU Braunschweig
- PostDoc at Chalmers University of Technology, Gothenburg, Sweden
- Dr.-Ing. at TU Kaiserslautern, Software Technology Group
- Study of Computer Science, Rostock University

Funding

DFG, BMBF, EU, State Lower Saxony, Industry

Contact

Technische Universität Braunschweig
Institute of Software Engineering and Automotive Informatics (ISF)
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-2275
i.schaefer@tu-braunschweig.de
www.tu-braunschweig.de/isf/

Mission Statement

Modern software systems are very complex and individually configured for different customers to fulfill their needs. This variability within software-systems leads to software families, which introduces new challenges for software engineering. We work on new techniques to design, implement, analyze and test these complex software systems in effective and efficient ways.

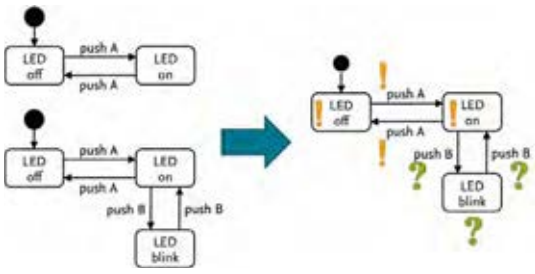
Research

Software Product Lines: These types of software systems allow for mass customization of software systems according to customer demands. We investigate how to cope with the complexity that software product lines introduce, as the number of potential product variants grows exponentially fast. To this end, we create novel techniques to program, analyze, verify and test these variant-rich systems in new ways, that exploit the variability information and reduce redundancy compared to existing software engineering techniques.

Programming Languages: In the last decades, hundreds of programming languages have evolved according to trends and advances in computer science. We investigate ways to adapt existing programming languages using new frameworks to be variability-aware. To this end, we introduce different delta-oriented dialects, such as DeltaJava. After the modification, these types of languages can be used to define families of software variants.

Performance Analysis of Large-Scale Systems: We develop multi-perspective modeling approaches covering different views and apply a delta-oriented modeling approach which integrates performance annotations to allow for a model-based performance analysis. We devise family-based performance analysis techniques in order to efficiently evaluate a large set of possible system variants at the same time.

Software Quality Assurance: Making sure that software works as intended, especially in safety-critical domains such as the automotive industry, is a fundamental task in software engineering. We make novel contributions to effective and efficient testing of software product lines and black-box systems where source code is not available. For example, we introduce a machine learning based test case prioritization. In addition, we investigate scalable verification techniques which prove that a software system fulfills its specification.



Publications

- I. Schaefer, C. Seidl, L. Cleophas, B. W. Watson. SPLicing TABASCO: Custom-tailored software product line variants from taxonomy-based toolkits. In: Annual Conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT), 2015.
- T. Thüm, S. Apel, C. Kästner, I. Schaefer, G. Saake. A Classification and Survey of Analysis Strategies for Software Product Lines. ACM Comput. Surv. 47(1): 6, 2014.
- M. Lochau, S. Lity, R. Lachmann, I. Schaefer, U. Goltz: Delta-oriented model-based integration testing of large-scale systems. Journal of Systems and Software 91: 63-84, 2014.
- I. Schaefer, R. Rabiser, D. Clarke, L. Bettini, D. Benavides, G. Botterweck, A. Pathak, S. Trujillo, K. Villela. Software diversity: state of the art and perspectives. Internal Journal on Software Tools for Technology Transfer Vol. 14, Springer, pp. 477-495, 2012.
- I. Schaefer, L. Bettini, V. Bono, F. Damiani, N. Tanzarella. Delta-oriented programming of software product lines. In: Software Product Lines: Going Beyond, Springer Berlin Heidelberg, pp. 77-91, 2010.

Institute of Automotive Management and Industrial Production (AIP)

Prof. Dr. Thomas S. Spengler

- Chair of Production and Logistics
- Full Professor for Business Administration at the Technische Universität Braunschweig
- Habilitation at the Karlsruhe Institute of Technology (KIT)
- Dr. rer. pol. at KIT
- Study of Industrial Engineering and Management at KIT

Researcher's Career

- Director of the Institute of Automotive Management and Industrial Production (AIP)
- Board member of the Automotive Research Centre Niedersachsen (NFF)
- Adjunct Professor and Member of the Graduate School of Engineering of the University of Rhode Island, USA
- Deputy Chairman of the Scientific Commission Production Management of the German Academic Association for Business Research (VHB)
- Member of the editorial board of European Journal of Operational Research, Production and Operations Management, and Business Research

Funding

Ministerial (BMBF, BMU, BMWi), DFG, industry

Contact

Technische Universität Braunschweig
Institute of Automotive Management and Industrial Production (AIP)
Chair of Production and Logistics
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-2201
t.spengler@tu-braunschweig.de
www.tu-braunschweig.de/aip/prodlog

Mission Statement

My research interests are the development and application of techno-economic models and quantitative methods for decision support in production, logistics, and sustainable management. I emphasize interdisciplinary cooperation with researchers from engineering and natural sciences, industrial partners, and political decision makers.

Research

For more than 15 years now, the Chair of Production and Logistics has been recognised for its research expertise in sustainable design, planning, and control of industrial production and logistics systems. Focusing on a technology and decision-oriented business administration, we address research questions related to the following topics:

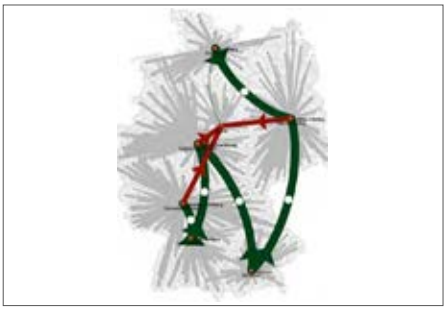
Energy- and resource-efficiency: Industrial production requires the use of energy- and resource-efficiency for the creation of final products. We deal with the development of descriptive models of resource and energy demands as well as the efficient design, planning, and control of production systems on this basis.

Digitization: The digitization in production and logistics (also Internet of Things or Industry 4.0) leads to new business models (e. g., predicted maintenance) and to new technologies in production and logistics systems (e. g., interaction between robots and workers). In this field, we concentrate on the selection, planning, and control of such new business models and technologies.

Mobility: Emissions and resource consumption of passenger and freight transport have to be cut down significantly. To support a sustainable mobility, we address, amongst others, research questions regarding the market introduction of electric vehicles, the production and recycling of innovative powertrains, and the economic operation of e-car-sharing fleets.

Circular economy: Against the background of resource scarcity, the closed-loop circulation of products, materials, and substances is becoming more and more important. We conduct research on the economic design of closed-loop supply chains and recycling concepts, as well as recycling planning and control.

We strive to derive recommendations for industry and policy. To this end, our interdisciplinary team develops and applies tools for decision support, which are based on methods of Operations Research such as optimization and simulation – often directly on-site with our partners from practice.



Publications

- Matzke, A.; Volling, T.; Spengler, T. S. (2016): Upgrade-auctions in build-to-order manufacturing with loss-averse customers, in: EJOR, 250 (2), pp. 470-479.
- Hoyer, C.; Kieckhäfer, K.; Spengler, T.S. (2015): Technology and Capacity Planning for the Recycling of Lithium-Ion Electric Vehicle Batteries in Germany, in: JBE, 85 (5), pp. 505-544.
- Kieckhäfer, K.; Volling, T.; Spengler, T.S. (2014): A hybrid simulation approach for estimating the market share evolution of electric vehicles, in: Transportation Science, 48 (4), pp. 651-670.
- Volling, T.; Matzke, A.; Grunewald, M.; Spengler, T.S. (2013): Planning of capacities and orders in build-to-order automobile production: A review, in: EJOR, 224 (2), pp. 240-260.
- Volling, T.; Grunewald, M.; Spengler, T.S. (2013): An integrated inventory-transportation system with periodic pick-ups and leveled replenishment, in: BuR, 6 (2), pp. 173-194.

Institute for Mathematical Optimization

Prof. Dr. Sebastian Stiller

Researcher's Career
- Professor for Mathematical Optimization at TU Braunschweig
- Junior Faculty at Berlin Mathematical School
- Junior Faculty of DFG-Research Center MATHEON, Berlin
- Postdoctoral Associate MIT (Cambridge, USA)
- EU Marie Curie Fellow
- Dr. rer. nat. at TU Berlin
- Diplommathematiker and MA in Philosophy at Friedrich-Alexander-Universität Erlangen

Funding
EU, DFG, EFRE, Industry

Contact
Technische Universität Braunschweig
Institut für Mathematische Optimierung
Pockelsstraße 14
38106 Braunschweig
Phone: +49 531 391-7550
sebastian.stiller@tu-braunschweig.de
www.tu-braunschweig.de/mo

Mission Statement

We conduct in-depth mathematical research in combinatorial optimization to solve challenging network and scheduling problems in engineering, other sciences, and industry. From our long and successful track record we are confident that best solutions in practice stem from strong mathematical foundations.

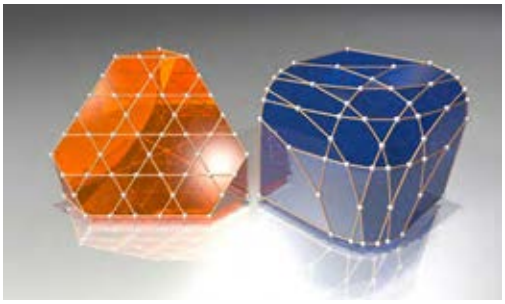
Research

The following applications currently drive our research.

Real-time Systems: Digitalization and Industry 4.0 depend on safe and predictable computing. With industry and engineering we develop analysis, feasibility tests, and algorithms to exploit the power of systems with large number of processors and large on-board networks.
Individual Mobility: We develop collaborative and co-modal routing algorithms and robust shortest path methods with partners in science and industry.
Efficiency in **Logistics** reduces cost and resource conflicts on public roads. We develop integer programming and heuristic methods for logistics used in industry, e.g., robust routing.
Networks for gas-transport pose highly complex, non-linear, and large-scale network optimization problems. We research network infeasibilty problems in this context.
Public Transport: We develop optimization methods for delay resistant timetabling and platforming.

Our expertise is based on theoretical research in the following areas:

Optimization under uncertainty / Robust optimization: The input data for optimization is almost never certain. As the type of uncertainty and the certainty requirements in the solution vary, different models are necessary. We develop models that are amenable to fast optimization algorithms, and at the same time show enough detail for practice.
Network flows and routing: We work on structural analysis, complexity theory, and algorithms for network flows and routing problems. We study approximation algorithms based on combinatorial and semi-definite methods for robust flows and algorithm engineering techniques for fast, shortest-paths computations. We also study fixed parameter tractability of infeasibility in network flows.
We study **scheduling** under uncertainty.
Algorithmic game theory allows us to analyze and to shape situations with self-interested agents influencing an optimization problem. We work on game theoretic network problems – in particular for logistics.



Disturbance polytope of balanced (left) solution is smaller than unbalanced (right).

Publications

- David Adjiashvili, Sebastian Stiller, Rico Zenklusen: Bulk-Robust combinatorial optimization. Mathematical Programming 149(1-2), pages 361-390, 2015.
- Vincenzo Bonifaci, Alberto Marchetti-Spaccamela, Sebastian Stiller, Andreas Wiese: Feasibility Analysis in the Sporadic DAG Task Model. ECRTS 2013, pages 225-233, 2013.
- Dimitris Bertsimas, Ebrahim Nasrabadi, Sebastian Stiller: Robust and Adaptive Network Flows. Operations Research 61(5), pages 1218-1242, 2013.
- Vincenzo Bonifaci, Alberto Marchetti-Spaccamela, and Sebastian Stiller. A constant-approximate feasibility test for multiprocessor real-time scheduling. Algorithmica, 62 (3-4), pages 1034–1049, 2012.
- Laura Galli, Sebastian Stiller: Strong Formulations for the Multi-module PESP and a Quadratic Algorithm for Graphical Diophantine Equation Systems. European Symposium on Algorithms, 2010, pages 338-349, 2010.

Institute of Social Sciences

Prof. Dr. Monika Taddicken

Researcher's Career

- Full Professor for Communication Science, Technische Universität Braunschweig
- Research Fellow at University of Wisconsin, Madison
- Senior Researcher and Leader at the Cluster of Excellence CliSAP and the Department of Communication Science and Journalism, Universität Hamburg
- Dr. rer soc at Universität Hohenheim (summa cum laude)
- Research Assistant and Coordinator at the Department of Communication Science, Universität Hohenheim
- Research Assistant at the Department of Marketing, Otto-Friedrich-Universität Bamberg
- Study of Social Sciences, degree Diplom-Sozialwirtin, Georg-August-Universität Göttingen and National University of Galway.

Funding

German Research Foundation (DFG), DAAD, Alcatel Lucent Foundation, German Society of Online Research (DGOF)

Contact

Technische Universität Braunschweig
Institute of Social Sciences
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8960
m.taddicken@tu-braunschweig.de
www.tu-braunschweig.de/kmw/
Twitter: KMW_TUBS | m_taddicken

Mission Statement

The department of Communication Science conducts fundamental and applied research about media and communication processes in all their facets. We aim to understand and conceptualize the individual as well as social relevance and impact of the diverse forms of communication and media in our contemporary mediatized society.

Research

New Media: Media environments have changed significantly in recent decades. The advent and rise of the Internet and so-called social media have radically modified the communicative landscape. Communicative roles – such as communicator and recipient – are converging. New forms of communication patterns, information-seeking behaviors, media repertoires, public spheres and debates have been arisen – as well as innovative media formats, outlets and technologies. We explore and analyze the use of these new media environments and effects on individuals and society as a whole.

Science Communication: Sciences are increasingly specializing themselves, but pervade society more and more. Individual as well as societal decisions often rely on scientific findings. However, scientific processes and topics are regularly complex, uncertain and tentative and therefore often difficult for laypeople to understand. Thus, the media are crucial for the social construction and public perception of scientific issues. Particularly the Internet gains importance for understanding and discussing sciences. Our research focuses on the audience and user's perspective. We try to answer questions such as "How do media users perceive mediated science issues?", "How are levels of knowledge, attitudes and behaviors affected by their media use, who participates how online?".

Methods and Methodology: Researching and analyzing human-behaviors is a complex and dynamic challenge. The Internet offers new and innovative methods and tools to cope with this task (e. g. web surveys, online experiments, netnography, big data analyses), but requires new ethic guidelines. With our methodological research we try to overcome bridges between traditional and new research instruments and modes as well as between quantitative and qualitative methods. Thus, we focus on methodological triangulations by combining different perspectives.

Publications and Patents

- Außerhofer, J., Maireder, A., Schumann, C. & Taddicken, M. (2015): Digital Methods. Reihe: Digital Communication Research, Band 2.
- Schmidt, J.-H. & Taddicken, M. (2015). Handbuch Soziale Medien [Handbook Social Media]. Wiesbaden: Springer.
- Schäfer, M. & Taddicken, M. (2015). Mediatized Opinion Leaders: New Patterns of Opinion Leadership in New Media Environments? International Journal of Communication, 9, 960-981.
- Taddicken, M. (2014). The 'Privacy Paradox' in the Social Web:The Impact of Privacy Concerns, Individual Characteristics, and the Perceived Social Relevance on Different Forms of Self-Disclosure. Journal of Computer-Mediated Communication, 19 (2), 248-273. DOI: 10.1111/jcc4.12052.
- Taddicken, M. (2013). Climate Change From the User's Perspective: The Impact of Mass Media, Internet Use, and Other Variables on Knowledge and Attitudes. Journal of Media Psychology, 25(1), 39-52. DOI: 10.1027/1864-1105/a000080

Institute of Automotive Management and Industrial Production (AIP)

Prof. Dr. David M. Woisetschläger

- Chair of Services Management and Director of the Institute of Automotive Management and Industrial Production, TU Braunschweig

Researcher's Career

- Positions as Visiting Professor of Marketing at the Newcastle University Business School (UK, 2015), Visiting Professor of Marketing, Ruhr-Universität Bochum (2010-2011), Université Nancy II, ICN Business School (France, 2010)
- Assistant Professor of Services Management, TU Dortmund
- Dr. rer. pol., Westfälische-Wilhelms-Universität Münster, Marketing Centrum Münster
- Research Assistant at the Marketing Center Münster, University of Münster
- Dipl.-Kfm., University of Mannheim
- Studies of Business Administration at the University of Mannheim, and UNC North Carolina

Funding

BMBF, BMU, BMWI, Volkswagen Foundation, industry

Contact

Technische Universität Braunschweig
Institute of Automotive Management and Industrial Production (AIP)
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-63120
d.woisetschlaeger@tu-braunschweig.de
www.tu-braunschweig.de/aip/dlm

Mission Statement

Investments in new services, in marketing actions and organizational improvements are key activities to gain and defend competitive advantage. A systematic assessment of the outcomes of these investments is often neglected. We conceptualize models and apply innovative methods to improve our understanding of how managerial actions create value.

Research

Customer Relationship Management: We identify antecedents of customer lifetime value along the lifecycle from new customer acquisition to win-back strategies. Transaction data and data from customer surveys are used to assess the effectiveness of loyalty programs, personalized online advertising or cross-buying initiatives. We analyze determinants and consequences of customer satisfaction, customer loyalty and customer (mis-)behavior and study the applicability and design of sales incentives, basing on indicators such as the net promoter score.

Service Innovation: We conceptualize and identify success factors of service innovations in organizations and study the requirements of stakeholder participation in the new service development process. In addition, we apply qualitative and quantitative methods to identify antecedents and barriers of customer and employee acceptance of innovative technology-mediated services (e.g., platform concepts such as peer-to-peer sharing, b2c sharing, or multi-sided markets) and innovative technologies based on automation (e.g., automated driving).

Brand Management and Social Media: We measure brand performance and conceptualize strategies intended to growing and sustaining brand equity. Our studies in the contexts of product & service brands, luxury brands and human brands show the effects of marketing mix instruments (e.g., advertising expenditures), inferred brand motives or credibility perceptions (e.g. of brand extensions) on brand equity and consumer online engagement.

Sports Marketing and Sponsorship: Our research examines exchange relationships among multiple actors in the sports business. We assess how sponsorships create attitudinal, behavioral and financial benefits for firms, clubs, and consumers and study managerial and consumer-level success factors of sponsorship activation strategies. We analyze how clubs can foster and capitalize on relationships to their multiple audiences.

Publications

- Evanschitzky, H., R. Ramaseshan, D. M. Woisetschläger, V. Richelsen, M. Blut und C. Backhaus (2012), "Consequences of customer loyalty to the loyalty program and to the company," Journal of the Academy of Marketing Science, 40 (5), 625-638.
- Grohs, R., H. Reisinger, D. M. Woisetschläger (2015), "Attenuation of negative sponsorship effects in the context of rival sports teams' fans," European Journal of Marketing, 49 (11/12), 1880-1901.
- Lindloff, K., N. Pieper, N. C. Bandelow, D. M. Woisetschläger (2014), "Drivers of carsharing diffusion in Germany: an actor-centred approach," Int. J. Automotive Technology and Management, 14 (3/4), 217-245.
- Woisetschläger, D. M., H. Evanschitzky, C. Backhaus (2011), "Zur Wirkung von Neukunden-Promotions auf Bestandskunden: Eine empirische Analyse in der Mobilfunkbranche," Zeitschrift für Betriebswirtschaft, 81 (2), 183-204.
- Woisetschläger, D. M., V. J. Haselhoff, C. Backhaus (2014), "Fans' resistance to naming right sponsorships," European Journal of Marketing, 48 (7/8), 1487-1510.

Institute of Operating Systems and Computer Networks

Prof. Dr.-Ing. Lars Wolf

- Head of the IBR institute

Researcher's Career
- Full Professor for Computer Science, TU Braunschweig
- Associate Professor for Computer Science and Deputy Director of Computing Center, Universität Karlsruhe (TH)
- Assistant Professor, TU Darmstadt
- Research Staff, IBM, Heidelberg
- Dr.-Ing. in Computer Science, TU Chemnitz
- Studies in Computer Science, TU Braunschweig and Universität Erlangen-Nürnberg

Funding
DFG, BMBF, BMWI, EU, DAAD, Lower Saxony, industry

Contact
Technische Universität Braunschweig
Institute of Operating Systems and Computer Networks (IBR)
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-3288
wolf@ibr.cs.tu-bs.de
www.ibr.cs.tu-bs.de

Mission Statement

Nowadays, nearly all things and devices are networked and can communicate with each other – from computers, smartphones, small sensor systems, to robots and vehicles. Our mission is to perform basic research on such networked systems and transfer results to real-world application areas.

Research

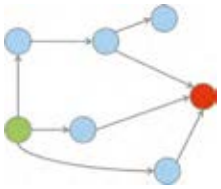
Wireless Sensor Networks: Networked sensing systems using small sensor nodes allow for the monitoring of processes and phenomena in nature as well as in human-created settings. We study and develop wireless sensor networking approaches and methods considering real-time, reliability, and energy requirements. Moreover, we perform real-world experiments and field tests using our own, open-hardware sensor node INGA. Application areas include smart farming, industry monitoring & surveillance, home & building automation, and ambient assisted living.

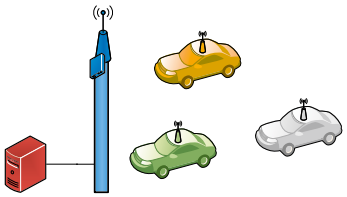
Vehicular Networking and Systems: Communication among vehicles and with infrastructure components including backend systems can reduce accidents, improve traffic safety & efficiency, and support cooperative driving. New functionalities such as autonomous driving and advanced parking are enabled. We analyze and develop new protocols and communication methods as well as backend components such as management components for autonomous parking and charging of electrical vehicles.

Opportunistic and Disruption-Tolerant Networking: Opportunistic and disruption-tolerant networking methods allow the transfer of data not only by routing in space but in space&time – benefiting from the mobility of network nodes. IBR-DTN is our implementation of the bundle protocol for this purpose. It is designed for embedded systems and can be used as framework for DTN applications. For even smaller settings, our µDTN is available and beneficial, e.g., in wireless sensor networks. Besides protocols, routing approaches and support mechanisms are a few of our research directions in this field.

Dependable Networking: Networked embedded systems such as vehicles and space missions operate in challenging, but changing environments. We study dependable networking platforms and protocols between components which are flexible and dynamic, Guarantees have to be given to all components. Safety, availability and security properties in the system must be ensured.

INGA Wireless Sensor Node


Routing in space and time


Vehicular Networking

Publications

- Julian Timpner and Lars Wolf: Query-response geocast for vehicular crowd sensing, in Ad Hoc Networks, Vol. 36, Part 2, Special Issue on Vehicular Crowd Sensing, June 2016
- Ulf Kulau, Felix Büsching and Lars Wolf: IdealVolting – Reliable Undervolting on Wireless Sensor Nodes, in ACM Transactions on Sensor Networks (TOSN), New York, NY, USA, ACM, 2016
- Julian Timpner, Dominik Schürmann and Lars Wolf: Trustworthy Parking Communities: Helping Your Neighbor to Find a Space, in IEEE Transactions on Dependable and Secure Computing, Vol. 13, No. 1, IEEE Comput. Soc, 2016
- Wolf-Bastian Pöttner, Hans Seidel, James Brown, Utz Roedig and Lars Wolf: Constructing Schedules for Time-Critical Data Delivery in Wireless Sensor Networks, in ACM Transactions on Sensor Networks (TOSN), Vol. 10, No. 3, August 2014
- Julian Timpner and Lars Wolf: Design and Evaluation of Charging Station Scheduling Strategies for Electric Vehicles, in IEEE Transactions on Intelligent Transportation Systems, Vol. 15, No. 2, 2014

2

Life Sciences

Life Sciences

Institute of Physical and Theoretical Chemistry

Prof. Dr. Sigurd Bauerecker

Researcher's Career

- Full Professor for Physical Chemistry, TU Braunschweig
- Heisenberg Professor, TU Braunschweig
- Research Periods at the ETH Zurich
- Group Leader, Helmholtz-Zentrum Geesthacht
- Dr. rer. nat. at the TU Braunschweig
- Study of Physics, Chemistry, Electrical Engineering, Braunschweig

Funding

DFG, DAAD, Helmholtz, VolkswagenStiftung, Industry

Contact

Technische Universität Braunschweig
Institute of Physical and
Theoretical Chemistry
Hans-Sommer-Straße 10
38106 Braunschweig
Phone: +49 531 391-5336
s.bauerecker@tu-braunschweig.de
www.tu-braunschweig.de/pci

Mission Statement

Our investigation of gas-phase molecules, aerosol particles and droplets is motivated by multiple factors such as: a better basic understanding of matter between molecule and bulk; their prominent role in the physics and chemistry of the atmospheres of the Earth, other planets, satellites and in space; their impact on weather and climate; the prospects of molecular aerosols and nanoparticles in health care, pharmacy and technical applications.

Research

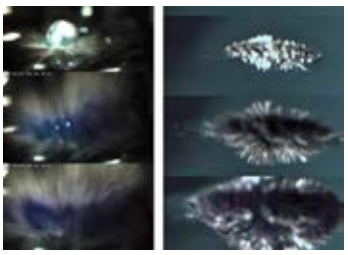
Objects of interest are supercooled gas molecules, molecular clusters (0.1 – 3 nm), molecular nanoparticles (3 – 1000 nm) and microparticles in the aerosol phase (1 – 10 µm), as well as acoustically levitated droplets (0.3 – 6 mm).

Particle properties are investigated as size and size distribution; shape (spherical, cubic, elongated, oblate, prolate, needleshaped, dendritic, …); state of aggregation (liquid, solid); phase (crystalline I, crystalline II, metastable, …); structure (crystalline, amorphous, core-shell, nanocomposite, covered surface, quasi-liquid layer, …); vibrational and scattering spectra, optical constants; intermolecular interactions (hydrogen and van der Waals bonding).

Particle and aerosol dynamics are in the focus of our research regarding size evolution (particle growth, decay, Ostwald ripening); shape evolution (spherical to elongated, dendritic growth), special phase transitions (freezing, melting, sublimation, desublimation, change between crystalline phases); molecular diffusion in nanoparticles; particle agglomeration.

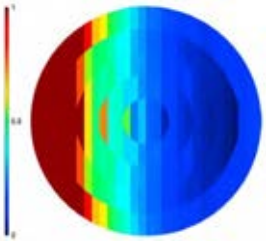
Experimental particle generation is performed by the following techniques: gas aggregation via optical long-path collisional cooling cells with adjustable temperature (4 – 400 K) and pressure (< 0.01 – 3000 mbar); sample-gas inlet techniques such as pulse-injection, (enclosive) flow cooling∞ acoustic trapping and levitation; climate chambers; laser heating, evaporation and desorption. The collisional cooling cells have been constructed, patented and upgraded together with industrial partners. Twin systems of these cells are used in a few collaborations.

Particle and aerosol characterization is realized by FTIR spectroscopy (rapid-scan, low- and high-resolution) in the 400 – 10000 cm^{-1} range; visible (VIS) and infrared (IR) high-speed imaging (analyses of fast processes such as freezing of supercooled droplets); and supported by methods of computational chemistry (ab initio, molecular dynamics, Monte Carlo, Mie calculations, discrete dipole approximation) together with collaboration partners.



Coulombic explosion of a sodium droplet in water with "blue" solvated electrons.

Dendritc freezing of a supercooled water droplet.



Portion of dendritic ice after stage-one freezing.

Publications and Patents

- T. Buttersack, S. Bauerecker: Critical radius of supercooled water droplets: on the transition toward dendritic freezing, J. Phys. Chem. B, 120 (2016) 504-512, http://pubs.acs.org/doi/abs/10.1021/acs.jpc
- O.N. Ulenikov, E.S. Bekhtereva, Yu.V. Krivchikova, V.A. Zamotaeva, T. Buttersack, C. Sydow and S. Bauerecker: Study of the high resolution spectrum of 32S16O18O: the ν1 and ν3 bands, (2015) J. Quant. Spectrosc. Radiat. Transfer, 168 (2016) 29-39, http://dx.doi.org/10.1016/j.jqsrt.2015.08.010.
- P.E. Mason, F. Uhlig, V. Vaněk, T. Buttersack, S. Bauerecker, and P. Jungwirth: Coulomb explosion at early stages of the reaction of alkali metals with water, Nature Chemistry 7 (2015) 250-254.
- S. Bauerecker, T. Buttersack: Electric effect during the dendritic freezing of supercooled water droplets, J. Phys. Chem. B, 118 47 (2014) 13629-13635, http://pubs.acs.org/doi/abs/10.1021/jp507440a.
- A.V. Nikitin, V. Boudon, Ch. Wenger, S. Albert, L.R. Brown, S. Bauerecker and M. Quack: High resolution spectroscopy and the first global analysis of the Tetradecad region of methane 12CH4, Phys. Chem. Chem. Phys. 15 (2013) 10071-10093, DOI: 10.1039/c3cp50799h.

Institute of Medicinal and Pharmaceutical Chemistry

Prof. Dr. Knut Baumann

- Chair, Institute of Medicinical and Pharmaceitical Chemistry

Researcher's Career

- Full Professor for Medicinal and Pharmaceutical Chemistry, TU Braunschweig
- Group Leader at the Institute of Pharmacy, University of Würzburg
- Postdoc at the Department of Chemistry, Arizona State University, Tempe, Arizona, USA
- Postdoc at the Institute of Pharmacy, University of Bern, Switzerland
- Dr. rer. nat. at the University of Würzburg
- Licensed pharmacist
- Studies of Pharmacy at the University of Würzburg

Funding
Industry, State of Lower Saxony

Contact
Technische Universität Braunschweig
Institute of Medicinal and Pharmaceutical Chemistry
Beethovenstraße 55
38106 Braunschweig
Phone +49 531 391-2750
k.baumann@tu-braunschweig.de
www.tu-braunschweig.de/pharmchem

Mission Statement

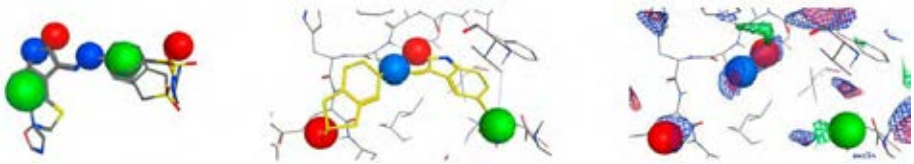
Pre-clinical drug discovery generates a huge amount of data that cannot be evaluated manually. Chemical structure data and biological activity data from various sources as well as analytical data need computational techniques to turn the data into information. Our research focuses on developing chemoinformatic techniques to use the aforementioned data most efficiently.

Research

Encoding chemical structures: Molecules cannot be fed into machine learning tools without encoding them. The chemical structure needs to be transformed into a numerical description of the molecule to develop mathematical models that relate chemical structures to biological activities. The mathematical disciplines of graph theory and geometry, among others, provide techniques to encode molecules. The resulting numerical representation is called molecular descriptor. Molecular descriptors can be used for a number of predictive modeling tasks such as virtual high-throughput screening, visualizing chemical libraries, the analysis of quantitative structure-activity relationships, and for predicting a molecule's target structure.

Development and validation of chemoinformatic models: Most machine learning techniques can be used to develop chemoinformatic models. The employed molecular descriptor is of utmost importance for the successful predictive modeling. If the numerical description of the molecule is unsuitable for the purpose, good results are rather unlikely. Since molecular descriptors are mostly complex and high dimensional descriptions of chemical molecules, data analysis may be prone to chance correlation and overfitting. Rigorous validation and assessment of the resulting models is therefore essential to exclude seemingly good models that would perform badly in the productive phase of the model (i.e. on future molecules).

Evaluation of analytical and bioanalytical data: Bio(-analytical) data often need tailored pre-processing and modelling techniques. Data from vibrational spectroscopy (IR, NIR, Raman spectroscopy) – a workhorse of nondestructive pharmaceutical analysis – often contain spikes, scattering light, or baseline drift. These interfering signals need to be removed for extracting meaningful information from the spectra. Moreover, dimension reduction and the selection of important wavelength regions are important tools to establish predictive multivariate calibration models.



Ligand-based und structure-based pharmacophores. Pharmacophores describe the geometrical arrangement of physical-chemical properties that are necessary for a particular type of biological action. They can be used to virtually screen large compound collections to find novel biologically active compounds.

Publications

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Institute of Pharmaceutical Biology

Prof. Dr. Ludger Beerhues

Researcher's Career
- Professor for Pharmaceutical Biology, TU Braunschweig
- Assistant/Associate Professor for Pharmaceutical Biology, University of Bonn
- Postdoc, Max Planck Institute for Plant Breeding Research, Cologne
- PhD, University of Münster
- Study of biology, University of Münster

Funding
DFG, DAAD, Leibniz Association, Lower Saxony

Contact
Technische Universität Braunschweig
Institute of Pharmaceutical Biology
Mendelssohnstraße 1
38106 Braunschweig
Phone: +49 531 391-5689
l.beerhues@tu-braunschweig.de
www.tu-braunschweig.de/pharmbiol

Mission Statement

Understanding the biosynthetic pathways of bioactive plant natural products at the metabolite, enzyme, and gene levels, aiming at metabolic engineering of compounds and reconstruction of pathways in microorganisms for drug development.

Research

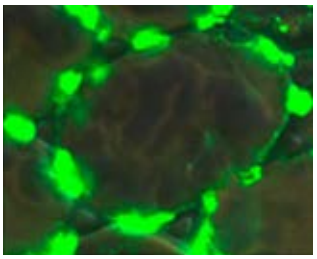
Biotechnology of andidepressant hyperforin: Extracts from the medicinal plant St. John's wort (Hypericum perforatum), which contain hyperforin, are used for the treatment of depression, based on clinical trials. We isolate and functionally characterize the genes that are involved in hyperforin biosynthesis and express them in yeast (Saccharomyces cerevisiae). In addition, we use root cultures as a potential production platform for hyperforin and derivatives (Center of Pharmaceutical Engineering).

Biosynthesis of antitumoral hypericin: St. John's wort contains another interesting compound, hypericin, which is used in photodynamic diagnosis and therapy of cancer. Hypericin is the crimson pigment of the medicinal plant. We study the biosynthesis of hypericin to pave the way for future biotechnological production.

Formation of PPAPs (Polycyclic Polyprenylated Acyl Phloroglucinols): PPAPs have challenging chemical structures and intriguing pharmacological activities, such as antibacterial and anticancer properties. We seek to understand how plants are able to form these amazing compounds and to realize the transfer of the biosynthetic machinery to yeast.

Fire blight-induced defence compounds of apple and pear: In response to infection, such as fire blight, scab, and powdery mildew, our important fruit trees form biphenyls and dibenzofurans as defence compounds. These phytoalexins occur only in a small transition zone of the infected stem. We established cell cultures that also produce these compounds. Understanding the biosynthesis and its temporal and spatial regulation may allow an increase in the disease resistance potential of valuable apple and pear cultivars.

Apple replant disease and phytoalexins: After repeated replanting apple suffers from soil sickness, which is due to changes in the microflora of the rhizosphere. The root system of apple plants is strongly affected. We detected formation of phytoalexins in roots that grow in sick soil and study the role of these compounds in apple replant disease.



Apple cell with immunofluorescent biphenyl synthase

Medicinal plant St. John's wort

Fire blight-infected apple shoots

Publications and Patents

- El-Awaad I, Bocola M, Beuerle T, Liu B, Beerhues L (2016) Bifunctional CYP81AA proteins catalyse identical hydroxylations but alternative regioselective phenol couplings in plant xanthone biosynthesis. Nature Communications 7: 11472. Doi: 10.1038/ncomms11472.
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- Gaid MM, Sircar D, Müller A, Beuerle T, Liu B, Ernst L, Hänsch R, Beerhues L (2012) Cinnamate:CoA ligase initiates biosynthesis of a benzoate-derived xanthone phytoalexin in Hypericum calycinum cell cultures. Plant Physiology 160: 1267-1280.

Institute of Pharmacology – Toxicology and Clinical Pharmacy

Prof. Dr. Sönke Behrends

Researcher's Career

- Professor of Pharmacology, Institute of Pharmacology, University of Braunschweig
- Canada Research Chair for Molecular Pharmacology
- Associate professor, University of Toronto
- Group leader and habilitation, University clinic Hamburg Eppendorf
- Postdoctoral Fellow, Institute of Pharmacology, Free University Berlin
- Dr. med. at Institute of Pharmacology, University of Göttingen
- Study of medicine, Universities Göttingen, Würzburg and Hannover

Funding
DFG, EU / BiostructX, Lower Saxony

Contact
Technische Universität Braunschweig
Institute of Pharmacology – Toxicology
and Clinical Pharmacy
Mendelssohnstr. 1
38106 Braunschweig
Phone +49 531 391-5604
s.behrends@tu-braunschweig.de
www.tu-braunschweig.de/ipt/forschung/agruppen/behrends

Mission Statement

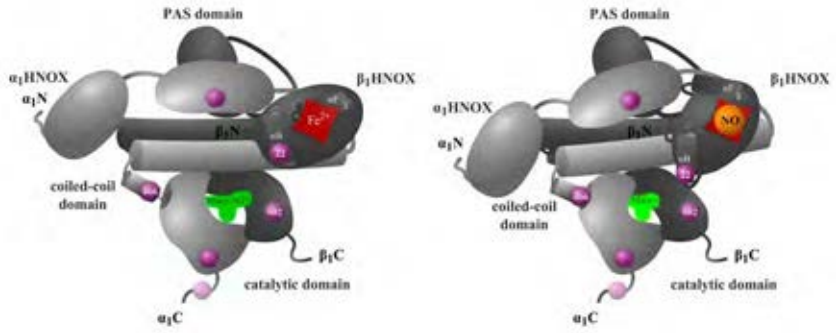
To understand the mechanism of action of novel drugs targeting nitric oxide sensitive guanylate cyclase and the physiological regulation and pharmacogenetic variation of the signal transduction pathway. Techniques range from work with purified protein to visualization in living human cells.

Research

Nitric oxide has long been considered exclusively as a toxic air pollutant. It is now known that this gas is produced by body cells. The gaseous signaling molecule is involved in diverse functions such as cell communication in the brain, regulation of blood pressure and penile erection. The most important receptor of nitric oxide is an enzyme that produces the signaling molecule cyclic GMP. We and others have identified and localized the respective genes and have characterized the resulting enzyme isoforms.

Using a novel approach based on fluorescence resonance energy transfer from endogenous tryptophanes to the fluorescent substrate analogue MANT-GTP, we could show what conformational changes occur in the enzyme as a consequence of nitric oxide binding. In collaboration with groups in London, La Jolla and Bayer in Wuppertal, we could identify a genetic variation in susceptibility to hypoxia-induced pulmonary hypertension in high-altitude residents due to a point mutation in the enzyme. This supported guanylate cyclase as a pharmacological target for reducing pulmonary artery pressure. The recent approval of the drug riociguat to treat pulmonary hypertension has confirmed this idea. Although our data indicate a highly allosteric mechanism of action of riociguat, the exact binding site is still unknown.

In contrast to nitric oxide releasing drugs further development of the allosteric modulator riociguat and the heme displacing drug cinaciguat could lead to the development of isoform specific drugs. Specific subtypes associate with specific targeting proteins within cells or are expressed in an organ-specific manner. One major idea behind our research is to exploit this diversity in nitric oxide receptors for the development of novel specific drugs for single receptor subtypes with novel fields of application and a favorable side effect profile.



basal *NO-stimulated*

Publications

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Structure and Function of Proteins & Institute of Biochemistry, Biotechnology and Bioinformatics

Prof. Dr. Wulf Blankenfeldt

Researcher's Career

- Head of Department Structure and Function of Proteins at the Helmholtz Centre for Infection Research &
- Full Professor for Structural Biology of Proteins, TU Braunschweig
- Associate Professor of Biochemistry, University of Bayreuth
- Group Leader, Max Planck Institute of Molecular Physiology, Dortmund
- Postdoc at the University of St. Andrews, UK
- Dr. rer. nat. at TU Braunschweig
- Study of Chemistry, TU Braunschweig & National Taiwan Normal University, ROC

Funding
DFG, Volkswagen-Foundation

Contact
Structure and Function of Proteins –
Helmholtz Centre for Infection Research (HZI)
Inhoffenstraße 7
38124 Braunschweig
Phone: +49 531 6181-7001
wulf.blankenfeldt@helmholtz-hzi.de
www.helmholtz-hzi.de/sfpr

Mission Statement

Prokaryotic microorganisms inhabit nearly every niche on our planet, which is a consequence of the enormous metabolic diversity encoded in their genomes. We explore this diversity by searching for new enzymes and regulators that can also be employed as drug targets for novel anti-infectives.

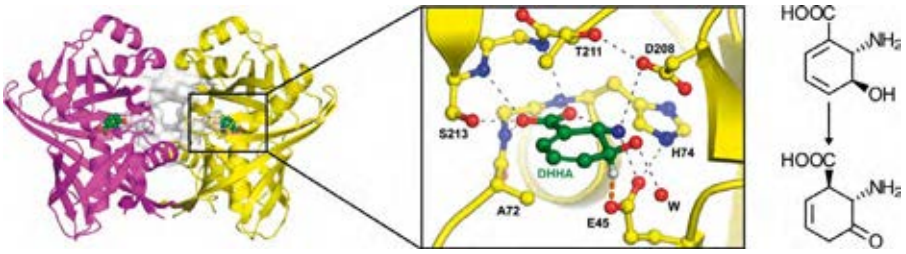
Research

Our main interest lies in understanding small molecule/protein interactions with the aim of exploring new targets for antibiotic discovery and pathoblocker development. As structural biologists, our methodological focus is protein crystallography, but we are also using biophysical techniques and metabolome analysis for synergistic characterization. Current projects include:

Biochemistry of Phenazines: Phenazines are a group of over 150 chorismate-derived bacterial secondary metabolites. They are redox-active, which provides them with a function as broad-specificity antibiotics and virulence factors through the generation of reactive oxygen species. The best-known phenazine producer is the opportunistic pathogen *Pseudomonas aeruginosa*, which generates the blue phenazine derivative pyocyanin. We are studying the conserved genes of phenazine biosynthesis and also investigate how phenazine producers like *P. aeruginosa* protect themselves against their toxicity. Further, we are working towards an understanding of the biosynthesis and propagation of the *Pseudomonas* Quinolone Signal PQS, a unique quorum-sensing signal that may be a promising target for new pharmaceuticals.

Uncharacterized proteins in pathogenic bacteria: Genome sequencing has lead to an explosion of sequence databases in recent years, but a large amount of deposited sequences lack functional annotation such that they cannot be harnessed for biotechnological or medical research. Of these non-annotated genes we address those that have been shown to be involved in infectious disease. Towards this end, we are developing bioinformatic tools to identify proteins whose structures cannot be predicted, and combine structural, analytical and metabolomics approaches to find their molecular function.

Toxic proteins:
Many bacterial toxins are proteins that need to encode several molecular functions to unfold their action, e.g. crossing of membranes and delivery of toxic cargo. We are investigating several of these molecular machines to understand their activity in atomic detail.



Publications

- Goncharenko, K.V.#, Vit, A.#, Blankenfeldt, W.* & Seebeck, F.P.* (2015) Structure of the sulfoxide synthase EgtB from the ergothioneine biosynthetic pathway. Angew. Chem. Int. Ed. Engl., 54:2821-2824. #equal contribution; *corresponding authors
- Xu. N., Ahuja, E.G., Janning, P., Mavrodi, D.V., Thomashow, L.S. & Blankenfeldt, W. (2013) Trapped intermediates in crystals of the FMN-dependent oxidase PhzG provide insight into the final steps of phenazine biosynthesis. Acta Crystallogr. D Biol. Crystallogr. 69:1403-1413.
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Institute of Inorganic and Analytical Chemistry

Prof. Dr. Martin Bröring

Researcher's Career
- Full Professor (W3) for Inorganic Chemistry, TU Braunschweig
- Associate Professor (C3) for Bioinorganic Chemistry, Universität Marburg
- Habilitation, Emmy-Noether Awardee and Group Leader, Universität Würzburg
- Postdoctoral Researcher, Stanford University
- Dr. rer. nat. in Chemistry, Universität Köln
- Study of Chemistry in Würzburg and Köln

Funding
DFG, BMBF, DAAD, AvH, Volkswagen Foundation, FC

Contact
Technische Universität Braunschweig
Institute of Inorganic and Analytical Chemistry
Hagenring 30
38106 Braunschweig
Phone +49 531 391-5302
m.broering@tu-bs.de
www.tu-braunschweig.de/iaac/personal/broering

Mission Statement

Biological energy collection and conversion is largely based on metal porphyrins, the "pigments of life", and modern research can learn from these paradigms. We develop biomimetic approaches towards problems in energy research and life science by synthesis and assembly of tailor-made porphyrin-like metal chelates.

Research

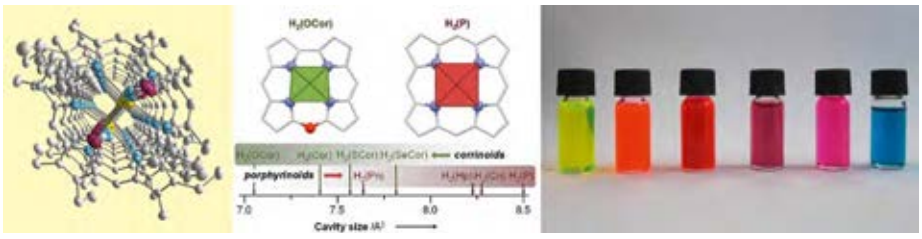
Novel Porphyrinoids: We prepare metal porphyrin variants with fine-tuned core sizes (corrole, heterocorrole), broken conjugation (isoporphyrin, isocorrole) or linear ligand structures (bidipyrrin, tripyrrin) and focus on the isolation and detailed characterization of these novel species. Unexpected and intriguing electronic structures result from such variations. Applications are found in organometallic synthesis (*Viking Helmet* corroles, Corrolocenes), in bioinorganic modelling (Cpd. I, Cyt *c*', light collection), and catalysis (C-C coupling, atom transfer).

DYEmers: Boron chelates of linear oligopyrroles (BODIPYs) are easily engineered with respect to photophysical properties by di- and oligomerization strategies. Such strongly luminescent oligomers we call DYEmers hold great potential as sensor materials and probes as well as in energy research, and applications as biosensors (CO release), battery components (redox flow) and photocatalysts (H_2 generation) are investigated in cooperation.

bioHybrids: Exchange of non-covalently bound cofactors in heme proteins against synthetic metal complexes is currently in the focus of many bioinorganic research activities. We are aiming towards the preparation and investigation of biohybrid compounds and bioconjugated catalysts using metal (iso-/hetero-)corrole complexes with biomimetic side chains.

Complex(es in) Materials: Supramolecular assemblies of our metal chelates can be obtained by ligand substitution (coordination polymers) or by stacking interactions (CT materials). We have developed several preparative strategies for ring-contracted and linear oligopyrrole building blocks and study such assemblies in cooperation with respect to optical or conductivity properties using solid state methodology.

MAGicLAB: The group owns a facility for the investigation of paramagnetic material (Mössbauer- and EPR spectroscopy, SQUID magnetometry). Many international cooperations span topics from solid state physics to molecular biology.



Publications

- R. Wicht, S. Bahnmüller, K. Brandhorst, P. Schweyen, M. Bröring (2016) Cationic Nickel porphyrinoids with unexpected reactivity. Chem. Sci., 7:583-588.
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- P. Schweyen, K. Brandhorst, R. Wicht, B. Wolfram, M. Bröring (2015) The Corrole Radical. Angew. Chem. 127:8331-8334.
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Institute of Pharmaceutical Technology

Prof. Dr. Heike Bunjes

Researcher's Career
- Professor for Pharmaceutical Technology, Institute of Pharmaceutical Technology
- Junior professor for Pharmaceutical Technology, Institute of Pharmacy, Friedrich-Schiller-Universität Jena
- Dr. rer. nat., Institute of Pharmacy, Friedrich-Schiller-Universität Jena
- Studies in Pharmacy, TU Braunschweig

Funding
DFG, Lower Saxony, Phospholipid Research Center, industry

Contact
Technische Universität Braunschweig
Institute of Pharmaceutical Technology
Mendelssohnstraße 1
38106 Braunschweig
Phone: +49 531 391-5652
heike.bunjes@tu-braunschweig.de
www.tu-braunschweig.de/pharmtech

Mission Statement

Our goal is to develop delivery systems for active pharmaceutical ingredients with challenging physicochemical properties such as poor solubility or delicate chemical structure. An important basis is the fundamental understanding of the interactions between formulation composition and preparation, resulting structural properties and pharmaceutical performance.

Research

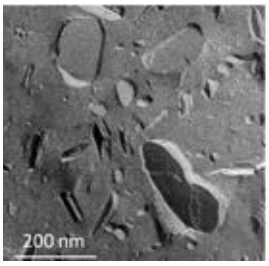
Nanoparticulate lipid carriers: Our group has long-term experience in the development, preparation and physicochemical characterization of different kinds of colloidal/nanostructured lipid-based drug delivery systems. These include solid lipid nanoparticles, lipid nanoemulsions, liposomes as well as dispersions of lyotropic and thermotropic liquid crystalline phases. Such dispersions can be used as carriers for poorly soluble drugs, for example to enable their parenteral administration.

Drug nanosuspensions: The applicability of poorly soluble drugs can also be improved by processing them into drug nanosuspensions. We work on issues of drug nanoparticle stabilization and their processing into solid dosage forms.

Protein formulations: Proteins like, for example, monoclonal antibodies represent an important class of active pharmaceutical ingredients. Their complex three-dimensional structure results, however, in challenges with regard to formulation development. Our group works on strategies for the development of stable protein formulations, in particular with regard to controlled release applications.

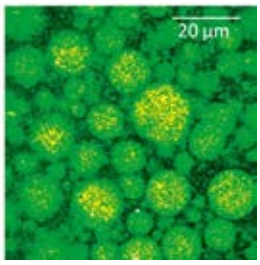
Carrier selection: When developing formulations for new drug candidates the availability of the drug substance is often limited. We establish miniaturized experimental approaches for the efficient identification of suitable carrier systems for poorly soluble drug substances and study the basics of drug-carrier interactions in order to develop a rational basis for carrier selection.

Drug release: Understanding and controlling the drug release from delivery systems is of paramount pharmaceutical importance. However, adequate methods for studying the release behavior from modern drug administration systems are not always available. We are concerned with establishing methods for investigating drug release from parenteral administration systems for poorly soluble and biomacromolecular drug substances under close to physiological conditions.



Solid lipid nanoparticles

Colloidal emulsions as drug carriers



Protein-loaded hydrogel microparticles

Publications

- Kupetz E., Preu L., Kunick C., Bunjes H., Parenteral formulation of an antileishmanial drug candidate – Tackling poor solubility, chemical instability, and polymorphism, Eur. J. Pharm. Biopharm. 85 (2013) 511-520.
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Institute of Biochemistry, Biotechnology and Bioinformatics (IB3)

Prof. Dr. Stefan Dübel

- Head, Dept. Biotechnology

Researcher's Career

- Full Professor, Biotechnology, TU Braunschweig, Managing Director of IB3 and Director, Centre of Molecular Engineering, iTUBS
- Group Leader, Institute for Molecular Genetics, University of Heidelberg
- Scholar, senior scientist and Group Leader, German Cancer Research Centre, Heidelberg (DKFZ)
- Ph.D. at Center for Molecular Biology Heidelberg (ZMBH)
- Studies of Biology, Mainz and Heidelberg

Funding

EU, BMBF, DFG, AIF, industry

Contact

Technische Universität Braunschweig
Institute of Biochemistry, Biotechnology and Bioinformatics (IB3)
Spielmannstraße 7
38106 Braunschweig
Phone +49 531 391-5731
biotech@tu-braunschweig.de
www.bbt.tu-bs.de/Biotech/

Mission Statement

A recombinant antibody generated by phage display is currently the world's bestselling biological drug. Since we developed the enabling technology, we continue to generate and refine human antibodies both by adding novel functions allowing new therapeutic paradigms and developing high-throughput in vitro antibody generation to substitute animal experiments.

Research

Phage display and human antibody discovery: We partner with academia and pharma in the generation of new drugs against cancer, autoimmune diseases and infections using our world leading antibody phage display systems, including the first trly comprehensive naïve functional human antibody gene repertoire.

Designer antibodies: The control of biochemical milieu during the in vitro selection step can be employed to predetermine antibody properties at the very moment of selection, e.g. tune fine specificity, to avoid crossreactivity or to generate compatible sandwich pairs.

Antibodies against pathogens: We generated neutralizing antibodies to numerous bacterial and viral pathogens, as well as conformation specific antibodies to alzheimer peptide.

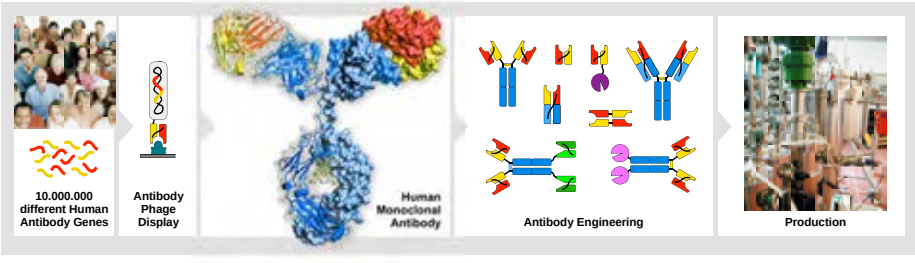
Discovery of novel disease biomarkers: Using phage display of whole genomes together with Hyperphage, we identified immunogenic proteins not found so far using cultivated pathogens, yielding new candidates for diagnostic markers or vaccines.

High-throughput *in vitro* antibody generation to avoid animal experiments: In international consortia, we generated large sets of research antibodies in a high throughput semi-automated pipeline, bypassing the capability of animal based methods both in numbers and quality.

Antibody Fusions & Bispecific Antibodies: Fusing our human antibodies to human effector proteins like human Rnase allows us to achieve anti-tumor procedures never before possible with naïve IgG. The Bispecific Yumab format allows rapid assessment of bispecific combinations from human antibody candidates directly from the library.

Biopolysaccharides: Schizophyllan & Scleroglucan secreted by filamentous growing fungi are used in a wide range of applications for skin care, immune response modification and enhanced oil recovery. Production and downstream processing are investigated, and specific antibodies were developed.

Protein knock down *in vivo* by intrabodies: Recently, we achieved the world's first protein knock down *in vivo* by expressing intracellular antibodies in trangenic mice.



Publications

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- Dübel, S. & Reichert, J.M. (eds.) (2014) Handbook of Therapeutic Antibodies, 2nd ed. 4 Vol., Wiley-VCH, Weinheim, ISBN 978-3-527-32937-3
- Marschall, A.L.J.et al. (2014) Functional knock down of VCAM1 in mice mediated by ER intrabodies. mAbs 6, 1394-1401

Institute of Psychological Methodology and Biopsychology (IPMB)

Prof. Dr. Frank Eggert

Researcher's Career

- Professor of Psychological Methodology and Biopsychology, TU Braunschweig
- Adjunct Professor of General Psychology, University of Kiel
- Senior Lecturer, University of Kiel
- Dr. phil. habil. and Venia Legendi in Psychology, University of Kiel
- Professioral Assistant, University of Kiel
- Dr. phil., University of Kiel
- Research Assistant, University of Kiel
- Dipl.-Psych., University of Kiel
- Study of Psychology, University of Kiel

Funding

BMWi, BMU, Volkswagen Foundation, Industry

Contact

Technische Universität Braunschweig
Institute of Psychological Methodology and Biopsychology (IPMB)
Spielmannstraße 19
38106 Braunschweig
Phone: +49 531 391-3146
f.eggert@tu-braunschweig.de
www.tu-braunschweig.de/psychologie/abt/methoden

Mission Statement

I try to understand how behaviour is selected by its consequences for the organism via its effect on the organism's environment. I am interested in behavioural adaptations at all levels (overt, verbal, covert) resulting from natural selection as well as operant conditioning or social discourses and the role these adaptations play in individual, social and cultural behaviour.

Research

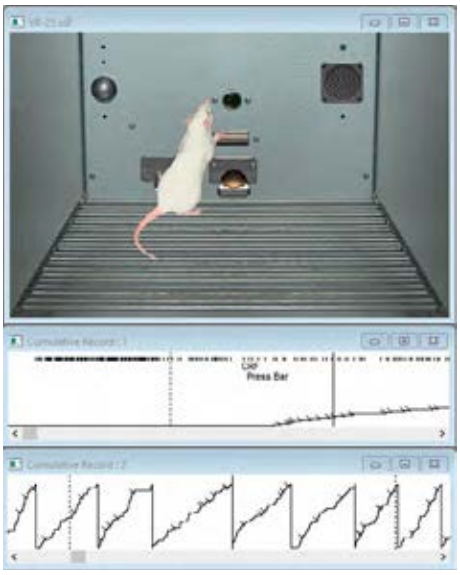
Human-Machine-Interaction: We developed a number of innovative driver assistance systems that are based on principles of behavioural control that have not been utilized in this field before. We used theoretically based design to develop a user inferface for influencing resource related behaviour by means of different strategies to present information to the user.

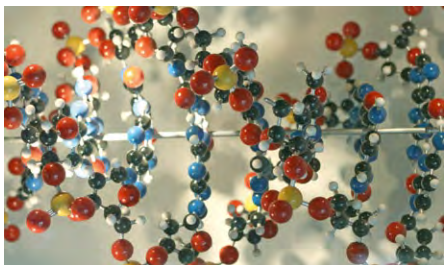
Resource conserving behaviour: We investigate a number of different factors that are involved in the control of resource relevant behaviour in humans. Further on, we try to develop a behavioural definition of sustainable behaviour in terms of a more general theory of behaviour.

Psychology as the science of behaviour: We are interested in the re-interpretation of common psychological constructs (and procedures) in terms of behaviour, trying to clarify the categorical foundations of Psychology.

Research methods in Psychology: We are interested in examining the role of statistics and formal methods in the research process and why they are applied inappropriately so often.

General theory of behaviour: We are interested in the theoretical integration of Behavioural Ecology and Psychology and the development of a general theory of behaviour.





Publications and Patents

- Lange, F. & Eggert, F. (2015). Selective cooperation in the supermarket: Field experimental evidence for indirect reciprocity. Human Nature 26(4).
- Buntins, M., Buntins, K. & Eggert, F. (2015). Psychological tests from a (fuzzy-)logical point of view. Quality and Quantity (10/15 online first).
- Lange, F., Brückner, C., Kröger, B., Beller, J. & Eggert, F. (2014). Wasting ways: Perceived distance to the recycling facilities predicts pro-environmental behavior. Resources Conservation and Recycling 92.
- Schwarze, A., Buntins, M., Schicke-Uffmann, J., Goltz, U. & Eggert, F. (2013). Modelling driving behaviour using hybrid automata. IET – Intelligent Transport Systems, 7(2).
- Lange, F., Haiduk, M., Schwarze, A. & Eggert, F. (2011). The dark side of stimulus control – Associations between contradictory stimulus configurations and pedestrians' and cyclists' illegal street crossing behavior. Accident Analysis and Prevention, 43.
- EP000001897785B1 Driver support system, steering system and method for supporting the driver of a vehicle.

Institute of Food Chemistry

Prof. Dr. Ulrich H. Engelhardt

Researcher's Career
- Associate Professor for Food Chemistry,
- Dr. rer. nat. at Braunschweig University, Institute of Food Chemistry
- Practical year for food chemist
- Study of Food Chemistry

Funding
BMBF, BMWi, DAAD, industry

Contact
Technische Universität Braunschweig
Institute of Food Chemistry
Schleinitzstrasse 20
38106 Braunschweig
Phone: +49 531 391-7203
u.engelhardt@tu-braunschweig.de
www.tu-braunschweig.de/ilc

Mission Statement

Isolation and identification of bio-active natural compounds from tea, coffee and herbal infusions by modern spectroscopic and spectrometric techniques. Method development for the determination of bioactives and contaminants.

Research

- Method development for the determination of phenolic compounds from tea, including flavanols theaflavins, thearubigins, flavonol glycosides.
- Preparative isolation of phenolic acids from coffee (chlorogenic acids and derivatives) including their roasting products (e.g. lactones).
- Determination of (natural) contaminants , such as nicotine or biphenyl from tea, vegetables, spices and herbs, including their changes during food processing.
- Analysis of selected bioactive compounds and metabolites in body fluids after beverage intake.

Publications

- Horanni, R., Engelhardt, U.H. (2015) Enantiomeric analysis of theanine in different teas (Camellia sinensis) using Marfey's reagent. Eur. Food Res. Technol. 240, 61-70
- Selmar, D., Engelhardt, U.H., Hänsel, S., Thräne, C., Nowak, M., Kleinwächter, M. (2015) Nicotine uptake by peppermint plants (Mentha × piperita) as a possible source of nicotine in plant-derived products. Agron. Sustain. Dev. 35:1185-1190
- Thräne, C., Isemer, C., Engelhardt, U.H. (2015) Determination of nicotine in tea (Camellia sinensis) by LC-ESI-MS/MS using a modified QuEChERS method. Eur. Food Res. Technol., 241:227-232
- Jiang, H., Engelhardt, U.H., Thräne, C., Maiwald, B., Stark, J. (2015) Determination of flavonol glycosides in green tea,oolong tea and black tea by UHPLC compared to HPLC. Food Chem. 183, 30-35
- Stodt, U.W., Stark, J., Engelhardt, U.H. (2015) Comparison of three Strategies for the Isolation of Black Tea Thearubigins with a Focus on Countercurrent Chromatography. Journal of Food Composition and Analysis 43 (2015) 160-168

Institute for Microbiology

Prof. Dr. Susanne Engelmann

Researcher's Career

- Professor for Microbial Proteomics at the TU Braunschweig
- Group leader of the Microbial Proteomics Group at the HZI in Braunschweig
- Group leader of the Pathogenomics Group at the University in Greifswald, Institute for Microbiology
- PostDoc at the University in Greifswald, Institute for Microbiology
- Dr. rer. nat. at the University in Greifswald, Institute for Microbiology
- Study of Biology at the University in Greifswald

Funding
DFG, BLE

Contact
Institute for Microbiology –
Helmholtz Centre for Infection Research (HZI)
Inhoffenstraße 7
38124 Braunschweig
Phone: +49 531 6181-3041
susanne.engelmann@helmholtz-hzi.de
www.tu-braunschweig.de/ifm/abt/engelmann

Mission Statement

We are using functional genomics approaches to get deeper insights into host pathogen interactions which is an essential prerequisite for the development of novel diagnostic tools and antiinfective strategies to successfully combat bacterial infections also in the future.

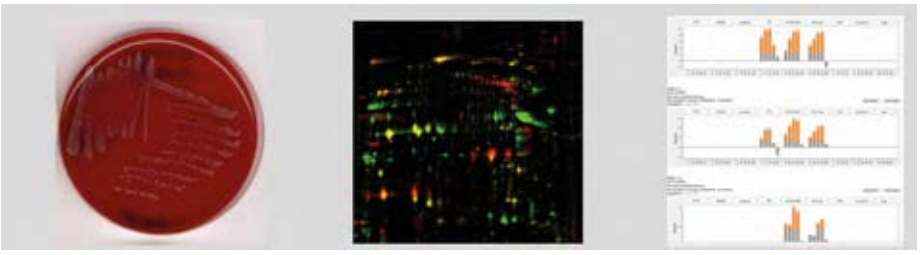
Research

Staphylococcus aureus is one of the leading nosocomial pathogens frequently involved in respiratory-associated pneumonia and sepsis. The mortality rate of infected patients in the hospitals is alarming and strongly demands novel and more effective antimicrobials. One hallmark of our research is thus to provide a more comprehensive understanding of host pathogen interactions during *S. aureus* colonization and infection.

Adaptation of *S. aureus* to infection and colonization related conditions: Adaptation of *S. aureus* to the host environment during colonization and infection is a very complex process and involves physiological adaptation and immune evasion strategies. We are using functional genomics technologies, particularly mass spectrometry based proteomics to gain new information on the dynamics of the protein inventory and protein modification events, the role of crucial regulons in metabolism and proteins displaying essential functions under these conditions.

Identification of novel targets for antiinfectiva and new vaccine candidates: By identifying proteins which are essential for *S. aureus* colonization and infection we are not only able to define vaccine candidates to monitor and prevent spreading of *S. aureus* but also drug targets leading to novel treatment options for infections with multiresistant isolates. Moreover, an *S. aureus* protein array was generated in cooperation with the Alere Technologies GmbH (Jena) with the potential to be developed into a tool for routine application in clinical diagnostics.

Functional characterization of novel virulence factors: The function of about 50% of secreted *S. aureus* proteins is not yet clear and a possible role in virulence has to be elucidated. Mutants, recombinant proteins and corresponding polyclonal antibodies are being generated and used for functional characterization (binding to immune cells and non-professional phagocytes, interaction with components of the immune system and virulence in animal models).



Publications

- Kloppot, P., Selle, M., Kohler, C., Stentzel, S., Fuchs, S., Liebscher, V., Müller, E., Kale, D., Ohlsen, K., Bröker, B. M., Zipfel, P., Kahl, B., Ehricht, R., Hecker, M., Engelmann, S. (2015) Microarray based identification of human antibodies against *S. aureus* antigens. Proteomics Clin. Appl. 9:1003-1011.
- Müller, M., Reiß, S., Schlüter, R., Mäder, U., Beyer, A., Reiß, W., Marles-Wright, J., Lewis, R. L., Pförtner, H., Völker, U., Riedel, K., Hecker, M., Engelmann, S., Pané-Farré, J. (2014) The DUF322 protein Asp23 of *S. aureus* is membrane localized and functionally linked to cell wall stress. Mol. Microbiol. 93:1259-1268.
- Fuchs, S., Zühlke, D., Pané-Farré, J., Kusch, H., Wolf, C., Reiß, S., Binh, L.T.N., Albrecht, D., Riedel, K., Hecker, M., Engelmann, S. (2013) Aureolib – a proteome signature library: Towards an understanding of *S. aureus* pathophysiology. PlosOne. 8:e70669.
- Pagels, M., Fuchs, S., Pané-Farré, J., Kohler, C., Menschner, L., Hecker, M., McNamarra, P.J., Bauer, M.C., von Wachenfeldt, C., Liebeke, M., Lalk, M., Sander, G., von Eiff, C., Proctor, R.A., Engelmann, S. (2010) Redox sensing by a Rex-family repressor is involved in the regulation of anaerobic gene expression in *S. aureus*. Mol. Microbiol. 76:1142-1161.
- Ziebandt, A.K., Kusch, H., Degner, M., Jaglitz, S., Sibbald, M.J.J.B., Arends, J. P., Chlebowicz, M.A., Albrecht, D., Pantuček, R., Doškar, J., Ziebuhr, W., Bröker, B. M., Hecker, M., van Dijl, J.M., Engelmann, S. (2010). Proteomics uncovers extreme heterogenity in the *S. aureus* exoproteome due to genomic plasticity and variant gene regulation. Proteomics 10:1634-1644.

Institut of Genetics

Prof. Dr. André Fleißner

Researcher's Career
- Associate Professor of Genetics, TU Braunschweig
- Assistant Professor of Genetics, TU Braunschweig
- Postdoc at the University of California, Berkeley
- Dr. rer. nat. at the University Münster, Institute of Botany
- Studies of Biology at the Freie Universität Berlin and the University Münster

Funding
DFG, EU

Contact
Technische Universität Braunschweig
Institute of Genetics
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391-5795
a.fleissner@tu-braunschweig.de
www.tu-braunschweig.de/ifg

Mission Statement

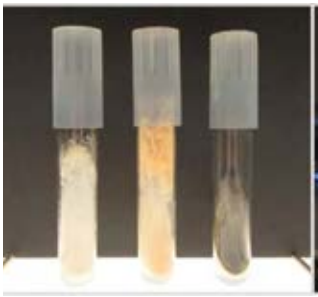
We are employing various fungal model organisms to elucidate the basic molecular mechanisms governing growth, development and differentiation of individual cells and cell populations. In addition, our expertise includes fungal pathogenesis and biotechnological applications.

Research

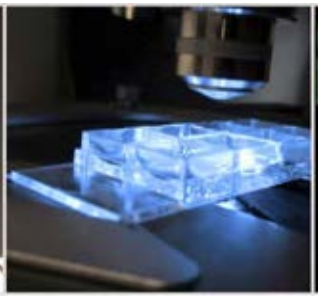
Cell-cell communication and fusion: Using the red bread mold *Neurospora crassa* we are investigating how cells communicate and fuse into supracellular structures. Currently, we are focussing on a novel signaling mechanism, in which cells alternate between signal sending and receiving, and the contribution of the plasma membrane to the formation and activation of signaling protein complexes. We are approaching these questions by using a combination of classical and molecular genetics, biochemical analysis and state-of-the-art imaging.

Membrane repair mechanisms: We are analyzing the molecular mechanisms mediating membrane repair in *Neurospora crassa* and the human pathogenic yeast *Candida albicans*. This research furthers our understanding of cellular stress responses, including the reaction of fungal cells to antimycotic drugs.

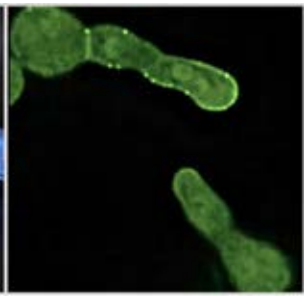
Fungi as biotechnological production hosts: Fungi have many features desirable in biotechnological applications, including fast growth and high secretory capacities. We aim to optimize their use as production hosts for heterologous proteins, including pharmaceutical relevant products, such as human antibody fragments. A current goal is to identify the main molecular restrictions which limit microbial productivity.



Different fungal strains



Fluorescence microscopy



Signaling complexes in interacting cells of *N. crassa*

Publications

- Herzog, S., Schumann, M.R., and Fleißner, A. (2015) Cell fusion in *Neurospora crassa*. Current Opinion in Microbiology, 28: 53-59.
- Priegnitz, B.E., Brandt, U., Pahirulzaman, K.A.K., Dickschat, J.S. and Fleißner, A. (2015) The AngFus3 MAP kinase controls hyphal differentiation and secondary metabolism in *Aspergillus niger*. Eukaryotic Cell, in press
- Aguilar, P.S., Baylies, M.K., Fleißner, A., Helming, L., Inoue, N., Podbilewicz, B., Wang, H., and Wong, M. (2013) Genetic basis of cell-cell fusion mechanisms. Trends in Genetics, 29(7): 427-437.
- Schürg, T., Brandt, U., Adis, C., and Fleißner, A. (2012) The *Saccharomyces cerevisiae* BEM1 homolog in *Neurospora crassa* promotes coordinated cell behavior resulting in cell fusion. Molecular Microbiology, 86: 349-366.
- Dettmann, A., Illgen, J., März, S., Schürg, T., Fleißner, A., and Seiler, S. (2012) The NDR kinase scaffold HYM1/MO25 is essential for MAK2 MAP kinase signaling in *Neurospora crassa*. PLoS Genetics DOI: 10.1371/journal.pgen.1002950.

Institute of Genetics

Prof. Dr. Reinhard Hehl

Researcher's Career

- Professor for Genetics at the Institute of Genetics, TU Braunschweig
- Postdoc at the UC Berkley/USDA, Plant Gene Expression Center, Albany, California, USA
- Postdoc at the Max-Planck Institute for Plant Breeding Research, Köln
- Dr. rer nat, Universität Köln
- Study of Biology Universität Köln

Funding

BMBF, industry

Contact

Technische Universität Braunschweig
Institute of Genetics
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 6181-5772
r.hehl@tu-braunschweig.de
http://www.tu-braunschweig.de/ifg/ag/hehl

Mission Statement

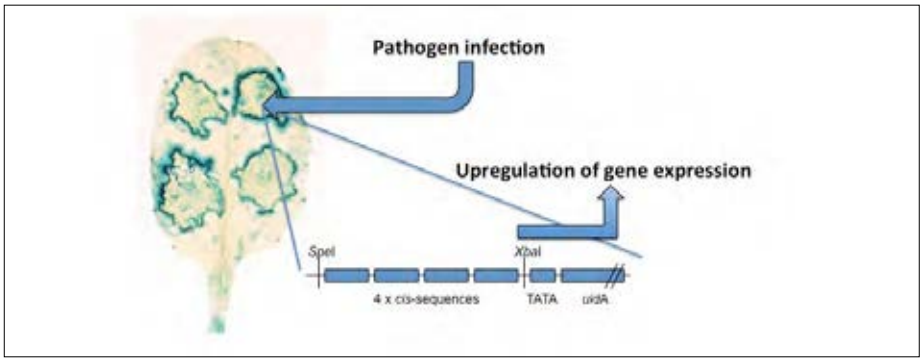
Like humans, plants can be infected with pathogenic microorganisms. To increase our understanding of the plant basal immune system, we study pathogen-responsive gene expression in the model plant *Arabidopsis thaliana*. Our goal is the identification and analysis of novel transcriptional regulators.

Research

Database development: Gene expression is regulated by the interaction of transcription factors with short cis-regulatory sequences in the promoters of the genes. To facilitate the study of transcriptional regulation in the model plant *A. thaliana*, we developed the database AthaMap (www.athamap.de) for genome-wide identification of cis-regulatory sequences. A second database is PathoPlant (www.pathoplant.de), a database on plant pathogen interaction. PathoPlant permits, for example, the identification of pathogen-responsive genes in *A. thaliana*.

Bioinformatic identification of cis-regulatory sequences in coregulated genes: Using several bioinformatics tools and databases, we identify conserved cis-regulatory sequences in pathogen-responsive genes. These cis-sequences and their interacting transcription factors are being studied using transient and transgenic reporter gene technology.

Synthetic plant promoters for basic and applied research: The identification of pathogen-responsive cis-regulatory sequences leads to the construction of synthetic promoters that harbour several copies of the cis-sequence upstream of a reporter gene. Using this setup, pathogen infection can be studied and monitored in transgenic plants. Pathogen responsive synthetic promoters can also be used to express disease resistance genes for the protection of plants against pathogens.



Publications

- Hehl, R., L. Norval, A. Romanov, L. Bülow. (2016) Boosting AthaMap database content with data from protein binding microarrays. Plant and Cell Physiology, 57:e4 doi: 10.1093/pcp/pcv156
- Lehmeyer, M., K. Kanofsky, E. K. R. Hanko, S. Ahrendt, M. Wehrs, F. Machens, R. Hehl. (2016) Functional dissection of a strong and specific microbe-associated molecular pattern-responsive synthetic promoter. Plant Biotechnology Journal, 14:61-71 doi: 10.1111/pbj12357
- Dubos, C., Z. Kelemen, A. Sebastian, L. Bülow, G. Huep, W. Xu, D. Grain, F. Salsac, C. Brousse, L. Lepiniec, B. Weisshaar, B. Contreras-Moreira, R. Hehl (2014) Integrating bioinformatic resources to predict transcription factors interacting with *cis*-sequences conserved in co-regulated genes. BMC Genomics, 15:317
- Machens, F., M. Becker, F. Umrath, R. Hehl. (2014) Identification of a novel type of WRKY transcription factor binding site in elicitor-responsive cis-sequences from *Arabidopsis thaliana*. Plant Molecular Biology, 84:371-385
- Niemeyer, J., J. Ruhe, F. Machens, D. J. Stahl, R. Hehl. (2014) Inducible expression of p50 from TMV for increased resistance to bacterial crown gall disease in tobacco. Plant Molecular Biology, 84:111-123

Department of Psychology – Institute of Clinical Psychology, Psychotherapy and Assessment

Prof. Dr. Nina Heinrichs

- Chair, Institute of Clinical Psychology, Psychotherapy and Assessment and
- Director of the University Outpatient Clinics for Children, Adolescents and Adults

Researcher's Career

- Full Professor for Clinical Psychology and Psychotherapy
- Full Professor for Clinical Child and Adolescent Psychology and Psychotherapy, University of Bielefeld
- Assistant Professor (Juniorprofessor), TU Braunschweig
- Dr. rer. nat. at TU Braunschweig
- Research Scholar, Center for Anxiety and Related Disorders at Boston University, Boston, USA
- Study of Psychology, Philipps-Universität Marburg, Marburg

Funding
DFG, BMBF, Alexander von Humboldt-Stiftung, Jacobs Stiftung, DFK, DAAD, AOK

Contact
Technische Universität Braunschweig
Department of Psychology
Humboldtstraße 33
38106 Braunschweig
Phone: +49 531 391-2854
n.heinrichs@tu-braunschweig.de
www.tu-braunschweig.de/psychologie/abt/klinische

Mission Statement

Understanding the factors that contribute to an individual's physical and mental health, and continuing to improve services across the lifespan delivered prior to difficulties arising (prevention), during first signs of challenges (early intervention) or when disorders have been established and treatment is needed. I am fascinated by the ways individuals' lives change over time, unintentionally or intentionally, and how they adapt to changes in their environment.

Research

My research seeks to improve our understanding of psychological factors on health outcomes of individuals, including children as well as adults.

Information Processing Biases: Understanding the role of information processing biases in the context of adults and children who suffer from anxiety disorders, in order to test cognitive models of these illnesses.

Couple and Parent-Child Relationships: A specific research interest in recursive influences of dyadic relationships (e.g. in couple relationships, or parent-child relationships) that may help identify more general principles of what makes relationships work and how this relates to mental health in individuals and families. We also work on developing interventions which involve significant others.

Efficacy and Effectiveness of Psychological Services Aiming to Improve Mental Health: Evaluating the provision of prevention or treatment services to families or individuals is an important aspect of our research in the institute. Knowing how strongly mental disorders can interfere not only with enjoyment of life but also with achieving one's goals in individuals, from childhood to adulthood, it is among the most important tasks to identify effective interventions for those suffering from mental disorders, such as anxiety disorders like social phobia or panic disorder in adults, depression, or oppositional, aggressive disorders in kids.

Identifying Mechanisms of Change: Dealing with change always results in questioning how change came on board. We are investigating the longitudinal impact of environmental factors on health outcomes, primarily in children. We are interested in determining the mechanisms through which impact can unfold with or without providing services.

Dissemination of Programs: It often takes a long time before most-up-to date treatment programs become available in practice. Only a small portion of research findings reaches physical or mental health professionals. There is a research field of dissemination and implementation science which tries to identify barriers in this process, and design studies to introduce strategies to overcome these barriers, hoping to make evidence-based practices more quickly available in real-world settings.

Publications

- Frantz, I., Stemmler, M., Hahlweg, K., Plück, J. & Heinrichs, N. (2015). Experiences in disseminating evidence-based prevention programs in a real-world setting. Prevention Science.
- Heinrichs, N., Bertram, H., Kuschel, A., & Hahlweg, K. (2005). Parent recruitment and retention in a universal prevention program for child behavior and emotional problems: Barriers to research and program participation. Prevention Science, 6, 275-286.
- Heinrichs, N., Rapee, R., Alden, L., Bögels, S., Hofmann, S. G., Oh, K. J., & Sakano, J. (2006). Cultural differences in perceived social norms and social anxiety. Behaviour Research and Therapy, 44, 1187-1197.
- Heinrichs, N. & Hofmann, S. G. (2001). Information processing in social phobia: A critical review. Clinical Psychology Review, 21, 751-770
- Heinrichs, N., Cronrath, A.-L., Degen, M. & Snyder, D. K. (2011). The recursive influences of child psychopathology and couple relationship functioning. Family Science, 1, 152-172.
- Heinrichs, N., Zimmermann, T., Huber, B., Herschbach, P., Russel, D.W., & Baucom, D. H. (2012). Cancer Distress Reduction with a Couple-Based Skills Training: A randomized controlled trial. Annals of Behavioral Medicine, 43, 239-252.

Institute of Microbiology

Prof. Dr. Dirk Heinz

Scientific Director
Helmholtz Centre for Infection Research (HZI)

Researcher's Career

- Full professorship for Molecular Structural Biology at TU Braunschweig
- Scientific Director, Helmholtz Centre for Infection Research, Braunschweig (HZI)
- Speaker of Helmholtz Programme "Infection Research"
- Head of Division of Structural Biology, German Research Center for Biotechnology (GBF)*, Braunschweig (now HZI)
- Head Department for Molecular Structural Biology, HZI, Braunschweig
- Head of Department of Structural Biology, GBF, Braunschweig
- Habilitation in Biochemistry, University of Freiburg
- Junior research group leader in the Department of Structural Biology, GBF
- Research Assistant, University of Freiburg
- Postdoctoral Fellow, University of Oregon, Eugene, U.S.A.

Funding
EU, BMBF, Lower Saxony/State, Helmholtz Association, DFG, DZIF, industry

Contact
Institut of Microbiology –
Helmholtz Centre for Infection Research (HZI)
Inhoffenstraße 7
38124 Braunschweig
Phone: +49 531 6181-1000
dirk.heinz@helmholtz-hzi.de
www.helmholtz-hzi.de

Mission Statement

The structure and function of biomacromolecules, such as proteins and nucleic acids, are the basis of all biological processes. Infections can be better understood by investigating the structures of bacterial virulence factors and their interactions with the host. Elucidating the details of these processes will provide us with new ideas to fight infections.

Research

- Structural analysis of virulence factors of pathogenic micro-organisms and their interactions with host cell receptors
- Structural analysis of enzymes of the co-factor synthesis
- Structural analysis of bacterial enzymes of natural compound synthesis

Currently, Prof. Heinz (as Scientific Director of the Helmholtz Centre for Infection Research) is not operating an active laboratory, neither on the premises of the TU nor the HZI.

Publications

- Hebecker S., Krausze J., Hasenkampf T., Schneider J., Groenewold M., Reichelt J., Jahn D., Heinz D.W. & Moser J. (2015) Structures of two bacterial resistance factors mediating tRNA-dependent aminoacylation of phosphatidylglycerol with lysine or alanine. Proc Natl Acad Sci USA. 25, 10691-6.
- Kling A., Lukat P., Almeida D.V., Bauer A., Fontaine E., Sordello S., Zaburannyi N., Herrmann J., Wenzel S.C., König C., Ammerman N.C., Barrio M.B., Borchers K., Bordon-Pallier F., Brönstrup M., Courtemanche G., Gerlitz M., Geslin M., Hammann P., Heinz D.W., Hoffmann H., Klieber S., Kohlmann M., Kurz M., Lair C., Matter H., Nuermberger E., Tyagi S., Fraisse L., Grosset J.H., Lagrange S. & Müller R. (2015) Targeting DnaN for tuberculosis therapy using novel griselimycins. Science 348, 1106-1112.
- Quade N., Mendonca C., Herbst K., Heroven A.K., Ritter C., Heinz D.W. & Dersch P. (2012) Structural basis for intrinsic thermosensing by the master virulence regulator RovA of Yersinia. J Biol Chem 287, 35796-35803.
- Quade N., Huo L., Rachid S., Heinz D.W. & Müller R. (2011) Unusual carbon fixation gives rise to diverse polyketide extender units. Nat Chem Biol 8, 117-124.
- Niemann H.H., Jäger V., Butler P.J., van den Heuvel J., Schmidt S., Ferraris D., Gherardi E. & Heinz D.W. (2007) Structure of the human receptor tyrosine kinase met in complex with the Listeria invasion protein InlB. Cell 27, 235-246.

Department of Psychology – Institute of Developmental-, Personality-, & Forensic Psychology

Prof. Dr. Daniela Hosser

Researcher's Career

- Full Professor for Psychology, TU Braunschweig
- Associate Professor for Psychology, TU Braunschweig
- Scientific Vice Director at the Criminological Research Institute of Lower Saxony, Hannover
- Senior Researcher at the Criminological Research Institute of Lower Saxony, Hannover
- Dr. rer. nat. TU Braunschweig, Institute of Psychology
- Research Assistant at the Criminological Research Institute of Lower Saxony, Hannover
- Study of Psychology, degree Dipl.-Psych. TU Braunschweig

Funding
DFG, BMBF, VolkswagenFoun, HeidehofFoun, Lower Saxony

Contact
Technische Universität Braunschweig
Department of Psychology
Humboldtstraße 33
38106 Braunschweig
Phone: +49 531 391 2815
daniela.hosser@tu-braunschweig.de
www.tu-braunschweig.de/psychologie/abt/epf

Mission Statement

The main aim of our research is to understand the origins, conditions, and functions of empathy, moral emotions, and emotion regulation and their role in the development of moral or antisocial behavior. Especially, we engage in the examination of delinquent trajectories and the evaluation of offender treatment and criminal prevention.

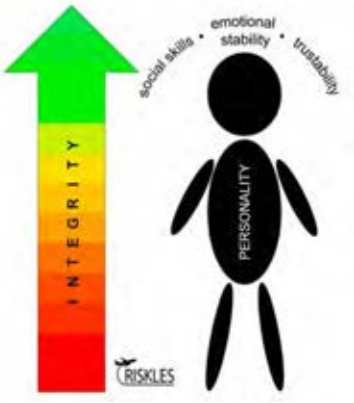
Research

Developmental Trajectories of Delinquent Behavior: We investigate trajectories of delinquency in serious offenders across adolescence and adulthood and how these trajectories differ for varying offender groups. Identifying specific risk and protective factors for different developmental conditions may help to further improve the effects of offender treatment. Our special focus is on the interplay of emotions, personality, and crime.

Emotion regulation during deception: Successful lying requires the effective regulation of emotions, especially when deceiving somebody face-to-face. However, the use of emotion regulation strategies during deception and the strategies' neural underpinnings are still unclear. In different settings we investigate emotion regulation during deception and compare fraudsters, violent-offenders, and non-offenders. Thereby, we use psychophysiological data, voice and face recording, as well as qualitative analysis.

Moral Emotions, Moral Behavior, and Well-Being: Using multimethod designs, longitudinal and cross-sectional data of varying samples and age groups, we study the relationship between moral emotions, moral or antisocial behavior, and well-being. In a broader ongoing study we analyze the impact of guilt and shame on well-being and social functioning in individuals in old age and near the end of life. Results may be helpful to improve (palliative) care with respect to the role of emotions and emotion regulation.

Integrity Testing for Pre-Employment Screening: We develop standardized personality tests to assess integrity via online-testing as part of the pre-employment screening for security personnel in various settings. Currently we work especially in the field of aviation security.



Publications

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- Grieger, L. & Hosser, D. (2014). Which risk factors are really predictive? An analysis of Andrews and Bonta's "Central Eight" risk factors for recidivism in German youth correctional facility inmates. Criminal Justice And Behavior, 41, (5), 613-634.
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- Grieger, L., Hosser, D. & Schmidt, A. F. (2012). Predictive validity of self-reported self-control for different forms of recidivism. Journal of Criminal Psychology, 2, (2), 80-95.
- Grieger, L. & Hosser, D. (2012). Attention deficit hyperactivity disorder does not predict criminal recidivism in young adult offenders: Results from a prospective study. International Journal of Law and Psychiatry, 35, 27-34.

Institute of Physical and Theoretical Chemistry

Prof. Dr. Christoph Jacob

Researcher's Career
- Professor for Theoretical Chemistry, TU Braunschweig
- Independent Group Leader, Karlsruhe Institute of Technology
- Postdoc at ETH Zurich
- Ph.D. at Vrije Universiteit Amsterdam
- Research Fellow, Auckland University
- Studies of Chemistry and Mathematics at University of Karlsruhe and Philipps University Marburg

Funding
DFG, industry

Contact
Technische Universität Braunschweig
Institute of Physical and
Theoretical Chemistry
Hans-Sommer-Straße 10
38106 Braunschweig
Phone: +49 531 391-5347
c.jacob@tu-braunschweig
www.christophjacob.eu

Mission Statement

Quantum-chemistry is applied to describe complex chemical systems, ranging from open-shell molecules to biomolecules and complex materials. We develop quantum-chemical subsystem and embedding methods as well as methods for theoretical spectroscopy, driven by challenging experimental problems.

Research

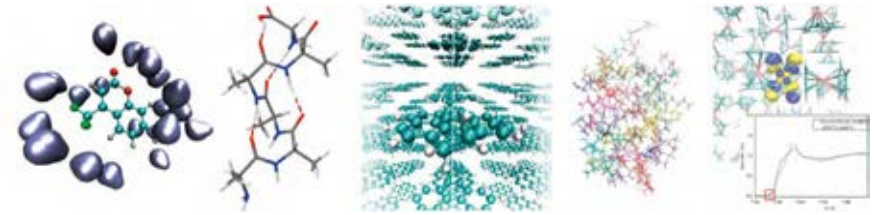
Purpose-Driven Computational Chemistry: In our research efforts, the application of computational chemistry to complex chemical systems and to challenging problems of theoretical spectroscopy goes hand in hand with quantum-chemical method and software development.

Subsystem Quantum Chemistry: To describe large chemical systems such as biomolecules and complex materials with quantum-chemical methods, we develop subsystem methods, in which such large systems are partitioned into smaller building blocks. These are then treated individually, embedded into the environment of all other subsystems. This also provides a starting point for quantum-chemical embedding methods, in which subsystems of interest are treated with more accurate methods or in which local spectroscopic properties of selected subsystems are targeted.

Computational Material Science: We use methods ranging from classical molecular dynamics to (subsystem) quantum-chemistry for modeling and predicting the properties of complex materials, with the goal of designing novel materials with specific properties. This includes providing a molecular-level picture of adhesion at interfaces and the design of molecular metamaterials.

Theoretical Spectroscopy: We develop and apply quantum-chemical methods for predicting spectroscopic properties of complex molecular systems, ranging from transition-metal catalysts to biological molecules as well as complex materials and from X-ray spectroscopy through optical (UV/Vis) and vibrational spectroscopy to nuclear-magnetic and electron-spin resonance (NMR and ESR) spectroscopy. Our method development in this area is driven by challenging experimental problems and novel spectroscopic experiments.

Spin in Chemistry: We develop novel quantum-chemical approaches for open-shell molecules, in particular transition metal complexes.



Publications

- A. J. Atkins, M. Bauer, Ch. R. Jacob, "High-resolution X-ray absorption spectroscopy of iron carbonyl complexes", Phys. Chem. Chem. Phys. 17 (2015) 13937-13948.
- A. Boubnov, H. W. P. Carvalho, D. E. Doronkin, T. Günter, E. Gallo, A. J. Atkins, Ch. R. Jacob, J.-D. Grunwaldt, "Selective Catalytic Reduction of NO Over Fe-ZSM-5: Mechanistic Insights by Operando HERFD-XANES and Valence-to-Core X-ray Emission Spectroscopy", J. Am. Chem. Soc. 136 (2014) 13006-13015.
- P. T. Panek, Ch. R. Jacob, "Efficient calculation of anharmonic vibrational spectra of large molecules with localized modes", ChemPhysChem 15 (2014) 3365-3377.
- Ch. R. Jacob, J. Neugebauer, "Subsystem Density-Functional Theory", WIREs Comput. Mol. Sci. 4 (2014) 325-362.
- S. Bernadotte, F. Evers, Ch. R. Jacob, "Plasmons in Molecules", J. Phys. Chem. C 117 (2013) 1863-1878.

Institute of Microbiology

Prof. Dr. Dieter Jahn

- Vice President for Research and International Affairs, TU Braunschweig
- Speaker of the Systems Biology Centre BRICS
- Coordinator of the infection biology consortium CDiff (*Clostridium difficile*)
- Co-Coordinator of the DFG Transregional Collaborative Research Centre SFB-TRR 51 "*Roseobacter*"
- Co-Coordinator of the DFG FOR 1220 "PROTRAIN"

Researcher's Career

- Full Professor for Microbiology at the TU Braunschweig
- Associate Professor for Biochemistry Freiburg University
- Junior Group Leader at Max-Planck Institute for Terrestrial Microbiology, Marburg
- Postdoc at Yale University, USA
- Dr. rer. nat. at the Philipps-Universität Marburg, Institute for Physiological Chemistry
- Study of Biology, Chemistry, Political Sciences, Marburg

Funding
DFG, BMBF, EU, State Lower Saxony, industry

Contact
Technische Universität Braunschweig
Braunschweig Integrated Centre of Systems Biology (BRICS)
Rebenring 56
38106 Braunschweig
Phone: +49 531 391-55101
d.jahn@tu-braunschweig.de
www.tu-braunschweig.de/ifm

Mission Statement

State-of-the-art microbiological research using a broad spectrum of methods in combination with various bacterial model systems is employed to achieve worldwide recognized scientific progress in the fields of bacterial physiology, biochemistry, infection biology, ecology, biotechnology and systems biology.

Research

Enzymology and structural biology of enzymes for the biosynthesis of heme and chlorophyll: For more than 25 years our laboratory has been investigating step by step the structure and function of enzymes for the biosynthesis of the tetrapyrroles heme and chlorophyll. Currently, we are focusing on enzymes of alternative heme and chlorophyll biosynthesis.

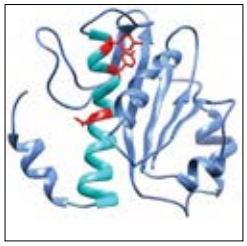
Systems infection biology of the pathogens *Clostridium difficile* and *Pseudomonas aeruginosa:* We use biochemistry, physiology and modern Omics technologies in combination with bioinformatics based modelling to elucidate the regulatory networks, involved regulators and the structure of enzyme complexes for anaerobic denitrification in *P. aeruginosa* and of iron uptake/oxygen stress in *C. difficile.*

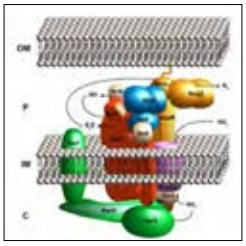
Molecular biology of marine bacteria: Anaerobic metabolism and iron acquisition with their underlying regulatory networks are investigated with systems biology methods for the marine model bacterium *Dinoroseobacter shibae* in the framework of the SFB-TRR 51.

Systems biotechnology of *Bacillus megaterium:* A plasmid-based system for the gram per liter intra- and extracellular production of recombinant proteins was developed in the framework of the SFB 578 (From Gene to Product) and is commercially available (MoBiTec GmbH, Göttingen). Currently, we are investigating and modelling culture heterogeneity in the DFG priority program 1617 (Sociobiology of Bacterial Populations).

Physiology and regulation of the anaerobic metabolism of *Bacillus subtilis:* We elucidated the anaerobic nitrate respiratory and fermentative metabolism of *B. subtilis* and determined the biochemistry of the involved regulatory proteins Fnr and AlsR.

Industrial microbiology: In cooperation with various companies (Behr AG, Volkswagen AG) we investigated the contamination of industrial surfaces and prevention strategies.





Publications

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Institute of Inorganic and Analytical Chemistry

Prof. Dr. Peter G. Jones

Researcher's Career

- 1988-2016: C3-Professor, TU Braunschweig, Germany.
- 1985-1988: C2-Professor in Göttingen.
- 1978-1985: Scientific Assistant with Prof. G. M. Sheldrick, University of Göttingen, Germany. Habilitation in Inorganic and Structural Chemistry, 1985.
- 1976-1978: Postdoc with Dr. O. Kennard, Cambridge Crystallographic Data Centre.
- 1973-1976: PhD, University of Cambridge, supervised by Dr. A. G. Maddock. Thesis: "Mössbauer, Crystallographic and Synthetic Studies of Gold Compounds".
- 1970-1973: Study of Natural Sciences, University of Cambridge, U.K.

Other activities:

- Director, Cambridge Crystallographic Data Centre, German Affiliated Centre, 1995-2016.
- Co-Editor, Acta Crystallographica C, 1992-2013.

Contact
Technische Universität Braunschweig
Institute of Inorganic and Analytical Chemistry
Hagenring 30
38106 Braunschweig
Phone: +49 531 391-5382
p.jones@tu-braunschweig.de
https://www.tu-braunschweig.de/iaac/personal/jones

Mission Statement

Many aspects of chemistry are involved with the interplay between structure and (re)activity. We use our expertise in solid-state structure determination to illuminate some of these aspects. Interactions between neighbouring molecules are particularly important in this respect.

Research

We still do chemistry! Our poster title from 2015 reminds people that we are not only X-ray structure specialists, but are also interested in several aspects of pure inorganic (and indeed organic) chemistry.

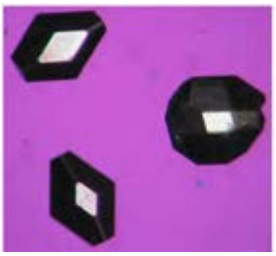
For many decades we have studied "simple" gold compounds, in particular those with the unexpected combination of a soft gold(I) centre with hard nitrogen ligands. **Amine complexes of gold(I)** have proved to be surprisingly stable and also reveal an impressive structural versatility.

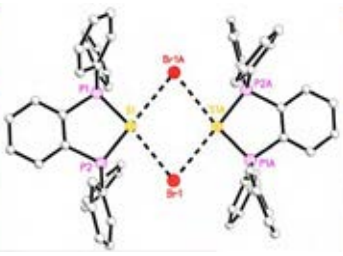
Phosphine chalcogenides are also good ligands for gold centres and the appropriate complexes can be oxidized with the elemental halogens chlorine and bromine (or equivalent reagents) to form unusual ionic products containing unprecendented P–E–X moieties (E = chalcogen, X = halogen). Related diphosphine derivatives form novel chelate complexes of gold(III) on oxidation.

Phosphine chalcogenides themselves can be oxidized with halogens to form a wide variety of halogen adducts involving "soft-soft" interactions between the chalcogen and the halogen. Many of these, especially with diphosphines, were thought to be too insoluble to study successfully, but we have employed some tricks to obtain single crystals and thus determine the structures of several previously unidentified materials.

The successful use of amines as solvents in gold chemistry has also prompted us to conduct research into **amine solvates** of simple molecules such as urea and thiourea. Packing analyses reveal robust structural motifs that in turn show which intermolecular interactions are particularly favourable.

The more crystallographic side of our research looks at the phenomenon of **polymorphism**, which is becoming increasingly important in the pharmacological industry. We are also happy to take a closer look at serendipitous discoveries such as **twinning effects** or **crystal-to-crystal transformations.**





Publications

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- "Pseudosymmetrie bei Aminkomplexen des Gold(I)-cyanids". C. Döring, P. G. Jones, Z. Naturforsch. 68b, 474 (2013).
- "Lutidine adducts of urea: molecular mechanisms for twinning effects on cooling". C. Taouss and Peter G. Jones, CrystEngComm, 16, 5695 (2014).
- "Single crystals that spawn other single crystals". C. Taouss, C. Döring, P. G. Jones, L. Pinkert, M. Strey, CrystEngComm, 18, 1842 (2016).
- "Two polymorphs of 4-hydroxypiperidine with different NH configurations". C. Döring, C. Näther, I. Jess, K. Ibrom, P. G. Jones, CrystEngComm, 17, 5206 (2015).

Department of Psychology – Institute of Industrial/Organizational and Social Psychology

Prof. Dr. Simone Kauffeld

- Vice president for teaching and diversity, TU Braunschweig
- Editor of the Journals "Personal Quarterly" and "Group. Interaction. Organization"
- Associate of the 4A-SIDE GmbH (HR consultancy)
- Former coordinator of the graduate school Grad.life, TU Braunschweig

Researcher's Career

- Full Professor for Industrial/ Organizational and Social Psychology, Institute of Psychology, TU Braunschweig
- Professor for Work and Organizational Psychology, University of Applied Sciences Northwestern Switzerland
- Visiting Scholar at Brooklyn College, City University of New York, USA
- Research group leader in competence development projects at the University of Kassel
- Ph.D. in Psychology (title of habilitation: "measuring, rating, and developing competences") from the University of Kassel
- Study of Psychology and Economics, Philipps-University Marburg and University of Koblenz-Landau

Funding
DFG, BMBF, BMWi, EFRE,
State Lower Saxony, Industry

Contact
Technische Universität Braunschweig
Industrial/Organizational and
Social Psychology
Spielmannstraße 19
38106 Braunschweig
Phone: +49 531 391 2547
s.kauffeld@tu-braunschweig.de
www.tu-braunschweig.de/psychologie/abt/aos

Mission Statement

We aim to contribute to a humane and efficient design and development of work and organizations. In our research, we build on Social and I-O psychological knowledge and use various methodological approaches (tool development, interaction analysis and temporal dynamics, multilevel modeling and social network analysis).

Research

Industrial and Organizational Psychology is the scientific study of the workplace. Methods of psychology are applied to questions concerning humans operating within the context of business and organizations. Our research builds on well-established psychological theories and models. However, we believe that research in organizational psychology is only as good as its practical value. Therefore, we work closely together with organizations and develop tools and concepts of practical revelance. The image below depicts the areas and methods that we focus on in our research.

Competence: In times of globalization and rapid development of information technologies, organizational success is more and more based on non-material competencies. Thus, occupational competence is a key element for future success of individual employees and companies as a whole. In our research, we focus on ways to measure, develop, and manage occupational competencies.

Team: Contemporary organizations are facing an increasing need for flexibility that calls for teamwork. However, functioning teamwork is not a matter of course, especially in times of increased digitization. We focus on intra-group processes to understand what makes teamwork successful. For instance, we examine communication patterns in both virtual teams and teams that work face-to-face.

Career and coaching: We use a blend of interaction and social network analysis to understand which processes contribute to successful and healthy careers. In doing so, we analyze early career stages and early career choices (e.g., choice of field of study) as well as long term career development (e.g., in academia). Moreover, we develop coaching tools such as the VaMoS (short for values, motives, and skills) questionnaire to support successful coaching interactions and we aim to gain insight into factors that influence interactions and relationships between coach and client.

Leadership: Following recent calls, we study leadership as a relational process and follow an organizational discourse approach. For example, we study leader-follower-interactions during annual appraisal interviews.

Publications

- Spurk, D., Kauffeld, S., Meinecke, A. L., & Ebner, K. (2016). Why do adaptable people feel less insecure? Indirect effects of career adaptability on job and career insecurity via two types of perceived marketability. Journal of Career Assessment, 24, 289-306.
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- Klonek, F.E., Lehmann-Willenbrock, N., & Kauffeld, S. (2014). The dynamics of resistance to change: A sequential analysis of change agents in action. Journal of Change Management, 44, 334-360.
- Gessnitzer, S., Schulte, E.-M., & Kauffeld, S. (2014). VaMoS: Measuring the "within person fit" of affective Values, cognitive Motives, and Skills. Journal of Career Assessment, 23, 559-581.
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- Kauffeld, S., & Lehmann-Willenbrock, N. (2012). Meetings matter: Effects of team meetings on team and organizational success. Small Group Research, 43, 130–158.

Zoological Institute, Cellular Neurobiology

Prof. Dr. Martin Korte

- Head of the Zoological Institute, TU Braunschweig
- Elected member to the Berlin-Brandenburgische Akademie der Wissenschaften (BBAW)
- Head of the graduate school Grad.TUBS, TU Braunschweig
- Former Vice President for Strategic development, TU Braunschweig
- Former Head of the „Strategiekommission der TU Braunschweig"

Researcher's Career

- Professor for Cellular Neurobiology
- Reseach Group leader for the "Neuroinfection and Neurodegeneration" group at the HZI, Braunschweig
- Research Group leader at the MPI for Neurobiology, Martinsried
- Postdoc at MPI of Neurobiology Martinsried
- Dr. rer. nat. at the MPI of Psychiatrie, Munich
- Research Assistent at the NIH, Bethesda, Maryland, USA

Funding

DFG, BMBF, Thyssen foundation, VW foundation

Contact

Technische Universität Braunschweig
Zoological Institute, Cellular Neurobiology
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391-3220
m.korte@tu-bs.de
www.zoologie.tu-bs.de

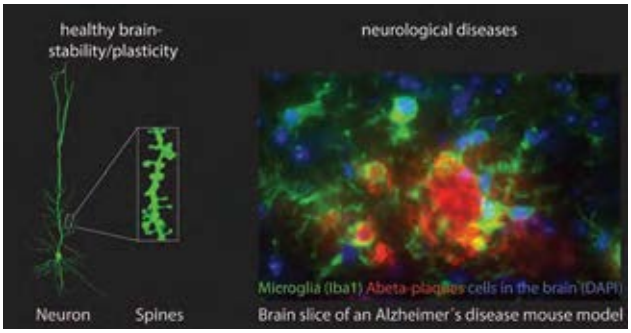
Mission Statement

The study of cellular mechanisms linking functional to structural modifications occurring during learning, memory and forgetting processes will contribute to a better understanding of how the brain keeps its stability and maintains its plasticity in normal brain function. This knowledge can then be applied to the diseased brain.

Research

Synaptic plasticity: We are interested in how exactly neurons are able to store information by modulating both the strength of their synapses as well as their number and size – a process termed neuronal plasticity. In experiments ranging from structural and/or functional manifestation of memory expressed as a long-term potentiation, studying learning behavior in living mice to the detailed investigation of signaling cascades in cultured neurons, our laboratory aims to reveal central pathways which allow nerve cells to rapidly change the structure of some synapses, while on the other hand others might be stabilized even for a life-time. In this respect we investigate two molecules intensively: Brain Derived Neurotrophic Factor (BDNF) – promotes plasticity and Nogo-A, which restricts it. Furthermore, we are focusing on the cytoskeleton of neurons, and especially the highly concerted regulation of actin dynamics (e.g. Profilin, Cofilin) during learning processes.

Modeling human diseases: Neurodegenerative diseases such as Alzheimer's disease and disorders like the Fragile X Syndrome represent medical challenges for health care systems. We are studying mouse models that mimic and recapitulate important aspects of these diseases. In this respect, chronic inflammation of the central nervous system caused by various factors such as peripheral infections (with pathogenes as variable as influenza viruses or toxoplasma gondii) or other risk factors such as obesity, stress or simply the aging process itself are gaining more and more attention. Understanding the crosstalk between the immune system and the brain might actually show that preventing imbalances in brain plasticity, sometimes starting already early in life, might in fact be easier than finding a cure against neurodegenera-tive diseases (such as dementia) once they have fully developed. Our goal is to contribute to a better understanding of neurological diseases, eventually providing insights for potential therapies or prevention.



Publications

- Sajikumar, S., Morris, RGM, Korte M. (2014). "Competition between recently potentiated synaptic inputs reveals a winner-take-all phase of synaptic tagging and capture." PNAS 111(33): 12217-1222
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- Delekate A, Zagrebelsky M, Kramer S, Schwab ME, Korte M (2011) NogoA restricts synaptic plasticity in the adult hippocampus on a fast time scale. Proc Natl Acad Sci USA 108:2569-2574.
- Kummer MP, Hermes M, Delekate, A, Hammerschmidt T, Kumar S, Terwel D, Walter J, Pape H-C, König S Roeber S, Jessen F, Klockgether T, Korte M, Heneka MT, (2011) Nitration of tyrosine 10 critically enhances amyloid beta aggregation and plaque formation. Neuron 71(5): 833-844

Zoological Institute – Cellular and Molecular Neurobiology

Prof. Dr. Reinhard W. Köster

- Chair, Cell Biology, TU Braunschweig
- Vice President of German Genetics Society (GfG)

Researcher's Career

- Full Professor for Cellular and Molecular Neurobiology, TU Braunschweig
- Associate Professor for Cell Biology and Cellular Physiology, TU Braunschweig
- Junior Group Leader of BMBF BioFuture Group Zebrafish Neuroimaging, Helmholtz Centre Munich
- Postdoc at California Institute of Technology, USA
- Dr. rer. nat. at Max-Planck-Institute for Biophysical Chemistry Göttingen / University Würzburg
- Studies of Chemistry, University Würzburg

Funding
DFG, EU, State Lower Saxony, VW-Foundation

Contact
Technische Universität Braunschweig
Zoological Institute
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391 3230
r.koester@tu-braunschweig.de
www.zoologie.tu-bs.de/

Mission Statement

We combine sophisticated genetics with bioimaging in transparent zebrafish to dissect cell biological and molecular mechanisms of neuronal migration, differentiation and function. Genetic modeling of neurodegenerative diseases (SCA1, HSP, AD) serves to study disease mechanisms, regeneration and pharmacological drug screening.

Research

Our reserach focuses on the zebrafish cerebellum as one of the evolutionary highest conserved brain compartments among vertebrates. This brain region is dedicated to control body posture, balance, locomotion and motor learning.

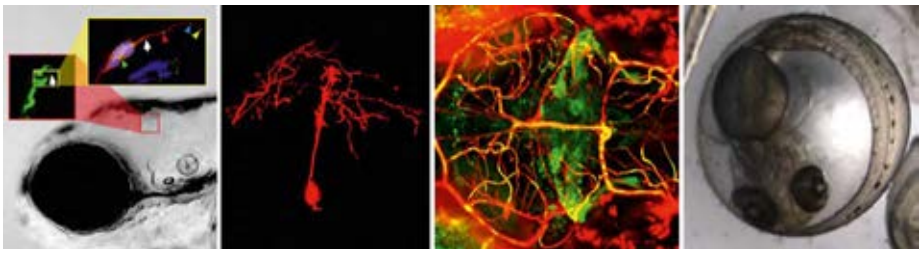
Neuronal Migration: Using *in vivo* microscopy we address molecular mechanisms of directional and cohesive neuronal migration, which serves to place neurons in their correct place of function. Currently we are investigating the regulation of neuronal motility by membrane depolarization and transmission of adhesive forces to the cytoskeleton.

Neuronal Differentiation and Function: With light-controlled channel proteins (optogenetics) we alter neuronal activity in the cerebellum during stereotypic behavior of zebrafish larvae to understand the circuitry and functional organization of the cerebellar cortex.

Genetic modeling of human neurodegenerative diseases: In our zebrafish neurodegenerative disease models (SCA1, HSP, AD) disease progression and cell biological mechanisms of degeneration can be followed directly *in vivo* to unravel the underlying pathogenic mechanisms of cytotoxicity. Moreover such models are being used for screening and validation of disease-interfering compounds. Currently we are analyzing pathogenic malfunctions of autophagy, ER-dynamics and protein aggregation.

Neuronal Regeneration: A cerebellar Purkinje cell specific inducible ablation technique (PC-ATTAC) enables us to follow Purkinje cell regeneration within the differentiated zebrafish brain by bioimaging in order to address signal transduction events and cellular dynamics during neuronal regeneration.

Technique Development: We develop methods for conditional and combinatorial genetics in zebrafish to monitor cellular and subcellular dynamics and to manipulate cell biological mechanisms with cell type specific and temporal control. Methods developed by us in zebrafish are: combinatorial Gal4 genetics and enhancer trap screening, bidirectional and multi-cistron expression systems, inducible cell type specific cell ablation, transsynaptic neuronal connectivity mapping, various compound screening assays.



Publications

- Sassen, W. A., Köster, R. W. (2015). A molecular toolbox for genetic maanipulation of zebrafish. Adv. Genom. Genet. 5: 151-163.
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- Weber, T., Köster, R. W. (2013). Genetic methods for multicolor imaging in zebrafish larvae. Methods 62: 279-291.
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Institut für Medizinische und Pharmazeutische Chemie (IMPC)

Prof. Dr. Conrad Kunick

Researcher's Career

- Professor for Medicinal and Pharmaceutical Chemistry, IMPC, TU Braunschweig
- Visiting Professor, Universität Münster
- Visiting Professor, Purdue University (West Lafayette, IN, USA)
- Habilitation (Pharmaceutical and Medicinal Chemistry), Universität Hamburg
- Research Assistant, Universität Hamburg
- Postdoc, Universität Bonn
- Dr. rer. nat., Pharmaceutical Chemistry, Universität Hamburg
- Study of Pharmacy, Universität Hamburg

Funding

DFG, EU, BMBF, COST, MWK, NIH/NCI, Mukoviszidose e.V.

Contact

Technische Universität Braunschweig
Institut für Medizinische und Pharmazeutische Chemie
Beethovenstraße 55
38106 Braunschweig
Phone: +49 531391-2754
c.kunick@tu-braunschweig.de
www.tu-braunschweig.de/pharmchem/forschung/kunick

Mission Statement

Our mission is the discovery and design of novel chemotypes as molecular probes in biological test systems with a focus on protein kinase inhibitors and antimicrobial agents. Biologically active compounds are optimized and both the molecular mechanism of action and the structure-activity relationships (SAR) are investigated.

Research

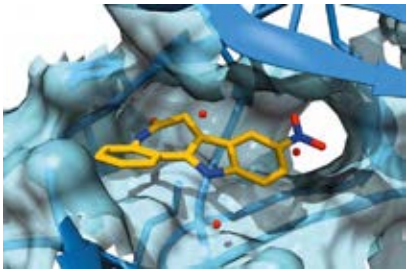
Protein Kinases are the main biological targets of our research compounds. These phosphorylating enzymes are involved in various biological regulation mechanisms and signaling cascades. The inhibition of protein kinases is one of the major strategies in industrial drug development.

Selective inhibitors are indispensable research tools to evaluate the role of distinct protein kinases in physiological and pathophysiological mechanisms. In this regard, we have developed inhibitors of mammalian and microbial kinases, e.g. ALK, CDK1, CDK5, DYRK1A, GSK-3, HIPK2, IGF1-R/SRC, *Pf*GSK-3, PLK1/VEGF-R2, and RET.

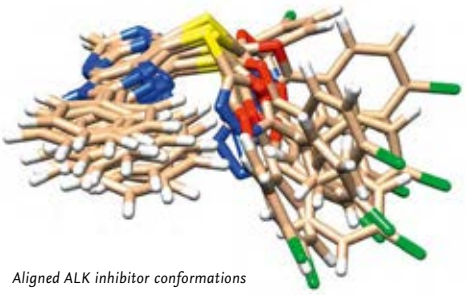
Potential therapeutic areas of protein kinase inhibitors developed in our group are

- Cancer
- Neurodegenerative diseases
- Infections by unicellular parasites (tropical infectious diseases, namely leishmaniasis, trypanosomiasis and malaria).

The commercially most successful compounds from our lab are the paullones. Our molecular entities kenpaullone and alsterpaullone are offered as standard tools for inhibition of cyclin-dependent kinases and of glycogen synthase kinase-3 (GSK-3) by many biochemical vendors. 1-Azakenpaullone is commercially available as selective GSK-3 inhibitor.



Alsterpaullone bound to the protein kinase GSK-3



Aligned ALK inhibitor conformations

Publications

- Falke, H., et al., 10-Iodo-11*H*-indolo[3,2-*c*]quinoline-6-carboxylic acids are selective inhibitors of DYRK1A. J. Med. Chem. 2015, 58, 3131-3143.
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- Fugel, W., et al., 3,6-Diamino-4-(2-halophenyl)-2-benzoylthieno[2,3-*b*]pyridin-5-carbonitriles are selective inhibitors of *Plasmodium falciparum* glycogen synthase kinase-3. J. Med. Chem. 2013, 56, 264–275.
- Egert-Schmidt, A.-M., et al., Identification of 2-anilino-9-methoxy-5,7-dihydro-6*H*-pyrimido[5,4-*d*][1] benzazepin-6-ones as dual PLK1/VEGF-R2 kinase inhibitor chemotypes by structure-based lead generation. J. Med. Chem. 2010, 53, 2433-2442.
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Institute of Organic Chemistry

Prof. Dr. Thomas Lindel

Researcher's Career
- Full Professor of Organic Chemistry, TU Braunschweig
- Associate Professor of Organic Chemistry, LMU München
- Research Group Leader, Institute of Pharmaceutical Chemistry, University of Heidelberg
- Postdoctoral Scientist, Scripps Institution of Oceanography, University of California, San Diego
- Doctorate at the Institute of Organic Chemistry, University of Münster
- Study of Chemistry, University of Münster

Funding
DFG, Fonds der Chemischen Industrie

Contact
Technische Universität Braunschweig
Institute of Organic Chemistry
Hagenring 30
38106 Braunschweig
Phone: +49 531 391 7300
th.lindel@tu-bs.de
www.oc.tu-bs.de/lindel

Mission Statement

Natural products have proven to be highly valuable tools of life. However, in many cases only the structures are described, perhaps accompanied by preliminary biological data. Chemical synthesis has to pave the way for sufficient amounts of material and for structural modification. Otherwise, the potential of many natural products will remain in the dark.

Research

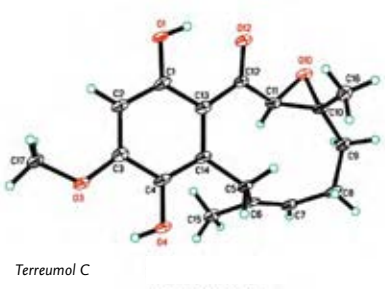
Pyrrole-imidazole alkaloids: Found only in marine sponges, about 200 pyrrole-imidazole alkaloids constitute a unique group of natural products with breathtaking structural diversity on the skeleton level. We develop methods to interconvert pyrrole-imidazole alkaloids and to make them from scratch. For instance, the cytotoxic dibromophakellstatin became available in amounts the isolation of which would have required the collection of tons of sponge.

Indole chemistry: Special emphasis is laid on marine indole alkaloids of mixed biosynthetic origin, such as the flustramines from the North Sea bryozoan *Flustra foliacea*. The discovery of a biomimetic prenyl shift reaction gave convenient access to antimicrobial derivatives of flustramine A. Other projects address the synthesis of microbial indole alkaloids with activity against multi-drug resistant pathogens.

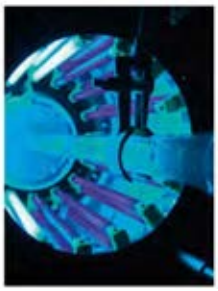
Terpenoid synthesis: Here, we are still struggling with the eunicellane carbon skeleton, which is part of tubulin-polymerizing diterpenoids from soft corals. It is difficult to make the ten-membered ring. We at least, we made the fungal terreumols in quantities above 100 mg, the biochemical target for which were are currently seeking. We also succeeded in synthesizing cubitene, a natural product from termites, which represents the core of the cytotoxic calyculones from the coral *Eunicea calyculata*.

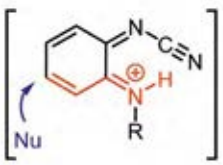
Bioorthogonal peptide labeling: Photoaffinity labeling aims at target identification and analysis. Ideally, biologically active molecules bind covalently to their biochemical target through irradiation of UV/Vis light, to be followed by isolation and mass spectral analysis. Recently we discovered a novel bioorthogonal and chemoselective photoarylation of carboxy side chains of peptides in the presence of water by employing 2-azidobenzimidazoles.

Chemistry of prosthetic groups: In cooperation with biologists at TU Braunschweig, the synthesis and functionalization of prosthetic groups of key enzymes are being investigated (PROTRAIN). In particular, the molybdenum cofactor and heme-based molecules are under investigation.



Terreumol C





Photoarylation

Publications

- Enantioselective total synthesis of terreumols A and C from the mushroom *Tricholoma terreum*, A. Frichert, P. G. Jones, T. Lindel, Angew. Chem. Int. Ed. 2016, 55, 2916-2919.
- Study on the synthesis of the cyclopenta[*f*]indole core of raputindole A, N. Marsch, M. Kock, T. Lindel, Beilstein J. Org. Chem. 2016, 12, 334-342.
- Selectfluor-induced oxidation of pyrrole-2-carboxamides to hydroxypyrrolones, T.-C. Allmann, R.-P. Moldovan, P. G. Jones, T. Lindel, Chem. Eur. J. 2016, 22, 111-115.
- Total synthesis of the marine natural product parazoanthin F by copper-mediated C-N coupling, J. Wefer, T. Lindel, Eur. J. Org. Chem. 2015, 6370-6381.
- Water-compatible photoarylation of amino acids and peptides, A. Sudakow, U. Papke, T. Lindel, Chem. Eur. J. 2014, 20, 10223-10226.

Computational Biology of Infection Research

Prof. Dr. Alice Carolyn McHardy

Researcher's Career

- Head of Department for Computational Biology of Infection Research at Helmholtz Centre for Infection Biology and full professor for Bioinformatics at TU Braunschweig
- Chair of Algorithmic Bioinformatics at Heinrich-Heine University Düsseldorf
- Head of independent Max-Planck Research Group for Computational Genomics & Epidemiology at the Max-Planck Institute for Informatics
- Postdoc, then permanent Research Staff in Bioinformatics & Pattern Discovery Group, IBM T.J. Watson Research Center, USA
- Dr. rer. nat. in Bioinformatics at Technical Faculty of Bielefeld University
- Study of Biochemistry at the University of Bielefeld

Funding
Helmholtz society, BMBF, DFG

Contact
Computational Biology of Infection Research
Helmholtz Centre for Infection Research (HZI)
Inhoffenstraße 7
38124 Braunschweig
Phone: +49 531 6181-1431
alice.mchardy@helmholtz-hzi.de
www.helmholtz-hzi.de

Mission Statement

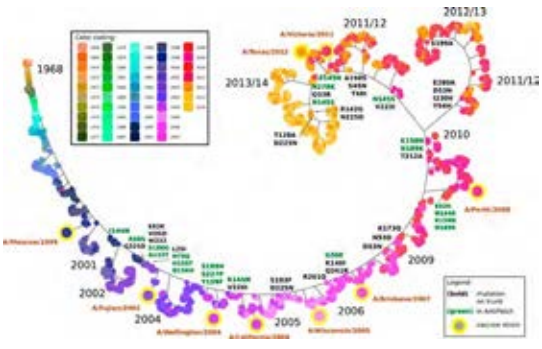
The department studies the interactions between humans, viruses and microorganisms with computational techniques using large biological data sets, and develops computational methods for this purpose.

Research

Our attention is focused on questions relating to human health and disease, such as the study of gene-phenotype connections within the human microbiome using metaomics technologies. Secondly, we study the interactions and co-evolution between viral pathogens and their hosts, with a particular focus on influenza viruses. Methodologically, our lab develops software and algorithms by combining methods from various fields of computer science and biology, such as machine learning, phylogenetic theory and population genetics.

Metaomics: Metaomics is a young research area which deals with the sequencing and study of whole communities of microorganisms, as opposed to the sequencing of genomes of individual organisms that have been obtained in pure culture. According to estimates, less than 1% of all microorganisms can be cultured using standard techniques; the current knowledge of prokaryote biology and the collection of sequenced genomes are strongly biased towards a few, well-characterized phyla, while very little is known about the vast majority of the prokaryotic world. Metaomics has the potential to level this inequality and has already delivered an enormous gain in biological knowledge. The lab co-organizes the Critical Assessment of Metagenome Interpretation challenge (CAMI; https://data.cami-challenge.org/), hosts the bioinformatics unit of the German centre for infection research (www.dzif.de), develops software and algorithms and collaborates locally, nationally and internationally with biologists and medical experts from universities and research institutes. Currently, we are working on methods that allow prediction of microbial phenotypes directly from the genomic information of individual microbes and suggestion of protein families that are key to their realization.

Influenza viruses: The lab has combined epidemiological, genetic, antigenic and structural information to determine the antigenicity-altering areas on the protein structure, key sites and amino acid changes. We analyse how these affect the fitness of the viral population with regards to escaping the human immune response. We furthermore develop techniques to study the genomic evolution of viruses on a genome-wide scale to make predictions regarding which future viral strains may become predominant in the next influenza seasons, and also to determine key areas of the proteins of animal influenza viruses which could be implicated in adaptation to the human host and initiation of future pandemic events.



Evolutionary changes of the major antigen of human influenza A/H3N2 viruses over time

Publications

- D. Bulgarelli*, R. Garrido-Oter*, P.C. Münch, A. Weiman, J. Dröge, Y. Pan, A.C. McHardy*, P. Schulze-Lefert* (*shared first & last authors) (2015) Structure and Function of the Bacterial Root Microbiota in Wild and Domesticated Barley. Cell Host Microbe, S1931-3128: 00031-1.
- Steinbrück L, McHardy AC. (2012) Inference of genotype-phenotype relationships in the antigenic evolution of human influenza A (H3N2) viruses. PLoS Comput Biol. 8: e1002492.
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- McHardy AC, Martin HG, Tsirigos A, Hugenholtz P, Rigoutsos I. (2007) Accurate phylogenetic classification of variable-length DNA fragments. Nat Methods. 4: 63-72.

Zoological Institute

Prof. Dr. Jochen Meier

Researcher's Career

- Full Professor for Cell Physiology at the TU Braunschweig
- Editor-in-Chief, Frontiers in Molecular Neuroscience
- Member of Scientific Program Advisory Group, Spring Hippocampal Research Conference
- Associate Professor for Molecular Neurophysiology, Charité Universitätsmedizin Berlin
- Venia Legendi et Docendi (Physiology), Charité Universitätsmedizin Berlin
- Helmholtz University Young Investigators Group
- Postdoc at Charité Universitätsmedizin Berlin
- Dr. rer. nat. at Université Pierre et Marie Curie, Paris
- Study of Biology, Heidelberg

Funding

DFG, BMBF, EU, BIH, HGF

Contact

Technische Universität Braunschweig
Zoological Institute
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391 3254
jochen.meier@tu-braunschweig.de
www.zoologie.tu-bs.de/index.php/en/zellphysiologie

Mission Statement

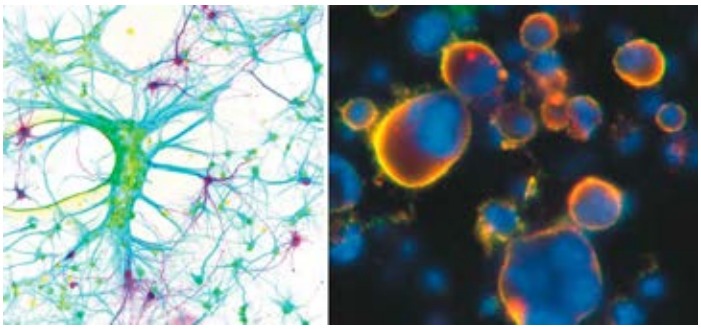
Excitatory and inhibitory transmission between neurons in the brain needs to be thoroughly regulated and coordinated. Deregulation of this coordination results in nervous system disorders. A core aspect of our work concerns study of the brain at the molecular level by investigating RNA editing and alternative RNA splicing.

Research

Epilepsy is a devastating neurodegenerative disease that severely deteriorates life quality due to unpredictable occurrence of seizures and associated cognitive dysfunction. Moreover, epilepsy patients suffer from severe psychiatric comorbidities including anxiety and depression. Most epilepsy syndromes have no discernable genetic component. This indicates that epileptogenesis is governed by disease-promoting molecular and cellular mechanisms of neuronal plasticity, which may vary from patient to patient, resulting in diverse clinical pictures of cryptogenic/idiopathic epilepsies. Therefore, we need new therapeutic strategies to satisfy the variable demands of patients.

We are focusing on maladaptive forms of neuronal plasticity by studying RNA editing of the neurotransmitter receptor for glycine (GlyR) as well as other molecular targets. Recently, we generated a new animal model that allows the targeted and neuron type-specific expression of the RNA-edited GlyR variant that is upregulated in the hippocampus of patients with temporal lobe epilepsy (TLE). Our recent studies showed that the very same molecule triggers distinct psychopathological symptoms of TLE including cognitive dysfunction and memory impairment as well as persistence of contextual fear memory and anxiety, depending on the neuron type that expresses this pathogenic molecule. It is important to note that RNA-edited GlyR functions at the presynaptic site of synaptic transmission, which in our opinion is the compartment that is most vulnerable to maladaptive neuronal plasticity.

To tackle this maladaptive form of neuronal plasticity we are now performing drug screening to identify specific antagonists of the pathogenic GlyR variant produced by RNA editing. Furthermore, we are establishing elaborated imaging techniques that allow visualization of GlyR RNA editing at the single cell level. These techniques and recent methodological advances should help us to develop genuine therapeutic approaches.



Publications

- G.Caliskan, I.Müller, M.Semtner, A.Winkelmann, A.S.Raza, J.O.Hollnagel, A.Rösler, U.Heinemann, O.Stork, J.C.Meier. Identification of parvalbumin interneurons as cellular substrate of fear memory persistence. Cerebral Cortex 2016; 26: 2325-40
- A.Winkelmann, M.Semtner, J.C.Meier. Chloride transporter KCC2-dependent neuroprotection depends on the N-terminal protein domain. Cell Death & Disease 2015; 6: e1776.
- A.Winkelmann, N.Maggio, J.Eller, G.Caliskan, M.Semtner, U.Häussler, R.Jüttner, T.Dugladze, B.Smolinsky, S.Kowalczyk, E.Chronowska, G.Schwarz, F.G.Rathjen, G.Rechavi, C.A.Haas, A.Kulik, T. Gloveli, U.Heinemann, J.C.Meier. Changes in neural network homeostasis trigger neuropsychiatric symptoms. Journal of Clinical Investigation 2014; 124: 696-711.
- B.Förstera, AA.Belaidi, R.Jüttner, C.Bernert, M.Tsokos, T.-N.Lehmann, P.Horn, G.Schwarz, J.C.Meier. Irregular RNA splicing curtails postsynaptic gephyrin in the cornu ammonis of patients with epilepsy. Brain 2010; 133: 3778-3794.

Institute of Plant Biology – Molecular and Cell Biology

Prof. Dr. Ralf-R. Mendel

- Chair, Department of Plant Biology Coordinator of the DFG-Collaborative Research Unit FOR 1220 "PROTRAIN"
- Coordinator of the DFG-Research Training Group 2223 „PROCOMPAS“.

Researcher's Career

- Full Professor of Plant Biology at the TU Braunschweig
- Adjunct Research Professor, University of Tennessee (USA)
- Research Group Leader, Institute of Genetics and Crop Plant Research, Gatersleben
- Dr. rer. nat. at the Martin-Luther-University Halle-Wittenberge
- Study of Biochemistry, Humboldt University Berlin

Funding

DFG, EU, State Lower Saxony

Contact

Technische Universität Braunschweig
Institute of Plant Biology
Humboldtstraße 1
38106 Braunschweig
Phone: +49 531 391-5870
r.mendel@tu-bs.de
http://ifp.rz.tu-bs.de/mendel/

Mission Statement

Our work combines state-of-the-art methods of molecular biochemistry, cell biology and cell technology, bioimaging, physiology, and genetics to study basic principles of molybdenum metabolism and sulfur detoxification in plants, humans and fungi.

Research

Enzymology of molybdenum metabolism: The metal molybdenum is essential for all forms of higher life. We have deciphered the metabolism of molybdenum in plants and humans where five enzymes need this metal for catalysis. These enzymes are vital for nitrogen nutrition, sulfur detoxification, and hormone synthesis. In order to become active, molybdenum has to be bound to a carrier compound within the cell, and in this form it is called 'Molybdeum Cofactor'. We have also deciphered the biosynthesis pathway for the molybdenum cofactor in plants and humans.

Detoxification of an environmental pollutant: The gas sulfur dixoide is toxic for plants and humans. We identified the enzyme sulfite oxidase to detoxify this harmful gas in plants, and we deciphered the enzymology of this process. The physiological importance has been studied both in the laboratory and on volcanic islands with naturally occurring sulfur dioxide.

Dynamics of protein-protein interactions: Using confocal laser scanning microscopy and labelled proteins we identify the interaction of proteins within living cells. We also developed a method to quantify the strengths of these interactions in living cells. We applied these approaches to decipher the interaction matrix of proteins of molybdenum metabolism in plant cells.

Cell technology and gene transfer into trees and cereals: We developed highly specific protocols to keep cells of trees and cereals in cell culture and used these cell cultures as recipients for gene transfer to study molybdenum and sulfur metabolism.

***Neurospora crassa* as new model organism:** We introduced the filamentous fungus *Neurospora crassa* as model organism to study molybdenum metabolism. It permits not only faster research but offers also molecular and genetic possibilities that cannot be met by plants and humans.

Publications and Patents

- Kaufholdt D., Gehl C., Geisler M., Jeske O., Voedisch S., Ratke C., Bollhöner B., Mendel R.R., Hänsch R. (2013) Visualization and quantification of protein interaction in the biosynthetic pathway of molybdenum cofactor in *Arabidopsis thaliana*. J Exp Bot 64: 2005-2016.
- Mendel R.R. (2013). The molybdenum cofactor. J Biol Chem 288: 13165-13172.
- Ringel P., Krausze J., van den Heuvel J., Curth U., Pierik A.J., Herzog S., Mendel R.R., Kruse T. (2013) Biochemical charecterization of molybdenum cofactor-free nitrate reductase from *Neurospora crassa.* J Biol Chem 288: 14657-14671.
- Probst C, Ringel P, Boysen V, Wirsing L, Alexander MM, Mendel RR, Kruse T. (2014) Genetic characterization of *Neurospora crassa* molybdenum cofactor biosynthesis. Fungal Genet Biol. 66: 69-78
- Hamisch D., Randewig D., Schliesky S., Bräutigam A., Weber AP., Geffers R., Herschbach C., Rennenberg H., Mendel RR., Hänsch R. (2012) Impact of SO_2 on *Arabidopsis thaliana* transcriptome in wildtype and sulfite oxidase knockout plants analyzed by RNA deep sequencing. New Phytologist 196: 1074-1085

Institute of Technical Chemistry (ITC)

Prof. Dr. Henning Menzel

- Co-coordinator of the DFG Research Unit FOR 2180 “Graded implants for bone-tendon junctions”
- Member, managing board "Franz-Patat-Zentrum", a scientific forum for interdisciplinary polymer research, Braunschweig

Researcher’s Career

- Professor for Macromolecular Chemistry at TU Braunschweig
- Adjunct Professor for Macromolecular Chemistry at the Leibniz University Hannover
- Visiting Scientist, Department of Chemistry, University of Michigan
- Habilitation at the Leibniz University Hannover, Institute for Macromolecular Chemistry
- Dr. rer. nat. at the Leibniz University Hannover, Institute for Macromolecular Chemistry
- Study of Chemistry, University of Technology Clausthal

Funding

DFG, BMBF, State Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute for Technical Chemistry
Hans-Sommer-Straße 10
38106 Braunschweig
Phone: +49 531 391-5361
h.menzel@tu-braunschweig.de
www.tu-braunschweig.de/itc

Mission Statement

Application oriented problems in synthetic macromolecular chemistry, with special interest in biomedical and biotechnological applications: Ultrathin polymer coatings are used to tailor the biointerfacial interactions with cells and bacteria. Polymeric drug delivery systems are used to implement biological signaling in biomedical devices.

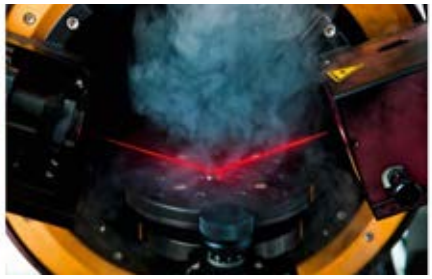
Research

Self-Binding ultrathin copolymer films on implants: One focus area is the preparation of copolymers, which show a self-binding to metallic and ceramic implant surfaces. The resulting coatings, just a few nanometer thin, introduce new functionalities to the implant surface, like e.g. the prevention of biofilm formation. For this, the coatings have to have a selective effect, being antibacterial without compromising the integration of the implant in normal tissue.

Functionalized electrode surfaces for microbial fuel cells: Ultrathin polymeric coatings are developed, which on the one hand foster the initial colonization of the electrodes by bacteria and the formation of a stable biofilm and on the other hand support the electron transfer from the bacteria onto the electrode. Starting point are synthetic copolymers, which bind in an easy and scalable process to surfaces of materials used as electrodes like e.g. stainless steel.

Drug delivery systems: Macroscopic hydrogels are prepared to investigate the possibilities to tailor the release profile for therapeutic proteins. The topic was expanded towards micro-particular hydrogels as injectable delivery systems for antibodies or nanogels for immobilization and delivery of growth factors at implant surfaces. The latter are further developed to act as a drug release system implemented on electro spun fiber mats. In this way, novel, cell-free implants shall be prepared, which activate and instruct endogenous stem cells to “regenerate” a tendon-bone junction.

Functionalized homo-polypeptides: Controlled polymerization of amino acid *N*-carboxyanhydrides result in well-defined synthetic homo-polypeptides with adjustable secondary structure. Since many years, we explore the possibilities of this system to prepare polymers with interesting architectures and functionalities. Currently we focus on glycosylated peptides and the influence of glycosylation on their secondary structure. We also study their interaction with lectins, as specific carbohydrate-binding proteins, which are involved in cell-cell interaction but also mediate attachment and binding of bacteria and viruses to cells in infection processes.



Publications and Patents

- Poth, N., Seiffart, V., Gross, G., Menzel, H., & Dempwolf, W. (2015). Biodegradable Chitosan Nanoparticle Coatings on Titanium for the Delivery of BMP-2. Biomolecules 5:3-19.
- Mildner, R., & Menzel, H. (2014). Hydrophobic Spacers Enhance the Helicity and Lectin Binding of Synthetic, pH-Responsive Glycopolypeptides. Biomacromolecules 15:4528-4533.
- Bertz, A., Wöhl-Bruhn, S., Miethe, S., Tiersch, B., Koetz, J., Hust, M., Bunjes, H., & Menzel, H. (2013). Encapsulation of Proteins in Hydrogel Carrier Systems for Controlled Drug Delivery: Influence of Network Structure and Drug Size on Release Rate. J Biotechnol 163:243-249.
- Pfaffenroth, C., Winkel, A., Dempwolf, W., Gamble, L.J., Castner, D.G., Stiesch, M., & Menzel, H. (2011). Self-Assembled Antimicrobial and Biocompatible Copolymer Films on Titanium. Macromol Biosci 11:1515-1525.
- Lorenz, C., Hoffmann, A., Gross, G., Windhagen, H., Dellinger, P., Möhwald, K., Dempwolf, W., & Menzel, H. (2011). Coating of titanium implant materials with thin polymeric films for binding the signaling protein BMP2. Macromol Biosci 11:234-244.

Department of Systems Immunology

Prof. Dr.
Michael Meyer-Hermann

- Head of Department of Systems Immunology at Helmholtz Centre for Infection Research/TU Braunschweig
- Board member of the Braunschweig Integrated Centre of Systems Biology
- Adjunct Fellow at the Frankfurt Institute for Advanced Studies

Researcher's Career

- Head of research group Systems Immunology at the Frankfurt Institute for Advanced Studies
- Marie-Curie Fellowship at the Centre for Mathematical Biology, Oxford University.
- Head of research group Theoretical Biophysics at Dresden University of Technology
- Ph.D. in Theoretical Elementary Particle Physics at the Institute for Theoretical Physics in Frankfurt/Main
- Studies in Physics, Mathematics, and Philosophy at Johann Wolfgang Goethe-University, Frankfurt/Main and University Pierre et Marie Curie, Paris

Funding
HFSP, BMBF, VW, Engelhorn Stiftung

Contact
Department of Systems Immunology –
Helmholtz Centre for Infection Research (HZI)
Rebenring 56
38106 Braunschweig
Phone: +49 531 391-55210
mmh@theoretical-biology.de
www.theoretical-biology.de

Mission Statement

Our main interest is the development of quantitative dynamic models of immunological systems to gain insights into the mechanisms of infection and immunity in close collaboration with experimental partners. Besides questions in basic research, we increasingly focus on improvement and exploration of novel therapeutic strategies.

Research

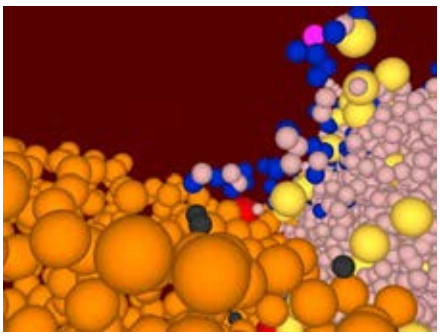
The human immune system consists of a multitude of specialised but complex subsystems that are critical for survival. Our research is dedicated to understanding the dynamics of infection and immunity in health and disease on a systemic level using tools from mathematics, physics, and computer science. As part of the Helmholtz Centre for Infection Research and the Braunschweig Integrated Centre of Systems Biology, we follow a multidisciplinary approach, and our work is driven by questions and data from biological and biomedical research.

Quantitative methods: We employ and actively develop quantitative methods. Besides traditional methods such as ordinary and partial differential equations, agent-based models are at the core of many projects in our department.

Adaptive immune responses: The adaptive immune response is essential for the effective resolution of infections, but also induces autoimmunity. Our interests include regulation, differentiation, and interaction of T cells as well as the maturation of B cells and the evolution of targeted antibody in the lymph node in response to particular pathogens.

Infectious diseases: Despite all medical progress and scientific efforts, infectious diseases continue to be a significant cause of individual and economic damage. Our research includes particularly widespread or severe viral infections such as Influenza, HIV or Ebola, but also bacterial and protozoan infections and aims at understanding the dynamics and interactions of the respective pathogen and its host.

Infection-associated and autoimmune diseases: In addition to its important role for defense against and resolution of infectious diseases, the immune system is also involved in the pathogenesis of various diseases. Our research in this area includes models of development and therapy of metabolic dysfunctions as well as chronic inflammatory diseases. There is particular interest in the interaction of the nervous, the endocrine, and the immune system.



Snapshot of a simulation of lymphoid tissue ontogenesis in space and time generated within the Delaunay – Object – Dynamics framework available at the SIMM department.

"Delaunay – Object – Dynamics framework"
(see Kempf et al, PLoS Comput Biol 9 (2013) e1003295 and references therein)"

Publications

- Binder*, SC & Eckweiler*, D; Schulz, S; Bielecka, A; Nicolai, T; Franke, R; Häussler*, S; Meyer-Hermann*, M; (2016). Functional modules of sigma factor regulons guarantee adaptability and evolvability. Scientific Reports 6: 22212 [* shared first and shared corresponding authors]
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- Khailaie, S; Robert, PA; Toker, A; Huehn, J; Meyer-Hermann, M; (2014). A signal integration model of thymic selection and natural regulatory T cell commitment. J. Immunol. 193: 5983
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Institute of Food Chemistry

Prof. Dr. Petra Mischnick

- Head of Agnes-Pockels-SchülerInnen-Labor (since 2002)
- Member of the Board of the International School of Metrology (since 2007)
- Member of the Board of the DFG-RTG 1952/1 (since 2014)
- Member of the Braunschweiger Wissenschaftliche Gesellschaft (since 2016)

Researcher's Career

- Professor for Food Chemistry at the TU Braunschweig
- Affiliated professor at the Royal Institute of Technology (KTH), Stockholm Sweden
- Guest professor at BoKU Vienna, Austria, KTH Stockholm and University of Lund, Sweden
- Habilitation in Organic Chemistry, University of Hamburg
- Dr. rer. nat, University of Hamburg, Institute of Organic Chemistry
- Study of Chemistry, University of Hamburg
- Study of Food Chemistry, TU Braunschweig

Funding
DFG, BMBF, State Lower Saxony, Industry, DAAD, Chinese Scholarship Council (CSC)

Contact
Technische Universität Braunschweig
Institute of Food Chemistry
Schleinitzstraße 20
38106 Braunschweig
Phone: +49 531 391-7201
p.mischnick@tu-braunschweig.de
www.tu-braunschweig.de/ilc

Mission Statement

Method development for a better understanding of reactivity, chemical structure and properties of polysaccharides and polysaccharide derivatives, employing particularly high resolution separation techniques and mass spectrometry.

Research

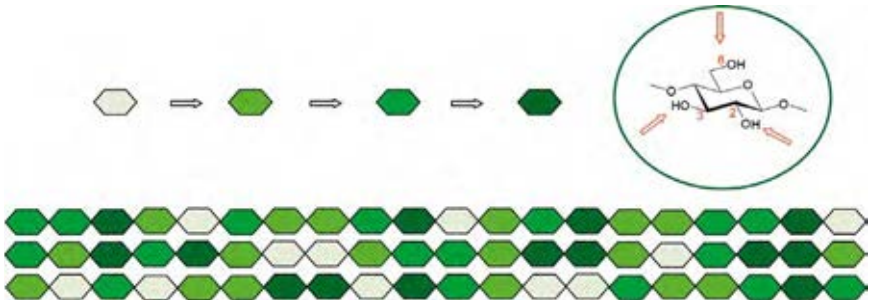
Polysaccharides, especially cellulose and starch as the most abundant renewable biomass, are the basis of new materials for a wide range of application in food, pharma, and construction, as well as for analytical and biomedical purposes. We are interested in how conditions of chemical modification influence the resulting structure and properties. Therefore, we develop analytical strategies for differentiated analysis of the substituent distribution on various structural levels, e.g. in cellulose ethers. Mainly applied instrumental analytical methods are mass spectro-metry, chromatography and capillary electrophoresis. Since quantitative mass spectrometry is a key methodology of our analytical procedures, we perform fundamental studies to recognize, understand and avoid discrimination effects.

By modification of polysaccharides, it is not possible to generate block structures like a copolymer of type AB. Since hydrophobic domains in the nanoscale are important structural features for gelation processes in aqueous solution, we study methods for the formation of such carbohydrate based multi-block structures by cationic ring opening polymerization of cyclodextrin derivatives or by transglycosidation of glucan ethers.

Glucomannans, from soft wood or from Konjac roots can be considered as a stereosiomer of cellulose at the majority of C-2, generating *cis*-diol instead of only *trans*-diol groups such as in cellulose. We study how stereochemistry influence the regioselectivity of chemical modification and try to use it to generate uncommon patterns and thus properties.

In addition to this we have worked with dextran, amylose and pullulan, with alginates and pectins. Glucans have been functionalized with unsaturated groups for further transformation, and such compounds have been applied for the inclusion of ferromagnetic nanoparticles, immobilization of enzymes or for the binding of signal molecules.

In cooperation with semiconductor technology, we have worked on 3D self-assembly of Si-cubes driven by DNA functionalization.



Publications

- S. Gangula, M. Nimtz, P. Mischnick, Study on relative ion intensities of various maltooligosaccharide ethers in Electrospray Ionization Ion Trap Mass Spectrometry: A quantitative evaluation, Int. J. Mass Spectrom. (2016) 57-65.
- M. Rother, W. Radke, P. Mischnick, Block-structured 1,4-glucans by transglycosidation of cellulose ethers. Macromol. Chem. Phys. 217 (2016) 889-900.
- J. Cuers, M. Rinken, R. Adden, P. Mischnick, Critical investigation of the substituent distribution in the polymer chains of hydroxypropyl methylcelluloses by LC-ESI-MS. Anal. Bioanal Chem. 405 (2013) 9021-9032.
- N. Lämmerhardt, St. Merzsch, J. Ledig, F. Meyer, M. Tornow, A. Waag, P. Mischnick, Towards 3-Dimensional Microelectronic Systems: DNA Functionalization of Semiconductor Surfaces and Self-Assembly of Silicon Microcubes Langmuir 29 (2013) 8410-8416.
- P. Mischnick, D. Momcilovic, Chemical Structure Analysis of Starch and Cellulose Derivatives. Adv. Carbohydr. Chem. Biochem., 64 (2010) 117-210.

Microbial Genome Research

Prof. Dr. Ulrich Nübel

Researcher's Career

- Head of research unit for Microbial Genome Research at Leibniz Institute DSMZ
- Associate Professor for Microbial Genomics at TU Braunschweig
- Scientist at Robert Koch Institute
- Postdoc at Montana State University, USA
- Dr. rer. nat. at Max Planck Institute for Marine Microbiology, Bremen, and the University of Bremen
- Study of Biotechnology at the TU Braunschweig

Funding
BMBF, EU Horizon 2020, State Lower Saxony, DAAD

Contact
Leibniz Institute DSMZ
Microbial Genome Research
Inhoffenstraße 7B
38124 Braunschweig
Phone: +49 531 6181-390
ulrich.nuebel@dsmz.de
www.dsmz.de

Mission Statement

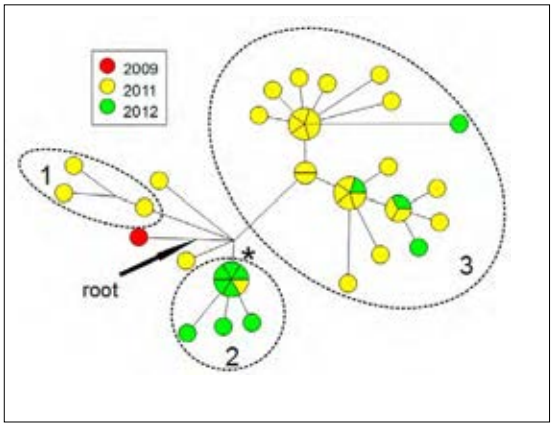
To understand the emergence, evolution and spatial spread of bacterial populations, with a focus on drug resistance and secondary metabolite biosynthesis.

Research

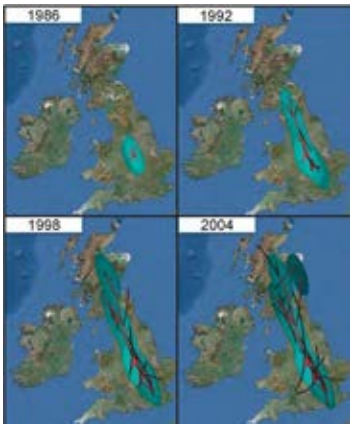
Population genomics and phylogeography: We apply genomic analyses at the level of bacterial populations to gain fundamental insights into the dynamics of bacterial evolution and dispersal. We investigate the mechanisms that cause genetic change, the rates at which variation accumulates and spreads in a population, and the functional and selective consequences it may have.

Genome-based molecular epidemiology: We trace the emergence and transmission of bacterial pathogens at high spatial and temporal resolution based on large-scale bacterial whole-genome sequence analyses. We develop sequence-based tools for early detection of outbreaks of infections in healthcare-associated settings (EU-funded project COMPARE) and we investigate major spreading routes and reservoirs of the pathogen *Clostridium difficile* (project CDiff).

Functional genomics of novel microbial producers: Prokaryotes represent an enormously diverse potential resource for novel bio-active compounds. We seek to accelerate natural product discovery by using high-throughput genome sequencing and genome mining to identify novel producer organisms outside of commonly studied bacterial groups (DZIF).



Phylogenetic analysis of Klebsiella pneumoniae outbreak



Genome-based analysis of MRSA spread

Publications

- Steglich, M., Nitsche, A., von Müller, L., Herrmann, M., Kohl, T. A., Niemann, S. & Nübel, U. (2015) Tracing the spread of Clostridium difficile ribotype 027 in Germany based on bacterial genome sequences. PLoS One 10, e0139811.
- Strommenger, B., Bartels, M. D., Kurt, K., Layer, F., Rohde, S. M., Boye, K., Westh, H., Witte, W., De Lencastre, H., Nübel, U. (2014) Evolution of methicillin-resistant Staphylococcus aureus towards increasing resistance. Journal of Antimicrobial Chemotherapy 69: 616-622.
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Institute of Medicinal and Pharmaceutical Chemistry

Prof. Dr. Ingo Ott

Researcher's Career

- Professor for Medicinal and Pharmaceutical Chemistry, Technische Universität Braunschweig
- Guest professor, Institute of General, Inorganic and Theoretical Chemistry, University of Innsbruck
- Postdoc, Shanghai Key Laboratory of Chemical Biology, East China University of Science and Technology (with Prof. Xuhong Qian)
- Research associate, Freie Universität Berlin
- Dr. rer. nat., Institute of Pharmacy, Freie Universität Berlin (with Prof. Ronald Gust)
- Approbation as pharmacist
- Mag. pharm., University of Innsbruck

Funding
DFG, DAAD, BMBF, Volkswagen Foundation, State of Lower Saxony

Contact
Technische Universität Braunschweig
Institute of Medicinal and Pharmaceutical Chemistry
Beethovenstraße 55
38106 Braunschweig
Phone: +49 531 3912743
ingo.ott@tu-bs.de
www.tu-braunschweig.de/pharmchem/forschung/ott/index.html

Mission Statement

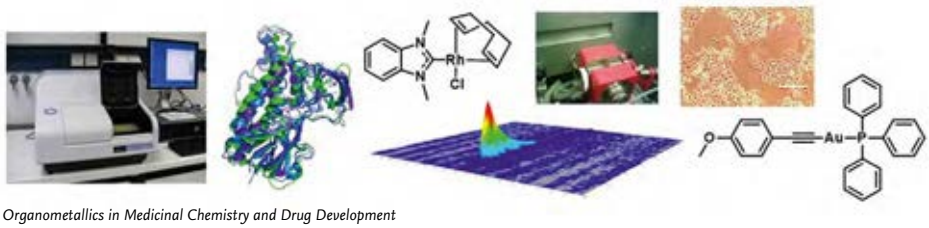
Innovative drug development is one of the biggest challenges in medicinal chemistry. Metal complexes offer a rich, yet largely unexplored, chemical space for drug design. The mission of the group is to contribute to the understanding of the pharmacological properties of metal complexes and to shape novel concepts for the design of metal-based pharmacophores and drugs.

Research

Medicinal Chemistry of Gold Complexes: The use of gold and its complexes in medicine dates back thousands of years, however, the most relevant biochemical mechanisms in gold pharmacology have been discovered only recently and are not yet fully understood. Nowadays, a combination of gold and drugs are used in the treatment of rheumatoid arthritis, and ongoing clinical trials evaluate their therapeutic application as anticancer or antibacterial agents. The enzyme thioredoxin reductase (TrxR), which is involved in several pathophysiological pathways, is a critical target for gold species. This is due to the high affinity of gold to cysteine and selenocysteine residues in the active site of the enzyme and so a direct consequence of the chemical properties of gold. Following this concept, several types of improved TrxR inhibitors with high selectivity were developed, additional relevant mechanisms of action have been identified, and their strong effects as anticancer and anti-infective drugs have been studied.

Organometallics in Drug Development: Organometallic complexes feature a metal-carbon bond, which is not present in any currently registered and approved drug. The high chemical stability of many organometallic centers, in combination with their geometric and electronic properties that differ fundamentally from functional groups used in synthetic medicinal chemistry, make them ideal sources for the design of truly innovative drugs. Complexes with N-heterocyclic carbene (NHC) or alkynyl ligands represent such organometallics, for which very interesting biological properties have been observed (e.g. tumor cell proliferation, apoptosis induction, anti-angiogenic effects).

Methods: The group applies methods ranging from synthetic chemistry over analytical chemistry (e.g. atomic absorption spectroscopy, HPLC-MS) to cell culture (e.g. proliferation assays) in an interdisciplinary manner.



Organometallics in Medicinal Chemistry and Drug Development

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- Oehninger L., Spreckelmeyer S., Holenya P., Meier S. M., Can S., Alborzinia H., Schur J., Keppler B. K., Wölfl S., Ott I., Rhodium(I) N-Heterocyclic Carbene Bioorganometallics as *in Vitro* Antiproliferative Agents with Distinct Effects on Cellular Signaling. J. Med. Chem. (2015), 58, 9591-9600.
- Meyer A., Bagowski C. P., Kokoschka M., Stefanopoulou M., Alborzinia H., Can S., Vlecken D. H., Sheldrick W. S., Wölfl S., Ott I., On the Biological Properties of Alkynyl Phosphine Gold(I) Complexes. Angew. Chem. Int. Ed. (2012), 51, 8895-8899.
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- Rubbiani R., Kitanovic I., Alborzinia H., Can S., Kitanovic A., Onambele L. A., Stefanopoulou M., Geldmacher Y., Sheldrick W. S., Wolber G., Prokop A., Wölfl S., Ott I., Benzimidazol-2-ylidene gold(I) Complexes are Thioredoxin Reductase Inhibitors with Multiple Antitumor Properties. J. Med. Chem. (2010), 53, 8608-8618.
- Ott I., Kircher B., Bagowski C. P., Vlecken D. H. W., Ott E. B., Will J., Bensdorf K., Sheldrick W. S., Gust R., Modulation of the Biological Properties of Aspirin by Bioorganometallic Derivatisation. Angew. Chem. Int. Ed. (2009), 48, 1160-1163.

Microbial Ecology and Diversity

Prof. Dr. Jorg Overmann

Researcher's Career

- Managing Director DSMZ and Professor (W3) TU Braunschweig
- Dissertation in Microbiology, University of Konstanz (summa cum laude)
- Acting Director (3 terms), Department Biologie I, LMU München
- Professor (C3), Ludwig-Maximilians-Universität München
- Habilitation, venia legendi for Microbiology, University of Oldenburg
- Junior group leader (Habilitand), ICBM, University of Oldenburg
- Post-Doc at the University of British Columbia, Canada (Prof. Dr. J. T. Beatty)
- Scientific Advisor, German-Israeli Foundation for Scientific Research and Development
- Member elect of the DFG review board 204 Microbiology, Virology and Immunology

Funding

DFG, BMBF, Horizon 2020, EU, Lower Saxony, VW Stiftung

Contact

Leibniz Institute DSMZ –
Microbial Ecology and Diversity
Inhoffenstraße 7B
38124 Braunschweig
Phone: +49 531 26160
joerg.overmann@dsmz.de
www.dsmz.de

Mission Statement

The DSMZ is one of the largest microbial resource centers worldwide and provides a wide diversity of biological resources and services. Research at the DSMZ focuses on microbial diversity and evolutionary mechanisms, biological interactions at the community and species level, molecular cancer research, and improved methods for access and preservation of biodiversity.

Research

Microbial Diversity & Evolution: How microbes interact, what their functional roles are, and how they evolve in their natural environments are fundamental questions in microbiology. The marine genus Phaeobacter and freshwater sphingomonads are used to understand population structure and evolutionary processes using comparative genomics (part of SFB Roseobacter). Within the DFG-funded Exploratories for Biodiversity Research, community composition, physiological traits, species interactions, and the biogeochemical role of Acidobacteria are elucidated using metagenomics, transcriptomics, and modelling. Phototrophic consortia serve as models to understand evolution, ecophysiology, and the molecular basis of heterologous bacterial multicellularity.

Bioeconomy & Health: Building on DSMZ's basic research and expertise in microbial cultivation, new uses of microbial biodiversity are actively pursued. With German, EU, and international partners in the ANoBIN, BluePharmTrain, and MaCuMBA projects, we are taking advantage of high-throughput cultivation and screening techniques to look for new, bioactive compounds that can be used in a variety of bioeconomic sectors. Through the CDiff consortium, we are examining the environmental distribution and role of the clinical pathogen, C.dificile.

Bioinformatics & Genomics: The above research areas are accomplished in partnership with a strong bioinformatics team that harnesses next-generation sequencing methods and provides in-house software development of new bioinformatics tools. DSMZ plays key roles in the Global Biodiversity Information Facility (GBIF), German Network for Bioinformatics Infrastructure (de.NBI), German Federation for Biological Data (GFBio), and has recently developed BacDive - The Bacterial Metadatabase, which digitalizes, mobilizes, and enables the comparison of taxon-associated microbial metadata.

Publications

- Pascual J et al. Novel isolates double the number of chemotrophic species and allow the first description of higher taxa in Acidobacteria subdivision 4. Syst Appl Microbiol. 2015 Dec;38(8):534-44.
- Söhngen C. et al. BacDive – The Bacterial Diversity Metadatabase in 2016. Nucleic Acids Res. 2016 Jan 4;44:D581-5.
- Overmann J. Significance and future role of microbial resource centers. Syst Appl Microbiol. 2015 Jun; 38(4):258-65.
- Foesel BU et al. Determinants of Acidobacteria activity inferred from the relative abundances of 16S rRNA transcripts in German grassland and forest soils. Environ Microbiol. 2014 Mar;1(3):658-75.
- Gich, F., Janys, M. A., König, M., Overmann, J. (2012) Enrichment of previously uncultured bacteria from natural complex communities by adhesion to solid surfaces. Environ. Microbiol. 14: 2984–2997

Zoological Institute – Division of Molecular Biology

Prof. Dr. Klemens Rottner

- Head of Division
- Research Group Leader: Helmholtz Centre for Infection Research
- Co-Coordinator of DFG Priority Program SPP1464

Researcher's Career

- Associate Professor for Molecular Cell Biology, TU Braunschweig
- Associate Professor for Genetics, Rheinische Friedrich-Wilhelms-Universität Bonn
- Group Leader, HZI Braunschweig
- EMBO long-term fellow, HZI Braunschweig
- Dr. rer. nat. at Paris-Lodron Universität, Salzburg, Austria
- Study of Biology, Salzburg, Austria

Funding

DFG, EU

Contact

Technische Universität Braunschweig
Zoological Institute –
Division of Molecular Biology
Spielmannstraße 7
38106 Braunschweig
Phone +49 531 391-3255
k.rottner@tu-braunschweig.de
www.zoologie.tu-bs.de

Mission Statement

In our work, we elucidate the molecular inventories and collective biochemical activities of selected cellular actin structures, such as those mediating cell migration and host-pathogen interaction. Full understanding of these processes will allow the development of novel drugs combating cancer and infection.

Research

Imaging actin dynamics and reorganization processes of the actin cytoskeleton: We are using live cell imaging approaches to follow assembly and disassembly of actin structures driving actin-based cell motility, allowing elucidation of both the dynamics of these structures and the mobility of structural components within them. We are also employing advanced photomanipulation techniques for determining rates of turnover of individual building blocks within these structures.

Molecular dissection of specific actin structures using genome editing: We are employing state-of-the-art genome editing approaches, such the CRISPR/Cas9 system to separate the essential from modulatory components of specific actin structures of interest. These structures include actin-based cell-edge protrusions such as lamellipodia or filopodia and specific actin-rich structures (e.g. ruffles) stimulated by specific virulence factors evolved by bacterial pathogens.

Establishment of signaling networks downstream of Rho-GTPases: Over the years, our research has focused around uncovering the precise signalling networks and pathways downstream of Rho-subfamily of small GTPases, many of which are implicated in cellular processes as fundamental as establishment of cell polarity or the regulation of cell migration and cell division.

Assessment of force development by and ultrastructural composition of actin-based protrusions: In recent efforts, our studies have been extended to determining the precise contributions of specific molecular components to ultrastructural organization of actin-based cell-edge protrusions (as unravelled by electron tomography) and to the development of forces exerted by these protrusions (directly measured, for instance, by atomic force microscopy).

None of these projects would be possible without our collaborators, including Profs. Jan Faix (Hannover), Josef Käs (Leipzig), Michael Schnoor (Mexico City), Michael Sixt (Klosterneuburg, Austria) and Theresia Stradal (Braunschweig).

Publications

- Koestler SA, Steffen A, Nemethova M, Winterhoff M, Luo N, Holleboom JM, Krupp J, Jacob S, Vinzenz M, Schur F, Schlüter K, Gunning PW, Winkler C, Schmeiser C, Faix J, Stradal TE, Small JV, Rottner K (2013) Arp2/3 complex is essential for actin network treadmilling as well as for targeting of capping protein and cofilin. Mol Biol Cell 18: 2861-2875.
- Steffen A, Ladwein M, Dimchev GA, Hein A, Schwenkmezger L, Arens S, Ladwein KI, Margit Holleboom J, Schur F, Victor Small J, Schwarz J, Gerhard R, Faix J, Stradal TE, Brakebusch C, Rottner K (2013) Rac function is crucial for cell migration but is not required for spreading and focal adhesion formation. J Cell Sci 126: 4572-4588.
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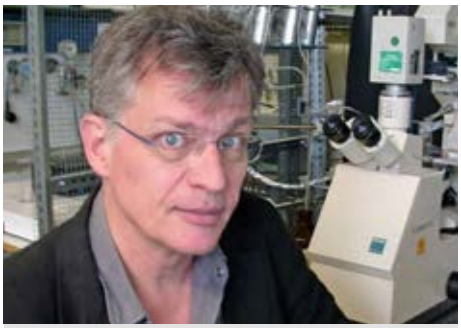
- Lai FP, Szczodrak M, Oelkers JM, Ladwein M, Acconcia F, Benesch S, Auinger S, Faix J, Small JV, Polo S, Stradal TE, Rottner K (2009) Cortactin promotes migration and platelet-derived growth factor-induced actin reorganization by signaling to Rho-GTPases. Mol Biol Cell 14: 3209-3223.
- Lai FP, Szczodrak M, Block J, Faix J, Breitsprecher D, Mannherz HG, Stradal TE, Dunn GA, Small JV, Rottner K (2008) Arp2/3 complex interactions and actin network turnover in lamellipodia. EMBO J. 27: 982-992.

Institute of Pharmacology – Toxicology and Clinical Pharmacy



Prof. Dr. Ingo Rustenbeck

Researcher's Career

- Professor of Pharmacology, Institute of Pharmacology, University of Braunschweig
- Bertram-Award of the German Diabetes Society
- Lecturer, Institute of Clinical Biochemistry, Hannover Medical School
- DFG Postdoctoral Fellow, Institute of Pharmacology, University of Göttingen
- Junior House Officer, Internal Medicine, University of Marburg
- Study of medicine, University of Göttingen

Funding

DFG, Lower Saxony, Deutsche Diabetesgesellschaft

Contact

Technische Universität Braunschweig
Institute of Pharmacology, Toxicology and Clinical Pharmacy
Mendelssohnstraße 1
38106 Braunschweig
Phone: +49 531 391-56 65
i.rustenbeck@tu-braunschweig.de
www.tu-braunschweig.de/ip

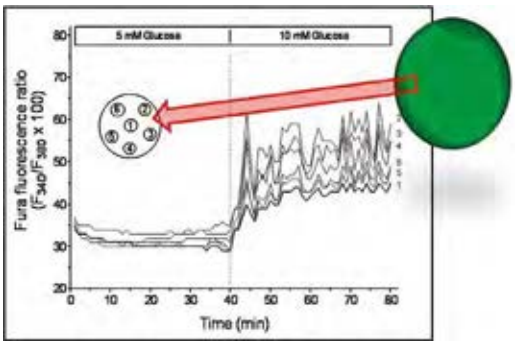
Mission Statement

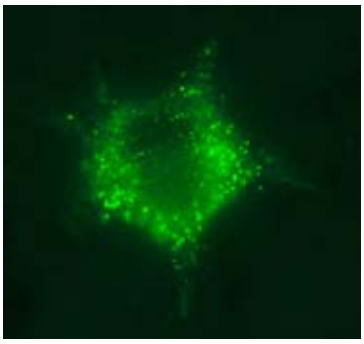
To understand what happens inside the pancreatic beta-cell

Research

The scientific interest of our group is directed towards the mechanisms which shape the **biphasic kinetic of insulin secretion**. The biphasic kinetic is regarded as indispensable for the maintenance of the glucose homeostasis of the organism. The diminution or even loss of the first phase secretion in response to a glucose challenge is the hallmark of the transition from impaired glucose tolerance to overt type 2 diabetes. Currently, a hypothesis is predominant in which the biphasic pattern is explained by different pools of secretory granules which become differentially recruited to exocytosis by a set of plasma membrane ion channels. New live cell imaging techniques for the visualisation of secretory granules and the growing perception that signals circumventing plasma membrane depolarisation are involved in early secretion events have put this "pool size hypothesis" into question. The pathophysiological perspective of our work is to clarify which events lead to the loss of the first phase and the pharmacological perspective is the reconstruction of the first phase by a beta cell-directed therapy.

By stimulating isolated pancreatic islets or single beta-cells in a closely comparable manner in a variety of measuring stands we intend to create an encompassing view of the intracellular events underlying the kinetics of insulin secretion. The plasma membrane potential, whole cell currents and the currents of K_{ATP} channels and voltage-dependent Ca^{2+} channels are registered by patch-clamping. The cytosolic calcium concentration and other parameters of signal transduction are measured by conventional live-cell imaging. Endpoint measurement of adenine nucleotides and Krebs cycle metabolites complement the assessment of beta cell energy metabolism. Finally, objective-based TIRF-microscopy with an integrated cell perifusion system permits the visualization of submembrane insulin granule mobility and fusion under physiologically relevant conditions. These events are analyzed by an observer-independent program, developed in cooperation with colleagues from the Institute of Medicinal Chemistry. Standard molecular biology techniques are employed to generate fluorescent fusion proteins as granule labels. Thus, an integrated view on the beta-cell is generated which should lead to the above mentioned aims.





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Institute for Biochemistry, Biotechnology and Bioinformatics

Prof. Dr. Anett Schallmey

Researcher's Career

- Professor for Biochemistry, TU Braunschweig
- Associate Professor for Biocatalysis, University of Amsterdam, Netherlands
- Junior Professor for Biocatalysis, RWTH Aachen University
- Postdoc at the Rijksuniversiteit Groningen, Netherlands
- Doctorate at the University of Greifswald, Department of Biotechnology and Enzyme Catalysis
- Biochemistry studies at the University of Greifswald

Funding

DFG, EU, BMWi, industry

Contact

Technische Universität Braunschweig
Institute for Biochemistry, Biotechnology and Bioinformatics
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391-55400
a.schallmey@tu-braunschweig.de
www.tu-braunschweig.de/bbt/biochem

Mission Statement

Enzymes are excellent and sustainable catalysts applicable for many chemical reactions and thus present a valuable alternative to many chemical catalysts. Our interdisciplinary research focusses on the investigation, utilization and engineering of novel enzymes as biocatalysts for various industrially relevant applications.

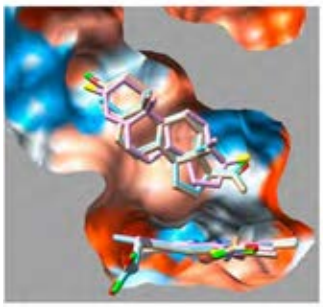
Research

Novel enzymes: The identification of novel enzyme catalysts, especially for yet biocatalytically underexplored reactions, is a major research focus in our group. Using enzyme-specific motifs and specific bioinformatics tools, we are mining the wealth of sequence data available in public databases for the discovery of interesting novel biocatalysts with valuable properties.

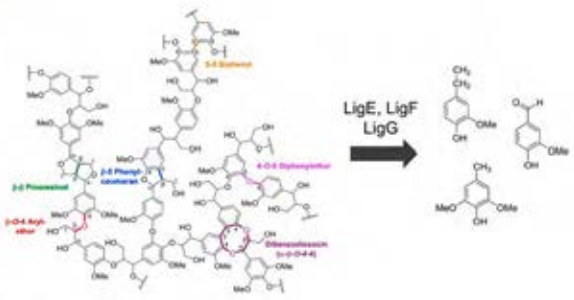
Selective transformations: The major advantage of enzymes compared to chemical catalysts is their intrinsic high selectivity. We are exploring the regio- and stereoselectivity of various oxygenases and lyases for the selective synthesis of fine chemicals and pharmaceuticals. This not only involves the application of free enzymes but also the generation of suitable whole-cell biocatalysts as well as the combination of different enzyme activities in biocascades.

Enzyme engineering: Many naturally occurring enzymes do not exhibit all characteristics required for their application in industrial processes. Hence, protein engineering is often the method of choice to adjust specific enzyme properties. In our projects, we apply different protein engineering techniques to modify the activity, selectivity or stability of our biocatalysts. This also includes the development of reaction-specific enzyme activity assays.

Biomass valorization: The establishment of biorefinery concepts for the valorization of lignocellulosic biomass will be the key to reach sustainability targets in the future. In this area, biomass-degrading enzymes are attracting significant research interest for their potential in the production of chemicals and biofuels from renewable feedstock. Specifically, our group investigates the valorization of lignin by selective biocatalytic depolymerisation of this aromatic polymer.



Active site of CYP154C5, a cytochrome P450 monooxygenase.



Enzymatic lignin depolymerisation.

Publications

- P. Picart, M. Sevenich, P. Dominguez de Maria, A. Schallmey. Exploring glutathione lyases as biocatalysts: Paving the way for enzymatic lignin depolymerization and future stereoselective applications, Green Chem., 17: 4931–4940, 2015.
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- P. Bracco, D. B. Janssen, A. Schallmey. Selective steroid oxyfunctionalisation by CYP154C5, a bacterial cytochrome P450. Microb. Cell. Fact., 12: 95, 2013.

Institute of Pharmacology – Toxicology and Clinical Pharmacy

Prof. Dr. Stephan Scherneck

Researcher's Career

- Junior Professor for Clinical Pharmacy, TU Braunschweig
- Postdoc and Consultant Pharmacist at Charité – Universitätsmedizin Berlin, Institute for Clinical Teratology and Drug Risk Assessment in Pregnancy
- Postdoc at Max Delbrück Center for Molecular Medicine, Berlin, Research Team "Genetics of Metabolic and Reproductive Disorders"
- Postdoc at German Institute of Human Nutrition Potsdam-Rehbruecke, Departments of Experimental Diabetology and Pharmacology
- Dr. rer. nat. at the University of Potsdam/ German Institute of Human Nutrition Potsdam-Rehbruecke, Department of Pharmacology
- Studies of Pharmacy at the Humboldt-Universität zu Berlin

Funding

Deutsche Diabetes Gesellschaft

Contact

Technische Universität Braunschweig
Institute of Pharmacology – Toxicology and Clinical Pharmacy
Mendelssohnstraße 1
38106 Braunschweig
Phone: +49 531 391-8440
s.scherneck@tu-braunschweig.de
www.tu-braunschweig.de/ipt

Mission Statement

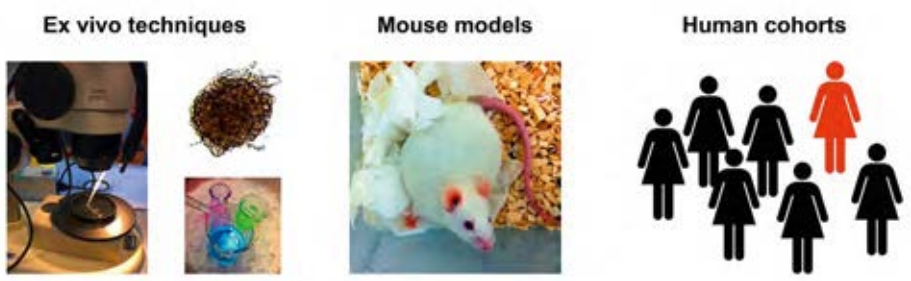
The focus of our research is on the identification of new targets for the treatment of endocrine disorders. For the translational approach we use mouse models of human diseases

Research

Investigation of functional links of type 2 and gestational diabetes: Gestational diabetes is a strong risk factor for the development of type 2 diabetes in later life. However, the molecular link connecting the pathogenesis of both diseases is still unknown. We use mouse models of the metabolic syndrome to identify candidate genes which are dysregulated in both disorders. A further aim is to establish biomarkers which may serve as predictors of these diseases in humans.

Use of antidiabetic drugs in pregnancy: Due to the long-time safety record, insulin is currently the medication of choice for the treatment of gestational diabetes and diabetes in pregnancy in general. However, the use of certain oral antidiabetic drugs could provide considerable benefits for the patients, e.g. less progression of obesity or better glycemic profiles via improved compliance. In collaboration with the Institute for Clinical Teratology and Drug Risk Assessment in Pregnancy at the Charité – Universitätsmedizin Berlin, we study the safety of the biguanide metformin in a large human cohort (funded by Deutsche Diabetes Gesellschaft). A convincing safety record may result in new treatment options.

Drug metabolism in pregnancy: A critical step in the assessment of drug safety in pregnancy is the availability of solid preclinical data about toxicity of a drug and its metabolites. The prediction is difficult because several pharmacokinetic parameters are markedly altered during pregnancy. This may lead to significantly different metabolite profiles as compared to the standard healthy male volunteer in phase I trials. To better predict drug safety in pregnancy, our group develops new *in vivo*- and ex vivo models.



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- Kluth O, Matzke D, Kamitz A, Jähnert M, Vogel H, Scherneck S, Schulze M, Staiger H, Machicao F, Häring HU, Joost HG, Schürmann A: Identification of Four Mouse Diabetes Candidate Genes Altering β-Cell Proliferation. PLoS Genetics 11, e1005506, 2015
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- Vogel H, Nestler M, Rüschendorf F, Block MD, Tischer S, Kluge R, Schürmann A, Joost HG, Scherneck S: Characterisation of Nob3, a major quantitative trait locus for obesity and hyperglycaemia on mouse Chromosome 1. Physiol Genomics 38:226-232, 2009

Institute of Genetics

Prof. Dr. Ralf Schnabel

Researcher's Career

- Full professor for Genetics at the TU Braunschweig
- Independent group leader, Max-Planck-Institut für Biochemie, Martinsried
- Junior Group leader, Max-Planck-Institut für Entwicklungsbiologie, Tübingen
- Postdoc at Laboratory for Molecular Biology, Cambridge UK
- Dr. rer. nat. at Max-Planck-Institut für Biochemie/LMU München
- Master of Science at Louisiana State University, Baton Rouge USA
- Study of Biochemistry, Universität Tübingen

Contact
Technische Universität Braunschweig
Institute of Genetics
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391-5770
r.schnabel@tu-braunschweig.de
www.tu-braunschweig.de/ifg

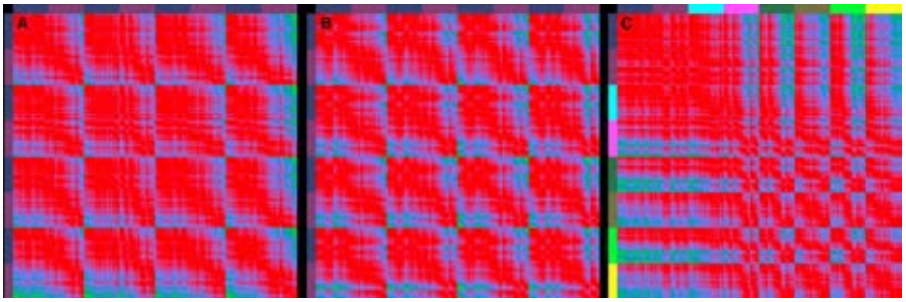
Mission Statement

Exploration of basic principles in developmental biology to unravel general strategies building animals from the fertilized zygote. The current focus concerns the question how the linear information of the DNA is translated into shape and form.

Research

Life is order. Therefore, it is a key question as to how the linear genetic information of the DNA is coded for the plethora of forms of organisms. A worm will produce a worm, a fly will produce a fly and families will pass on their facial features. The classical model suggests that form is created by a series of inductions that organise tissues, convoyed by growth, migration, and modulation of cell shape. In contrast, using 4D microscopic analyses and new bioinformatics tools, we showed that in the *C. elegans* embryo, pattern and form are the result of a cell sorting process involving long-range migrations coordinated by local comparison of cell 'addresses', which are intrinsic features of individual cell fates.

We termed this novel process guiding the generation of form 'cell-focussing'. Revolutionary work in tissue engineering has recently shown that eyecups or small brains can develop *de novo* from stem cells *in vitro*. Because this opposes the general model of morphogenesis, the existence of a 'latent intrinsic order principle' causing dynamic self-patterning is postulated. Cell-focussing embodies these principles and has therefore the potential to explain self-patterning. The creation of cell addresses used to arrange cell position should be an ingenious solution to translate the linear information of DNA into form. In a large genetic screen we isolated a mutant, which hinted that glycoproteins may code for the enigmatic cell addresses. However, it turned out that glycoproteins are only involved in migrations per se, cells just move less efficiently, as if they were now on slippery ground. Nevertheless, as can be seen in the corresponding distance maps of cells (picture A) they are still able to resort in a completely new, although blurred, pattern, which is expected when cell fates are specifically manipulated using a glp-1 mutant (B) compared to wild-type (C). Therefore, it is rather improbable that glycoproteins code for cell addresses. The search must go on.



Publications

- J. R. Priess, H. Schnabel, & R. Schnabel (1987) The glp-1 locus and cellular interaction in early *C. elegans* embryos. Cell 51, 601-611
- H. Schnabel & R. Schnabel (1990) An organ-specific differentiation gene, pha-1, from *Caenorhabditis elegans*. Science 250, 686-688
- R. Schnabel (1994) Autonomy and nonautonomy in cell fate specification of muscle in the *Caenorhabditis elegans* Embryo: A reciprocal induction. Science 263, 1449-1452
- Titus Kaletta, Heinke Schnabel & Ralf Schnabel (1997) Binary specification of the embryonic lineage in *Caenorhabditis elegans*. Nature, 390, 294-298
- Hoeppner DJ, Hengartner MO, Schnabel R (2001) Engulfment genes cooperate with ced-3 to promote cell death in *Caenorhabditis elegans*. Nature 412, 202-206

Institute of Environmental and Sustainable Chemistry

Prof. Dr. Uwe Schröder

Researcher's Career

- Full Professor for Sustainable Chemistry and Energy Research, TU Braunschweig
- Habilitation at the University of Greifswald
- Feodor Lynen Fellow of the Alexander-von-Humboldt-Foundation at Oxford University
- PhD in Physical Chemistry, Humboldt University, Berlin
- Member of the founding board of directors of the International Society of Microbial Electrochemistry and Technology (2012-14)
- Member of the board of directors of the Battery Lab Factory Braunschweig (BLB)
- Specialty Chief Editor of Bioenergy and Biofuels, for Frontiers in Energy Research and Frontiers in Bioengineering and Biotechnology
- Member of the editorial board of ChemSusChem (Wiley VCH)
- Member of the scientific board of Energy & Environmental Science (RSC)

Funding

DFG, BMBF, DBU, Lower Saxony, BMWi

Contact

Technische Universität Braunschweig
Institute of Environmental and Sustainable Chemistry
Hagenring 30
38106 Braunschweig
Phone +49 531 391-8425
uwe.schroeder@tu-braunschweig.de
www.tu-braunschweig.de/oekochemie/akschroeder

Mission Statement

Our mission is to develop greener – more sustainable – methods of (electro-)chemical energy conversion and storage, and to develop greener chemical processes.

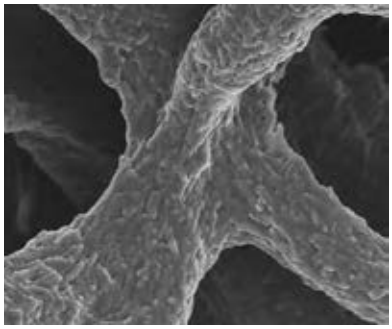
Research

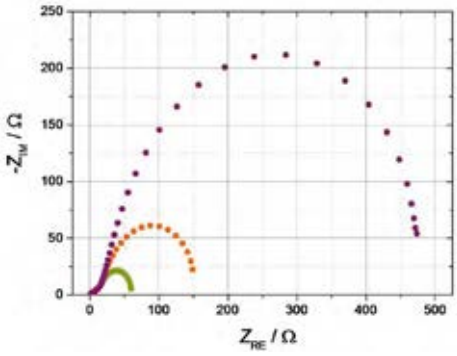
Microbial electrochemistry and technology: We explore the use of current – producing bacteria in microbial fuel cells to convert chemical energy that is contained in waste streams, such as wastewater into electricity. We study the mechanisms of bioelectrochemical energy conversion and develop new components for microbial electrochemical systems.

Battery research: It is our main goal to gain a deeper understanding of the processes within lithium ion batteries and to develop new electrochemical techniques for battery studies. Further, we develop new concepts for redox flow batteries and study greener battery components.

"Electrofuels": We explore electrochemical synthesis for the development of regenerative fuels and green platform chemicals. Electrochemical synthesis allows the achievement of fuel synthesis at room temperature, ambient pressure and in aqueous solution. "Electrofuels" can be seen as an opportunity to store fluctuating electric energy from wind power and photovoltaics into liquid fuels.

Further, our institute deals, for example, with fate monitoring and metabolism studies of biologically active substances (pesticides, biocides, human and veterinary medicines) in different environmental compartments (liquid manure, sewage sludge, soil, plant, water, sediment) and with development of strategies for the removal of these compounds from waste streams such as manure and wastewater.





Publications

- Schröder, U., Harnisch, F., Angenent, L.T., Microbial electrochemistry and technology: Terminology and classification (2015) Energy and Environmental Science, 8 (2), pp. 513-519.
- Nilges, P., Schröder, U., Electrochemistry for biofuel generation: Production of furans by electrocatalytic hydrogenation of furfurals, (2013) Energy and Environmental Science, 6 (10), pp. 2925-2931.
- Chen, S., He, G., Liu, Q., Harnisch, F., Zhou, Y., Chen, Y., Hanif, M., Wang, S., Peng, X., Hou, H., Schröder, U., Layered corrugated electrode macrostructures boost microbial bioelectrocatalysis, (2012) Energy and Environmental Science, 5 (12), pp. 9769-9772.
- Schröder, U., Discover the possibilities: Microbial bioelectrochemical systems and the revival of a 100-year-old discovery, (2011) Journal of Solid State Electrochemistry, 15 (7-8), pp. 1481-1486.
- Nilges, P., Dos Santos, T.R., Harnisch, F., Schröder, U., Electrochemistry for biofuel generation: Electrochemical conversion of levulinic acid to octane, (2012) Energy and Environmental Science, 5 (1), pp. 5231-5235.

Institute of Organic Chemistry

Prof. Dr. Stefan Schulz

- Head, Instiute of Organic Chemistry TU Braunschweig
- Coordinator of graduate school MINAS - Microbial Natural Products
- Former president of the International Society of Chemical Ecology, council member
- Editorial board member Natural Product Reports, Journal of Chemical Ecology, Marine Drugs, Chemoecology

Researcher's Career
- Full Professor of Organic Chemistry at the TU Braunschweig
- Rejected Calls for Professor of Organic Chemistry at Würzburg, TU Munich, LMU Munich
- Junior Group Leader at Institute of Organic Chemistry, Hamburg
- Postdoc at Cornell University, Ihaca, USA
- Dr. rer. nat. at the Universität Hamburg, Institute of Organic Chemistry
- Study of Chemistry, Hamburg

Funding
DFG, BMBF, State Lower Saxony, Industry

Contact
Technische Universität Braunschweig
Institute of Organic Chemistry
Hagenring 30
38106 Braunschweig
Phone: +49 531 391-7353
stefan.schulz@tu-braunschweig.de
www.oc.tu-bs.de/schulz/index.html

Mission Statement

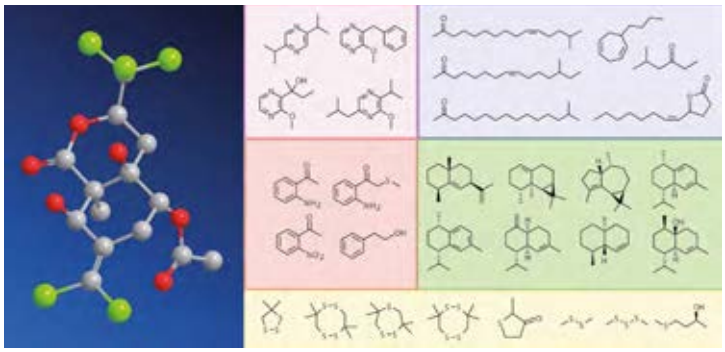
Chemical Communication and Chemical Ecology are the focus of our Natural Products Research. Identification and isolation of compounds, stereoselective synthesis, and biosynthesic investigations are used to understand why and for what purpose natural organisms produce signalling compounds, defence compounds, or antibiotics.

Research

Chemical Communication: Arthropods are well known for their widespread use of semiochemicals, compounds mediating inter- and intraspecific interactions among individuals. Such compounds occur usually in low concentrations and need organic trace analysis methods such as gas chromatography/mass spectrometry (GC/MS) for their identification. Structural proposals based on mass spectra need to be verified by synthesis. Often stereochemistry is important for biological activity and therefore stereoselective synthesis and analysis is performed. Our research includes various vertebrates such as amphibia, reptiles, and mammals, as well as insects and arachnids. Projects are investigated in close cooperation with biologists from all parts of the world.

Bacterial Volatiles and Communication: Bacteria can produce a wealth of volatile compounds, the function of which is currently only poorly understood. We aim to clarify the structural space used by the bacteria and investigate the function of these compounds. While volatiles are analyzed as described above, bacteria also communicate by "quorum sensing" using non-volatile com-pounds. These compounds are analyzed by HPLC/MS. Target compounds are synthesized to test their structure and evaluated for their activty in cooperation with biologists.

Antibiotics: We are searching for new natural products from various sources to find new antibitotics. Current approaches like genome mining make it possible to detect even minute amounts of new compounds. Because these compounds are difficult to obtain in enough quantites for NMR analysis, total syntheses may shorten the time needed for their identification. Structural proposals are made from MS and/or NMR spectra as well as microderivatization methods developed by us.



Sigillin A, a unique polychlorinated natural benzopyranone from a springtail (left) and volatile ompounds produced by bacteria, belonging to five major compound classes: pyrazines, aliphatic compounds, aromatic compounds, terpenes, and sulfur compounds (right).

Publications

- Schmidt, W., Schulze, T. M., Brasse, G., Nagrodzka, E., Maczka, M., Zettel, J., Jones, P. G., Grunenberg, J., Hilker, M., Trauer-Kizilelma, U., Braun, U., and Schulz, S. 2015 Sigillin A, a unique polychlorinated arthropod deterrent from the snow flea *Ceratophysella sigillata*. Angew. Chem. Int. Ed. 54:7698-7702.
- Hötling, S., Haberlag, B., Tamm, M., Collatz, J., Mack, P., Steidle, J. L. M., Vences, M., and Schulz, S. 2014 Identification and Synthesis of Macrolide Pheromones of the Grain Beetle *Oryzaephilus surinamensis* and the Frog *Spinomantis aglavei*. Chem. Eur. J. 20:3183-3191.
- Neumann, A., Patzelt, D., Wagner-Döbler, I., and Schulz, S. 2013 Identification of new *N*-acylhomoserine lactone signalling compounds of *Dinoroseobacter shibae* DFL-12^T by overexpression of luxI genes. ChemBioChem 14:2355-2361.
- Poth, D., Wollenberg, K. C., Vences, M., and Schulz, S. 2012 Volatile amphibian pheromones: Macrolides of mantellid frogs from Madagascar. Angew. Chem. Int. Ed. 51:2187-2190.
- Jerhot, E., Stoltz, J. A., Andrade, M. C. B., and Schulz, S. 2010 Acylated serine derivatives: A unique class of arthropod pheromones of the Australian redback spider, *Latrodectus hasselti*. Angew. Chem. Int. Ed 49:2037-2040.

Institute of Technical Chemistry

Prof. Dr. Adrian Schumpe

Researcher's Career
- Full Professor for Technical Chemistry, TU Braunschweig
- Associate Professor for Technical Chemistry, Univ. Erlangen-Nürnberg
- Research Accociate, GBF, Braunschweig
- Dr. rer. nat. habil., C.v.Ossietsky Univ. Oldenburg
- Research Accociate, C.v.Ossietsky Univ. Oldenburg
- Postdoc, Univ. of Pittsburgh, USA
- Dr. rer. nat. at the Univ. Hannover
- Study of Chemistry, Univ. Hannover

Funding
EU, State Lower Saxony, DFG

Contact
Technische Universität Braunschweig
Institute of Technical Chemistry
Hans-Sommer-Straße 10
38106 Braunschweig
Phone: +49 531 391-5365
a.schumpe@tu-braunschweig.de
www.tu-braunschweig.de/itc

Mission Statement

Mass transfer with chemical reaction in multiphase reactors, specifically, high-pressure bubble columns and stirred reactors, are studied in order to improve reactor design and scale-up.

Research

Wet oxidation of waste water from hydrothermal carbonization (HTC): When biomass is subjected to HTC, up to 1/3 of the carbon may end up in dissolved byproducts. Reducing the biological oxygen demand of the waste water by wet oxidation shall be studied in stirred autoclaves (1 L) and in a high-pressure bubble column (20 L).

Kinetics of hydrothermal carbonization (HTC): The carbonization kinetics of lignocellulosic biomass has been studied at 180–240°C. A lumped model has been developed for the kinetics of destruction and biochar as well as byproduct formation.

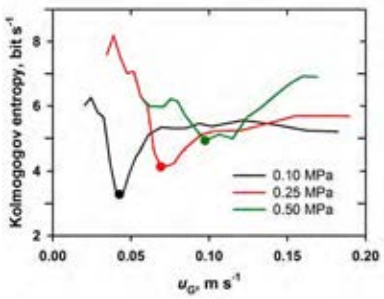
Absorption into stirred emulsions: The absorption of oxygen and carbon dioxide into stirred emulsions of hydrocarbons (o/w and w/o) is studied by barometric and fluorometric methods. The effect of surfactant (SDS) addition and mass transfer with fast chemical reaction are considered.

Analysis of pressure fluctuations in a bubble column: Flow regime transitions in a 0.1 m diameter bubble column, operated at pressures up to 2 MPa, were studied by statistic, fractal and stochastic analysis of the pressure fluctuations. Spectral analysis allowed the identification of pressure sources.

Absorption into suspensions of moderately hydrophobic catalysts: The potential of mass transfer enhancement by hydrophobized particles was studied using Pd/C catalyst for hydroxylamine production (HPO process) and glucose oxidation.

Surfactant adsorption on activated carbon: Mass transfer with and without chemical reaction can be significantly increased when dissolved surfactants are adsorbed on suspended solids (e.g., activated carbon). This may just increase the liquid-side mass transfer coefficient k_L or even enable surface convection.

Gas solubility: Empirical models have been developed to predict the combined effects of dissolved salts and organic solutes (e.g., in bio-media) on the solubility of gases.



Flow transitions in a bubble column.

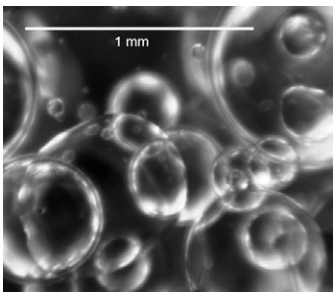


Photo of w/o emulsion.

Publications

- M. Jatzwauck, A. Schumpe (2014), Kinetics of hydrothermal carbonization (HTC) of soft rushes. Biomass Bioenerg. 75: 94-100.
- C. Grote, M. Rosu, A. Schumpe (2010), The effect of Pd-catalyst wettability on hydrogenation of nitrate to hydroxylamine. Canad. J. Chem. Eng. 88(4): 633-637.
- S. Nedeltchev, A. Schumpe (2008), A new approach for the prediction of gas holdup in bubble columns operated under various pressures in the homogeneous regime. J. Chem. Eng. Japan 41(8): 744-755. (Outstanding Paper Award 2008)
- M. Rosu, A. Marlina, A. Kaya, A. Schumpe (2007), Surfactant adsorption onto activated carbon and its effect on absorption with chemical reaction. Chem. Eng. Sci. 62(24): 7336-7343.
- A. Kaya, A. Schumpe (2005), Surfactant adsorption rather than "shuttle effect"? Chem. Eng. Sci. 60(22): 6504-6510.

Institute of Microbiology – Deparmtent Microbial Drugs

Prof. Dr. Marc Stadler

- Head of Department Microbial Drugs, Helmholtz Centre for Infection Research

Researcher's Career

- Acting Vice President and Executive Board member, International Mycological Association (IMA)
- Executive Board Member, International Commission for the Taxonomy of fungi (ICTF)
- Task Leader, German Centre for Infection Research (DZIF)
- Researchers Career
- Visiting Professor, CAS State Key Lab of Mycology, Beijing, P.R. China, 2013
- Head of Department Microbial Drugs, HZI Braunschweig, 2012
- Professor, TU Braunschweig, 2012
- Lecturer (Mycology, Organic Chemistry), Univ. Bayreuth, Habilitation 2009
- Co-founder, shareholder and Director of InterMed Discovery GmbH, Dortmund, Germany 2006-2012
- Principal Research Scientist, Bayer AG, (Pharma Division, Natural Products Research) Wuppertal, Germany 1995-2006
- Postdoc (Natural Product Chemistry, University of Lund, Sweden) 1994-1995
- Dr. rer. nat. (Biotechnology, Universität Kaiserslautern) 1993

Funding

BMBF DZIF; EU; Alexander-von Humboldt-Stiftung; DAAD, DFG

Contact

Department Microbial Drugs –
Helmholtz Centre for Infection Research (HZI)
Inhoffenstraße 7 | 38124 Braunschweig
marc.stadler@helmholtz-hzi.de
Phone: +49 531 6181-4240
www.helmholtz-hzi.de/en/research/research_topics/antiinfectives/microbial_drugs

Mission Statement

Our mission is the discovery and preclinical development of novel anti-infectives and other useful compounds from natural sources in order to combat the newly arising multi-resistant human pathogens in an interdisciplinary, international scenario.

Research

Our interdisciplinary team consists of **microbiologists, mycologists, analytical chemists and biotechnological engineers.** We are involved in training students in the aforementioned disciplines and are also steadily recruiting Ph.D. students with respective qualifications from around the world who graduate at the Technical University of Braunschweig.
Our research involves several major tasks that all relate to **natural products-based drug discovery from bacterial and fungal sources.**

As taxonomy and the ability to produce biologically active secondary metabolites are known to be closely correlated, we are undertaking great efforts in the isolation and characterisation of strains (in particular, actinobacteria, **myxobacteria and fungi**) by means of classical taxonomy and molecular phylogeny.

In a **world-wide scientific network** involving many experts in **biodiversity research**, young researchers come to work, in our laboratory, on the biological sources from their home countries. The cultures of these organisms are first subjected to small scale fermentation and their extracts are studied for production of **antibiotics, antivirals** and other useful biologically active compounds. We are continuously finding new chemical entities from **new species and hitherto unexplored organisms**.

The **production, isolation and structure elucidation** of these compounds using state-of-the-art fermentation techniques and **analytical and chromatographic instruments (HPLC, NMR, MS)** is one of our major tasks. Moreover, we design **sustainable biotechnological production processes** for interesting lead compounds in up to multi-gram scale for exploratory studies and **preclinical development** and can perform **fermentations up to pilot scale** including adequate downstream processing procedures.

We collaborate with partners in academia and industry to improve the production rates and optimise the bioactivities of our compounds by means of synthetic biotechnology or medicinal chemistry.

Publications

- **Mudalungu CM, Richter C, Wittstein K, Ali Abdalla M, Matasyoh JC, Stadler M, Süssmuth RD (2016) Laxitextines A and B, cyathane xylosides from the tropical fungus *Laxitextum incrustatum*. J Nat Prod 79: 894-898.
- **Mohr KI, Volz C, Jansen R, Wray V, Bernecker S, Wink J, Gerth K, Stadler M, Müller R (2015) Pinensins: The first antifungal lantibiotics. Angew Chem Int Ed 54: 11254–11258.
- Kuhnert E, Surup F, Wiebach V, Bernecker S, Stadler M (2015) Botryane, noreudesmane and abietane terpenoids from the ascomycete *Hypoxylon rickii*. Phytochemistry 117: 116-122.
- Surup F, Thongbai B, Kuhnert E, Hyde KD, Stadler M (2015) Deconins A-E – unprecedented cuparenic and mevalonic or propionic acid conjugates from the basidomycete *Deconica* sp. 471. J Nat Prod 78: 934-938
- Kuhnert E, Surup F, Sir EB, Lambert C, Hyde KD, Hladki AI, Romero AI, Stadler M (2015) Lenormandins A – G, new azaphilones from *Hypoxylon lenormandii* and *Hypoxylon jaklitschii* sp. nov., recognised by chemotaxonomic data. Fungal Divers 71:165-184.

Institute of Microbiology

Prof. Dr. Michael Steinert

- Managing Director of the Institut für Mikrobiologie
- Scientific Advisory Board of the Leibnitz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen
- Board of the Helmholtz International Graduate School for Infection Research
- Vice dean of studies (Biology, TU Braunschweig)
- Coordinator of the thematic priority "Infection Biology" (Master Biology)

Researcher's Career

- Prof. for Microbiology at the TU Braunschweig
- Scientific group leader at the University of Würzburg
- Postdoc at the Centers for Disease Control, USA
- Dr. rer. nat. at the University of Würzburg, Institut for Molecular Infection Biology
- Study of Biology, Würzburg

Funding

DFG, BMBF, State Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute of Microbiology
Spielmannstraße 7
38106 Braunschweig
Phone: +49 531 391 5802
m.steinert@tu-bs.de
www.tu-braunschweig.de/ifm

Mission Statement

Infectious diseases are a continous threat to human and animal health. Our mission is to discover principles of infection at the molecular, cellular, organ, host, and population level with the goal to develop novel infection intervention and prevention strategies.

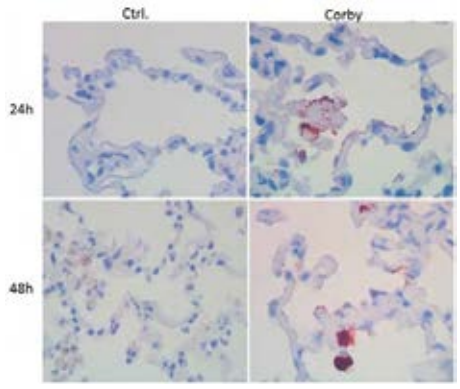
Research

Ecology, transmission and pathogenicity of *Legionella pneumophila:* We analyse the pathogen-host interactions of the causative agent of Legionnaires' disease. In addition to protozoa and human host cells we study the infection of human lung tissue explants. Special emphasis is placed on peptidyl-proly-cis/trans-isomerases (PPIases), the bacterial secretome and outer membrane vesicles.

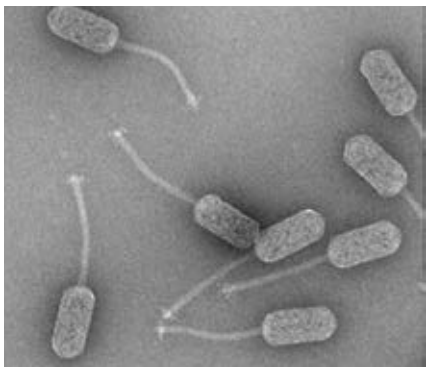
Novel therapeutic strategies for *Clostridium difficile* infections: *C. difficile* has become the primary cause of antibiotic-associated diarrhea and pseudomembranous colitis. We analyze the virulence mechanisms of *C. difficile* including tissue colonization and spore-mediated persistence. Moreover, we aim to identify new bacterial drug targets and to develop alternative treatment strategies.

Pneumococcal-Host-Interactions (PD Dr. Simone Bergmann): We analyze the interaction between the opportunistic pathogen *Streptococcus pneumoniae* and different human host niches including the pharyngeal epithelium, the lung tissue and the vascular system. In addition to a detailed biochemical deciphering of protein interactions, various cell culture-based infection models are utilized (e.g. microfluidic pump system for simulation of bloodstream infections, venous endothelium model).

Evolution and pathogenicity of *Paenibacillus larvae:* *Paenibacillus larvae* is the causative agent of American foulbrood (AFB), the most serious bacterial infection in honey bees. We use biochemistry, molecular biology and modern Omics technologies to elucidate AFB outbreaks and the virulence mechanisms of *P. larvae.* Moreover, we characterize *P. larvae*-specific bacteriophages and develop criteria for a safe phage therapy.



Uninfected (left) and Legionella-infected (right) human lung tissue explants.



Paenibacillus larvae-directed bacteriophages.

Publications and Patents

- Ünal, C.,M. & Steinert, M. (2015) Novel therapeutic strategies for *Clostridium difficile* infections. Expert Opinion on Therapeutic Targets, 20(3).
- Beims, H., Wittmann, J., Bunk, B., Spröer, C., Rohde, C., Günther, G., Rohde, M., von der Ohe, W. & Steinert, M. (2015) Characterization of *Paenibacillus larvae*-directed bacteriophage HB10c2 and evaluation of its application in honey bee larvae suffering from American Foulbrood.
- Applied and Environmental Microbiology, 81(16): 5411-5419.
- Ünal, C. & Steinert, M. (2014) Microbial peptidyl-prolyl cis/trans isomerase (PPIase)-virulence factors and potential alternative drug targets. Microbiology and Molecular Biology Reviews, 78(3):544-571.
- Jäger, J., Marwitz, S., Tiefenau, J., Rasch, J., Shevchuk, O., Kugler, C., Goldmann, T. & Steinert, M. (2014) Human lung tissue explants reveal novel interactions during *Legionella pneumophila* infections. Infection and Immunity 82(1): 275-85.

Department of Cell Biology

Prof. Dr. Theresia E. B. Stradal

Researcher's Career

- Full Professor at TU Braunschweig and Head of the Department of Cell Biology at the HZI
- Associate Professor for Molecular Cell Biology at the University of Münster (WWU)
- Habilitation at Hannover Medical School, Biochemistry
- Group leader, Helmholtz Centre for Infection Research (HZI formerly GBF), Braunschweig
- FEBS Letters Young Scientist Award
- Postdoc in the Department of Cell Biology, German Research Centre for Biotechnology (GBF), Braunschweig, Germany
- Dr. rer. nat at the Institute of Molecular Biology, Austrian Academy of Sciences, Salzburg
- Studies in Biology, University of Salzburg, Austria

Funding
DFG, HGF

Contact
Department of Cell Biology –
Helmholtz Centre for Infection Research (HZI)
Inhoffenstraße 7 | 38124 Braunschweig
theresia.stradal@helmholtz-hzi.de
Phone: +49 531 6181-2900
www.helmholtz-hzi.de/zbio

Mission Statement

We address host-pathogen interactions at the level of single cells, embodying the smallest living unit on both sides. Pathogens need to manipulate the normal behavior of host cells in order to establish a niche for survival and to evade the host's defense mechanisms. We study this interplay at the cellular and molecular level.

Research

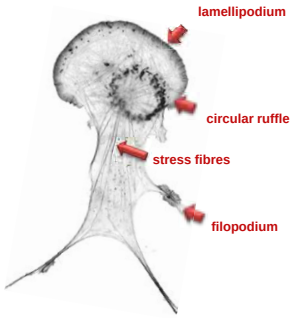
Recent reports published by the World Health Organization (WHO) entitled "The Global Burden of Disease" (GBD) highlight the importance of research on host-pathogen interactions. Evolution is an ongoing process, driving the development of highly virulent and multi-resistant bacteria strains or so called "emerging pathogens". A deeper understanding of the complex interactions between pathogenic bacteria and their hosts is indispensable in order to face these problems in the future.

The HZI department Cell Biology studies both the defense mechanisms of the host and the virulence mechanisms of the pathogens. Our core expertise is the combination of video-microscopy and protein biochemistry, applied to different models of cell movement in the context of bacterial infections. In the past, we were able to uncover regulatory mechanisms in cell movement and how bacterial virulence factors influence them.

Pathogenic bacteria frequently manipulate eukaryotic host cells by targeting actin cytoskeletal turnover. This is achieved, for example, by manipulating or mimicking the regulator's controlling actin dynamics such as members of the Rho family of small GTPases. Rho-GTPases serve as molecular switches that – while cycling - turn entire signalling pathways on and off, like those driving actin remodelling.

Interestingly, bacterial virulence factors have also emerged to bind to host cell signalling adaptors, highlighting the fact that these factors do not simply elicit global signals, but assemble larger complexes guiding the signal to a specific destination in the cell.

To gain more insight into these intricate mechanisms, we have begun to identify host targets of bacterial effectors by using proteomics and performing yeast-2-hybrid screens. Potential candidates are validated and tested for their influence on virulence factor-elicited signalling using state of the art biochemistry, cell biology and imaging. Finally, crystal structures of these complexes disclose the molecular details of these interactions at the host-pathogen interface. Our research has shown that during the infection process bacterial pathogens are highly dependent on cooperation with host proteins – an insight which might lead to new strategies for fighting infections.



F-actin organization in a migrating cell

Publications

- Blasche, S., Arens, S., Ceol, A., Siszler, G., Schmidt, M.A., Häuser, R., Schwarz, F., Wuchty, S., Aloy, P., Uetz, P., Stradal, T.E., Kögl, M. (2014) The EHEC-host interactome reveals novel targets for the translocated intimin receptor. Sci Rep. 18(4), 7531.
- Hänisch, J., Kölm, R., Wozniczka, M., Bumann, D. Rottner, K, Stradal, T.E. (2011) Activation of a RhoA/myosin II-dependent but Arp2/3 complex-independent pathway facilitates Salmonella invasion. Cell Host & Microbe 9(4), 273-285.
- Rottner, K., Stradal, T.E. (2011) Actin dynamics and turnover in cell motility. Curr. Opin. Cell. Biol. 23(5), 569-578.
- Klink, B.U., Barden, S., Heidler, T.V., Borchers, C., Ladwein, M., Stradal, T.E., Rottner, K., Heinz, D.W. (2010) Structure of Shigella IpgB2 in complex with human RhoA: implications for the mechanism of bacterial guanine nucleotide exchange factor mimicry. J. Biol. Chem. 285(22), 17197-17208.
- Weiss, S.M., Ladwein, M., Schmidt, D., Ehinger, J., Lommel, S., Städing, K., Beutling, U., Disanza, A., Frank, R., Jänsch, L., Scita, G., Gunzer, F., Rottner, K., Stradal, T.E. (2009) IRSp53 links Tir to EspFU/N-WASP-mediated actin assembly in EHEC pedestal formation. Cell Host & Microbe 5, 244-258.

Institute of Inorganic and Analytical Chemistry

Prof. Dr. Dr. h.c. Matthias Tamm

- Dean of the Faculty of Life Sciences
- Director of the Institute of Inorganic and Analytical Chemistry
- Elected Review Board Member, DFG

Researcher's Career

- Full Professor of Inorganic and Analytical Chemistry, TU Braunschweig
- Temporary Professorship, TU München
- Privatdozent and Hochschuldozent, Westfälische Wilhelms-Universität Münster
- Visiting Research Scientist, DuPont Central Research and Development (USA)
- Ph.D. at the TU Berlin
- Study of Chemistry at the TU Berlin

Funding

DFG, GIF, Lower Saxony, FCI, EU

Contact

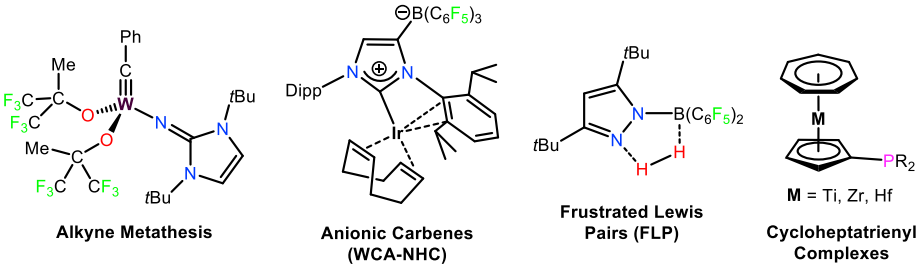
Technische Universität Braunschweig
Institute of Inorganic and Analytical Chemistry
Hagenring 38
38106 Braunschweig
Phone: +49 531 391 5309
m.tamm@tu-braunschweig.de
www.tu-braunschweig.de/iaac/personal/tamm

Mission Statement

Our mission is the advancement of organometallic chemistry by creating transition metal complexes with unusual electronic and structural properties and by exploiting their reactivitiy for the development of homogeneous catalysts for selective molecule activation and sustainable synthesis.

Research

Our research activities lie in the areas of preparative organometallic and coordination chemistry with an emphasis on the development of novel, unusual ligand systems and on the investigation and application of their transition metal complexes. With these ancillary ligands at hand, we have developed numerous homogeneous catalysts with particularly important contributions in the field of catalytic alkyne metathesis, while highly active catalysts for olefin polymerization, hydroamination, hydrosilylation, hydrogenation and cross-coupling reactions were also established. In the course of our studies on so-called "frustrated Lewis pairs", we aim at the development of metal-free catalysts and systems for reversible H_2 activation and storage. Furthermore, we have a long-standing interest in advancing the organometallic chemistry of cycloheptatrienyl ligands, which can be regarded as neglected carbocyclic ligands in comparison with their cyclopentadienyl and arene congeners. The figure below shows selected representative compounds from our current and future research activities.



Publications

- Nasr, A.; Winkler, A.; Tamm, M. (2016) Anionic N-Heterocyclic Carbenes: Synthesis, Coordination Chemistry and Applications in Homogeneous Catalysis. Coord. Chem. Rev. 316: 68-124.
- Wu, X.; Tamm, M. (2014) Transition metal complexes supported by highly basic imidazolin-2-iminato and imidazolin-2-imine N-donor ligands. Coord. Chem. Rev. 260: 116-138.
- Doddi, A., Bockfeld, D., Bannenberg, T., Jones, P.G., Tamm, M. (2014) N-Heterocyclic Carbene-Phosphinidyne Transition Metal Complexes. Angew. Chem. Int. Ed. 53: 13568-13572.
- Kolychev, E.L., Kronig, S., Brandhorst, K., Freytag, M., Jones, P.G., Tamm, M. (2013) Iridium(I) Complexes with Anionic N-Heterocyclic Carbene Ligands as Catalysts for the Hydrogenation of Alkenes in Non-Polar Media. J. Am. Chem. Soc. 135: 12448-12459.
- Tagne Kuate, A.C., Sameni, S., Freytag, M., Jones, P.G., Tamm, M. (2013) Phosphane-Functionalized Cycloheptatrienyl-Cyclopentadienyl Titanium Sandwich Complexes: Phosphorus Ligands with an Integrated Reducing Agent for Pd(0) Catalyst Generation. Angew. Chem. Int. Ed. 52: 8638-8642.
- Haberlag, B., Freytag, M., Daniliuc, C.G., Jones, P.G., Tamm, M. (2012) Efficient Metathesis of Terminal Alkynes. Angew. Chem. Int. Ed. 51: 13019-13022.
- Lysenko, S., Volbeda, J., Jones, P.G., Tamm, M. (2012) Catalytic Metathesis of Conjugated Diynes. Angew. Chem. Int. Ed. 51: 6757-6761.

Institute of Physical and Theoretical Chemistry

Prof. Dr. Philip Tinnefeld

- Member of BRICS (Braunschweig Integrated Center for Systems Biology) and LENA (Laboratory for Emerging Nanometrology)
- Member of Graduate School on Nanometrology

Researcher's Career

- Full Professor for Biophysical Chemistry at TU Braunschweig
- Associate Professor for Biophysics at Ludwig-Maximilians-University Munich
- Assistant Professor (C1) at University of Bielefeld
- Postdoc at University of California, Los Angeles (UCLA) and Katholieke Universiteit Leuven (Belgium)
- Ph.D. in Physical Chemistry, University of Heidelberg
- Studies of Chemistry in Münster, Montpellier and Heidelberg

Funding

DFG, VW-foundation, BMBF, EU (ERC starting grant)

Contact

Technische Universität Braunschweig
Institute for Physical and Theoretical Chemistry – NanoBioSciences
Hans-Sommer-Straße 10
38106 Braunschweig
p.tinnefeld@tu-braunschweig.de
www.tu-braunschweig.de/pci/forschung/tinnefeld

Mission Statement

We develop methods for superresolution microscopy and for biosensing and study biomolecular systems on the single molecule level. Tools from biology to physics are used for questions ranging from basic research of nanoscale light control to DNA based molecular devices for nanometrology and signal amplification.

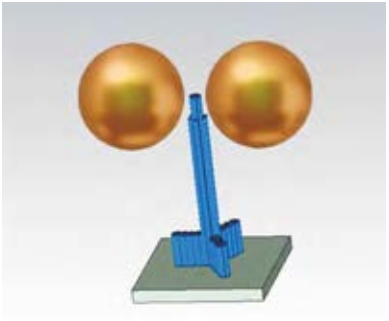
Research

Fluorescence microscopy beyond the diffraction limit: In recent years fluorescence microscopy has experienced a revolution with new ideas quickly emerging. One intermediate result of this development is that the properties of the fluorescent labels are becoming the most critical building block for further advancement. In this context, we develop fluorescent labels that intrinsically exhibit the required intensity fluctuations through, for example, superresolution with transient binding (STB).

Nano-Devices and Sensors for a self-assembled Nano-Lab: We extend the capabilities of DNA origami for various sensing devices. After calibration samples, energy transfer devices, nano-adapters and signal amplifiers, we develop further nanoscale devices such as force sensors, temperature sensors, ultra-bright point-like light sources, and molecular amplifiers. These devices will be used for in-vivo biosensing, membrane biophysics, microscopy and for single-molecule assays.

DNA-directed Nanophotonics: DNA nanostructures can be viewed as a molecular breadboard. We design new DNA origamis which will be the basis for new hybrid materials by attaching semiconductor and metallic nanoparticles and nanorods. With the aid of the DNA origami, we place single dye molecules to demonstrate fluorescence enhancement in plamonic hotspots. Self-assembled devices will also be crucial for nanoscale light control including energy transfer, switching and plasmonic transport.

Biomolecular structure and dynamics studied by FRET: Single-molecule Fluorescence Resonance Energy Transfer has become very popular for measuring distances between single biomolecules and for resolving biomolecular dynamics. Using multi-color experiments and advanced labeling techniques, we pursue the revelation of the choreography of central biomolecular mechanisms such as transcription or RNA processing.



Sketch of a self-assembled nanoantenna: gold nanoparticles are bound to a DNA nanostructure and focus the light in the center. This leads to a massive enhancement of fluorescent signals of molecules in the so-called Hot-Spot and can be used to drastically increase the sensitivity of diagnostic assays.

Publications

- G. P. Acuna, F. M. Möller, P. Holzmeister, S. Beater, B. Lalkens, P. Tinnefeld; Fluorescence Enhancement at Docking Sites of DNA-Directed Self-Assembled Nanoantennas, Science 338, 506-510, 2012.
- P. Holzmeister, E. Pibiri, J.J. Schmied, T. Sen, G.P. Acuna, P. Tinnefeld; Quantum Yield and Excitation Rate of Single Molecules close to Metallic Nanostructures, Nature Commun. 5, 5356, 1-9, 2014.
- J.J. Schmied, C. Forthmann, E. Pibiri, M. Raab, B. Wünsch, T. Dammeyer, P. Tinnefeld; DNA Origami-based Standards for Quantitative Fluorescence Microscopy, Nature Protoc. 9, 1367-1391, 2014.
- P. Tinnefeld; Single-Molecule Detection: Breaking the Concentration Barrier, Nature Nanotechnol. 8, 480-482, 2013.
- J.J. Schmied, A. Gietl, P. Holzmeister, C. Forthmann, C. Steinhauer, T. Dammeyer, P. Tinnefeld; Fluorescence and Super-resolution Standards Based on DNA Origami, Nature Methods 9, 12, 1133-1134, 2012.

Department of Traffic and Engineering Psychology

Prof. Dr. Mark Vollrath

Researcher's Career

- Full Professor for Traffic and Engineering Psychology, TU Braunschweig
- Head of Department Human Factors, German Aerospace Center (DLR) Braunschweig
- Habilitation about Alcohol Tolerance at Julius-Maximilans-Universität, Würzburg
- Dissertation on Articulation Pauses in Speech at Julius-Maximilans-Universität, Würzburg
- Study of Psychology at Julius-Maximilans-Universität, Würzburg

Funding

DFG, Bast, BMBF, BMWI, EU, UDV, industry

Contact

Technische Universität Braunschweig
Department of Traffic and Engineering Psychology
Gaußstraße 23
38106 Braunschweig
Phone: +49 531 391-3644
mark.vollrath@tu-braunschweig.de
www.tu-braunschweig.de/psychologie/abt/ingenieur

Background and Aims

Mobility is a core component of life quality. Understanding the mobile human is the most important step towards improving traffic safety and protecting the environment by cycling and walking. This is used for designing and evaluating human-machine-interaction in a human-centered manner.

Research

Psychological models of driver (cyclist, pedestrian) behavior: Perception, attention and situation awareness are the key components of the human information process that governs behavior in general and human error in particular. Additionally, attitudes, motivation and social norms influence dangerous behavior, but also the choice of transportation modes. This research area is concerned with the fundamental psychological processes in mobility.

Information and warning systems: Computer technology provides information that can be used to support the driver and prevent driver errors. However, additional information can always lead to distraction and thus cause new problems. Taking the human information processing resources into account leads to solutions that really improve safety and comfort, with special regard to older and younger drivers.

Driver state: Being able to easily manage the demands of the current traffic situations depends, to a large part, on the driver state. Driving experience and training provide the basic abilities which are then influenced by factors such as fatigue, stress, emotion or distraction. Additionally, driver state may be changed by alcohol, licit or illicit drugs. Research is targeted to detecting the driver's state, evaluating the risk due to different factors, but also developing concepts to manage driver state.

Driver assistance systems and automation: Driver assistance systems can support the driver by taking over parts of the driving task or even completely taking over driving for certain time-periods in special situations. However, this changes the role of the driver fundamentally. How do drivers cope with their new driving situation and how can it be assured that the resulting man-machine-system is safer and more efficient than the old driver-vehicle system? Driving simulator studies are conducted to examine these issues.

Cycling: Severe accidents in urban surroundings often involve cyclists. Risk factors may be risky behaviors like cycling in the wrong direction, cycling with alcohol or without lights. However, very few studies really analyze this in such detail that adequate countermeasures can be developed. A cycling simulator as well as observation studies facilitate examination of these topics.

Publications

- Vollrath, M. (2015). Ingenieurpsychologie. Psychologische Grundlagen und Anwendungsgebiete (Grundriss der Psychologie Band 30). Stuttgart: Kohlhammer.
- Beller, J., Heesen, M., & Vollrath, M. (2013). Improving the driver-automation interaction: An approach using automation uncertainty. Human Factors, 55(6), 1130–1141.
- Muhrer, E., Reinprecht, K. & Vollrath, M. (2012). Driving with a partially autonomous forward collision warning system: how do drivers react? Human Factors, 54(5), 698-708.
- Werneke, J. & Vollrath, M. (2013). How to present collision warnings at intersections? – A comparison of different approaches. Accident Analysis and Prevention, 52, 91-99.
- Winkler, S., Werneke, J. & Vollrath, M. (2016). Timing of early warning stages in a multi stage collision warning system: Drivers' evaluation depending on situational influences. Transportation Research Part F, 36, 57-68.

Department of the History of Sciences and Pharmacy

Prof. Dr. med. Bettina Wahrig

- Head of the Division for the History of Science and Pharmacy at Technische Universität Braunschweig

Researcher's Career

- Studied medicine and philosophy in Mainz and Marburg
- PhD in Marburg in 1984
- Free-lance cooperation with the editor of the critical edition of Nietzsche's works in Florence
- Researcher and senior researcher at the Institute for the History of Medicine in Lübeck
- Habilitation at University of Lübeck
- Holds the chair for the history of science and pharmacy since 1997
- Guest researcher at the Max Planck-Institute für the History of Science in Berlin and at the University of Strasbourg
- President of the Gesellschaft für Wissenschaftsgeschichte (2008-2013)
- President of the National Committee of the International Union for History and Philosophy of Science and Technology (2005-2014)
- Member of the standing committee of the Deutsche Forschungsgemeinschaft (2008-2016)

Funding
DFG, MWK

Contact
Technische Universität Braunschweig
Department of the history of science
and pharmacy
Beethovenstraße 55
38106 Braunschweig
Phone: +49 531 391-5990
b.wahrig@tu-braunschweig.de
www.tu-braunschweig.de/pharmaziegeschichte

Mission Statement

We interpret the dynamics of knowledge and science in a historical and cultural context. History is not about the lonesome (male) hero discovering eternal truths. Instead we ask: How have the dynamics of the living body and the effects of pharmaceuticals been explained in a gender and cross-cultural perspective?

Research

History of precarious substances in the life sciences: This is about the histories of dangerous, highly effective and ambiguous substances, e.g. pharmaceuticals, poisons, food additives. In the course of its history a precarious substance may migrate across different fields of research and application. Cooperators have been Viola Balz (now Dresden), Alexander von Schwerin (now Berlin), Heiko Stoff (now Hannover), Florence Vienne and myself, focusing on the history of hormones, enzymes and vitamins, of radioactivity research within life sciences, of the history of mutagens and food additives, and the history of the first neuroleptics in the 20th century. We have also looked into the concepts and the forms of "biologics" in the 20th century and the political history of the cell.

Poisons and poisonings in the history of science, literature and film: In a cooperative project with the film historian Heike Klippel (HBK Braunschweig), we explore the motives, narratives, and interdiscourses concerning poisoning. In my department, the emphasis is on the history of the understanding of the nature of poisons, on experimental practices concerning the effects and the proof procedures for poisons, and on medical and court cases, casting some glances on the mutual influence between science and fiction in the long 19th century. Our research questions concern longue durée aspects of motives and narratives around poisons and poisonings, especially in the perspective of gender studies.

Drugs and gender: In a cooperative project with Ljiljana Verner (Hannover), we explore the interrelations between gendered concepts of drug effects, drug policies, consumer attitudes and gender stereotypes within the drug market of today.

Material cultures of knowledge: German/Taiwanese research on the history of material cultures in the perspective of comparison and of cultural exchange. Topics are the history of drugs, gender relations, natural history, the history of humanities, health care systems around 1900, and colonialism.

Aerugo (Grünspan). Specimen from the "Arzneimittelhistorische Sammlung Schneider"(the division's collection of ca. 1000 historical medicinal substances

Publications

- Schwerin, Alexander von; Stoff, Heiko; Wahrig, Bettina (Hg.) (2013): Biologics. A History of Agents Made From Living Organisms in the Twentieth Century. London: Pickering & Chatto .
- Wahrig, Bettina (2015): Eigenes und Fremdes: Paolo Mantegazza und die Geburt der europäischen Coca, in: Polubojarinova, Larissa et al. (Hg.): Phänomenologie, Geschichte und Anthropologie des Reisens. Kiel, pp. 208-220.
- Wahrig-Burfeind, Renate; Wahrig, Bettina (2014): Der Lexikograf Gerhard Wahrig – Systemgrenzen und Ressourcen: Zur Entstehung seines Projekts "Wörterbuch als Datenbank", in: Ber. Wissenschaftsgesch. 37, pp. 263-286.
- Wahrig, Bettina (2014): Zeit der Aufklärung: Instrumente und Hände in der Geburtshilfe des 18. und frühen 19. Jahrhunderts, in: Stauf, Renate et al. (Hg.): Wechselwirkungen. Die Herausforderung der Künste durch die Wissenschaften. Heidelberg, pp. 99-111.
- Wahrig, Bettina (2013): Clocks with Hands: Instruments, Hands and Parturients in a Changing Horizon of Time, in: History and Philosophy of the Life Sciences 35, pp. 62–67.

Institute for Physical and Theoretical Chemistry – Biophysical Chemistry

Prof. Dr. Peter J. Walla

Researcher's Career

- Associate Professor for Chemistry, University of Braunschweig.
- Head of Research Group, Max-Planck-Institute for Biophysical Chemistry, Göttingen.
- Assistant Professor for Chemistry, University of Braunschweig.
- Head of Department Optics Detection, DIREVO Biotech AG, Cologne, Germany.
- Emmy-Noether Award, German Science Foundation.
- Postdoc, University of California at Berkeley, USA.
- Dr. rer. nat. University of Göttingen and Max-Planck-Institute for Biophysical Chemistry, Göttingen.
- Studies of Chemistry, Universities of Heidelberg and Göttingen.

Funding

DFG, Fonds der chemischen Industrie

Contact

Technische Universität Braunschweig
Institute for Physical and Theoretical Chemistry – RG Biophysical Chemistry
Hans-Sommerstraße 10
38106 Braunschweig
Phone: +49 531 391-5328
p.walla@tu-braunschweig.de
www.pci.tu-bs.de/agwalla/en/

Mission Statement

Sustainable energy supply is rapidly becoming one of the most critical issues for upcoming decades. We explore in detail the very efficient photophysical molecular mechanisms by which nature harvests solar energy and develop concepts for artificial light-harvesting and energy converting devices using state-of-the art laser- and microscope technology.

Research

Solar light-harvesting and energy conversion: Nature has achieved remarkable efficiency in harvesting photons (the smallest units of light), transferring their excitation energy in an energy-funnel-like manner to reaction centres and converting it into electrical energy through charge separation (Fig .1). In low light conditions the efficiency by which photons are converted into charge separation is close to unity. To achieve this extremely high efficiency the individual energy transfer steps in nature occur on ultrafast timescales that are faster than the molecular conversion into heat.

State-of-the art laser- and microscope technology: These processes occur on a femtosecond (10^{-15} s) timescale and can only be observed with modern laser technology as even the fastest electronic devices can only detect processes being several orders of magnitude slower. We explore the natural photophysical light-harvesting, energy transfer, energy conversion mechanisms and the regulation of the energy flow in detail and try to use this knowledge to construct artificial devices that make similar mechanisms available for utilization in artificially engineered solar light-harvesting and energy converters. To unveil and develop these mechanisms we use the latest state-of-the-art laser as well as microscope technology (Fig.2).

Exploring communication between nervecells: The same tools are also used to unveil other important biomolecular and biological questions in close collaboration with biologically oriented groups. An important focus is on neurobiologcal questions such as the molecular mechanisms by which the fast signal transmission between nerve cells occurs (Fig. 3) or how changes in nerve cells enable memory.

Figure 1: Nature is remarkably efficient in harvesting solar energy.

Figure 2: Using state-of-the art spectroscopy and microscopy we investigate the underlying processes of light harvesting and engineer artifical light-harvesting devices.

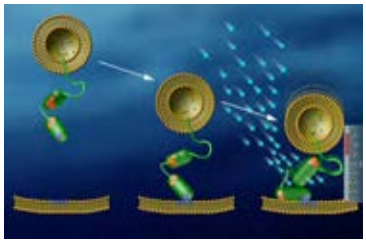


Figure 3: The same tools are also used in other projects exploring, for example, the proteins that trigger nerve cell communication.

Publications

- C.-C. Lin, J. Seikowski, A. Pérez-Lara, R. Jahn, C. Höbartner, P. J. Walla, "Control of membrane gaps by synaptotagmin-Ca^{2+} measured with a novel membrane distance ruler", Nature Commu., 5, 5859 (2014).
- P.-J. Walla, C.-P. Holleboom, G. R. Fleming, "Electronic Carotenoid-Chlorophyll Interactions Regulating Photosynthetic Light Harvesting of Higher Plants and Green Algae", in: Demmig-Adams B., Adams W. W. III, Garab G., Govindjee (eds.), Vol. 40 Series: Advances in Photosynthesis and Respiration, 40, 229-243 (2014).
- P. J. Walla, "Modern Biophysical Chemistry, 2nd Edition", Wiley-VCH (2014).
- L. Wilk, M. Grunwald, P.-N. Liao, P. J. Walla, W. Kühlbrandt, "Direct interaction of the major light-harvesting complex II and PsbS in nonphotochemical quenching", PNAS, 110, 5452-5456 (2013).
- J. M. Hernandez, A. Stein, E. Behrmann, D. Riedel, A. Cypionka, Z. Farsi, P. J. Walla, S. Raunser and R. Jahn, "Membrane Fusion Intermediates via Directional and Full Assembly of the SNARE Complex", Science, 336, 1581-1584 (2012).

Institute of Medicinal and Pharmaceutical Chemistry

Prof. Dr. Hermann Wätzig

Researcher's Career

- Appointment to the Scientific Board of CE Pharm
- Appointment to the Scientific Board of DPhG
- Appointment to the Scientific Board of ISEAC
- Public appointment to member of the European Pharmacopoeial Commission Expert Group
- Public appointment to member of the Pharmacopoeial Commission of the Federal Institute of Pharmaceuticals and Medicinal Products (BfArM), board of pharmaceutical chemistry
- Editorial Board Member of the journal Electrophoresis

Funding

Pharmaceutical industry, analytical instrument industry

Contact

Technische Universität Braunschweig
Institute for Medicinal and Pharmaceutical Chemistry
Beethovenstraße 55
38106 Braunschweig
h.waetzig@tu-braunschweig.de
www.tu-braunschweig.de/pharmchem/forschung/waetzig/index.html

Mission Statement

Quality of pharmaceuticals means quality of analytical research in the first place. This particularly includes the thorough characterization of biopharmaceuticals and setting quality standards in drug screening.

Research

In close collaboration with pharmaceutical companies and national as well as European competent authorities we work on analytical topics, emphasizing separation techniques, protein and proteome analysis, quality assurance of biotechnically produced pharmaceuticals and statistical issues from quality control.

Hence we employ capillary and gel electrophoresis (CE and SDS-PAGE, 2-DE), HPLC and mass spectrometry, we develop strategies to economically qualify analytical instrumentation, we optimize and validate methods, especially in order to improve precision and accuracy. We have recently achieved percental relative standard deviations RSD% of approximately 1 to 2% for various analytical applications of chromatography in bioanalysis (SEC, SAX, RP-LC), further we have obtained similar numbers even for gel electrophoresis.

We work out concepts for how to set specifications and how to use statistical process control (SPC) with the goal of facilitating the parametric release. Moreover trend test, data evaluation related to method transfers and outlier detection are related to this branch.

One recent research topic deals with affinity capillary electrophoresis (ACE). This is an efficient and precise possibility for studying interactions in solutions. We use this approach to investigate specific interactions of proteins with, for example, metal ions or anions from organic acids. In this way we also like to better understand how proteins influence their direct environment and how this is related to various mechanisms of biochemical regulation and to the efficacy of pharmaceuticals.

Publications and Patents

- Deeb, Sami El; Wätzig, Hermann; El-Hady, Deia Abd; AlBishri, Hassan M.; de Griend, Cari Sänger-van; Scriba, Gerhard K E (2014): Recent advances in capillary electrophoretic migration techniques for pharmaceutical analysis. In: Electrophoresis 35 (1), S. 170-189. DOI: 10.1002/elps.201300411.
- Deeb, Sami El; Wätzig, Hermann; El-Hady, Deia Abd (2013): Capillary electrophoresis to investigate biopharmaceuticals and pharmaceutically-relevant binding properties. In: TrAC Trends in Analytical Chemistry 48, S. 112-131. DOI: 10.1016/j.trac.2013.04.005.
- Grotefend, Sandra; Kaminski, Lukas; Wroblewitz, Stefanie; Deeb, Sami El; Kühn, Nancy; Reichl, Stephan et al. (2012): Protein quantitation using various modes of high performance liquid chromatography. In: Journal of pharmaceutical and biomedical analysis 71, S. 127-138. DOI: 10.1016/j.jpba.2012.08.024.
- El-Hady, Deia; Kühne, Sascha; El-Maali, Nagwa; Wätzig, Hermann (2010): Precision in affinity capillary electrophoresis for drug-protein binding studies. In: Journal of pharmaceutical and biomedical analysis 52 (2), S. 232-241. DOI: 10.1016/j.jpba.2009.12.022.1234. DOI: 10.1021/pr700589s.

Institute of Organic Chemistry

Prof. Dr. Daniel B. Werz

Researcher's Career

- Associate Professor of Organic Chemistry at TU Braunschweig
- Deputy Full Professor of Organic Chemistry at University of Göttingen
- Emmy Noether Junior Research Group Leader at the University of Göttingen
- Postdoc at ETH Zurich, Switzerland
- Dr. rer. nat. at the University of Heidelberg
- Studies of Chemistry (Diploma) at the Universities of Heidelberg and Bristol, UK

Funding
DFG, AvH, DAAD, State Lower Saxony, Fonds der Chemischen Industrie, EU (ERC Consolidator Grant)

Contact
Technische Universität Braunschweig
Institute of Organic Chemistry
Hagenring 30
38106 Braunschweig
Phone: +49 531 391-5266
d.werz@tu-braunschweig.de
www.werzlab.de

Mission Statement

State of the art organic chemical research is performed, developing novel synthetic and catalytic methods for the efficient and elegant preparation of simple and complex organic molecules.

Research

Donor-Acceptor Cyclopropanes and Cyclobutanes: The weak bond between vicinal donors and acceptors in a cyclopropane or a cyclobutane paves the way for a plethora of unusual reactions leading to aliphatic and aromatic heterocycles under mild and efficient conditions.

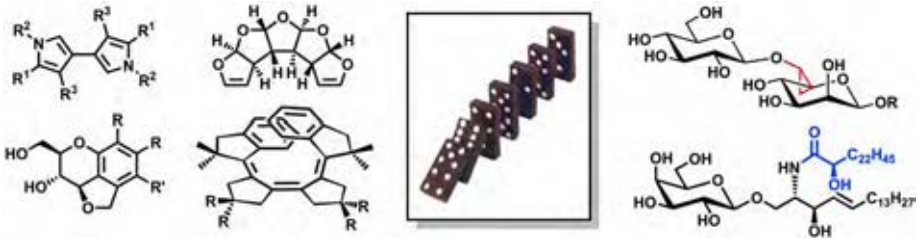
Pd-Catalyzed Reactions: Pd acts as one of the most versatile metals for catalysis. Novel reaction types using this metal and specific ligands are developed.

Domino Cascades: Transformations that involve several bond-forming or bond-breaking steps are designed to build up great molecular complexity in a single step. Such procedures are not only appealing in terms of chemical creativity, but do also save waste, time and energy.

Bacterial Carbohydrates and Glycolipids: Unusual bacterial monosaccharides are synthesized and incorporated into more complex glycans. In the framework of SFB 803 defined mammalian glycolipids with distinct fatty acids are prepared to elucidate their effect on the membrane dynamics etc.

Carbohydrate Mimics: Slight differences in the structure of carbohydrates (which need to be synthesized) will provide improved properties or pave the way to decipher enzymatic reactions.

Novel Fluorophores: Novel scaffolds based on heterocyclic chemistry for the preparation of near-infrared fluorophores are designed and synthesized.



Typical molecules synthesized in the Werz lab by cyclopropane chemistry and domino reactions (left) and glycolipids and carbohydrate mimics (right).

Publications

- Pawliczek, M., Schneider, T. F., Maaß, C., Stalke, D., Werz, D. B. (2015) Formal anti-Carbopalladation Reactions of Non-Activated Alkynes: Requirements, Mechanistic Insights and Applications. Angew. Chem. Int. Ed. 54: 4119-4123.
- Milde, B., Leibeling, M., Pawliczek, M., Grunenberg, J., Jones, P. G., Werz, D. B. (2015) π-Helicenes Truncated to a Minimum: Access Through a Domino Approach Involving Multiple Carbopalladations and a Stille Coupling. Angew. Chem. Int. Ed. 54:1331-1335.
- Schütte, O. M., Ries, A., Orth, A., Patalag, L. J., Römer, W., Steinem, C., Werz, D. B. (2014) Influence of Gb3 glycosphingolipids differing in their fatty acid chain on the phase behaviour of solid supported membranes: Chemical syntheses and impact of Shiga toxin binding. Chem. Sci. 5: 3104-3114.
- Kaschel, J., Schneider, T. F., Kratzert, D., Stalke, D., Werz, D. B. (2012) Domino Reactions of Donor-Acceptor-Substituted Cyclopropanes for the Synthesis of 3,3'-Linked Oligopyrroles and Pyrrolo [3,2-e] indoles. Angew. Chem. Int. Ed. 51: 11153-11156.
- Leibeling, M., Koester, D. C., Pawliczek, M., Schild, S. C., Werz, D. B. (2010) Domino access to highly substituted chromans and isochromans from carbohydrates. Nature Chem. Biol. 6: 199-201.

Institute of Food Chemistry

Prof. Dr. Peter Winterhalter

Researcher's Career
- Full Professor for Food Chemistry, TU Braunschweig
- Associate Professor for Food Chemistry, University Erlangen-Nürnberg
- Scientific Assistant at Würzburg University
- Postdoctoral fellow at the Australian Wine Research Institute, Adelaide
- Dr. rer. nat. at Würzburg University, Institute of Food Chemistry
- Practical year for food chemist
- Study of Food Chemistry at Karlsruhe University

Funding
BMBF, BMWi, DAAD, Industry

Contact
Technische Universität Braunschweig
Institute of Food Chemistry
Schleinitzstraße 20
38106 Braunschweig
Phone: +49 531 391-7200
p.winterhalter@tu-braunschweig.de
www.tu-braunschweig.de/ilc

Mission Statement

Isolation and identification of bio-active natural compounds using a broad spectrum of analytical methods including preparative countercurrent chromatography and structural elucidation by modern spectroscopic and spectrometric techniques

Research

Development of preparative separation systems: Analysis of complex natural extracts requires preparative separation techniques. We mainly focus on all-liquid countercurrent chromatographic separation systems, such as High Speed Countercurrent Chromatography, Low Speed Rotary Countercurrent Chromatography (LSRCCC) as well as Spiral-Coil LSRCCC for separations in a scale up to 100 g; separation of biopolymers is achieved by Centrifugal Precipitation Chromatography).

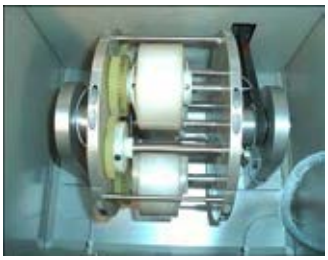
Bioactive compounds in fruits and vegetables: including anthocyanins, proanthocyanidins, stilbenes, lignans, isoflavones, glucosinolates: structural elucidation and biological activity (e.g. antioxidant, antidiabetic, anticancer).

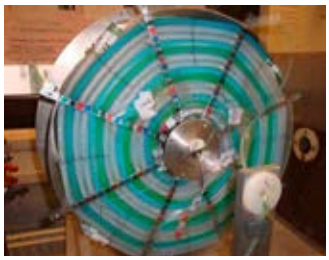
Analysis of wine and fruit juices: antioxidative compounds in red and white wines, "French Paradox", structural elucidation, biological screening; pigments in red wine, stability, contribution to color; authenticity; aging of wine and fruit juices, indicators for aging, influence of climatic change.

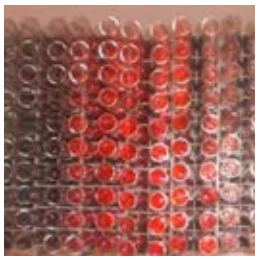
Aroma compounds in fruits and wine: pathways of formation, precursors, sensory contribution, application of precursors for the aromatization of convenience food.

Carotenoids and carotenoid metabolites: structural elucidation, pathways of formation, isolation and characterization of carotenases

Bioactives from side streams of the food industry: isolation and structural characterization, bioactivity and application in functional food.







Publications

- A. Murata, R. Akaike, T. Kawahashi, R. Tsuchiya, H. Takemoto, T. Ohnishi, Y. Todoroki, N. Mase, M. Yokoyama, K. Takagi, P. Winterhalter, N. Watanabe. Characterization of flower-inducing compound in Lemna paucicostata exposed to drought stress. Tetrahedron 70, 4969-4976 (2014).
- J. B. Althaus, G. Jerz, P. Winterhalter, M. Kaiser, R. Brun, T. J. Schmidt. Antiprotozoal activity of Buxus sempervirens and activity-guided isolation of O-tigloylcycloviro-buxeine-B as the main constituent active against Plasmodium falciparum. Molecules 19, 6184-6201 (2014).
- T. Esatbeyoglu, A. Juadjur, V. Wray, P. Winterhalter. Semisynthetic preparation and isolation of dimeric procyanidins B1-B8 from roasted hazelnut skins (Corylus avellana L.) on a large scale using countercurrent chromatography. J. Agric. Food Chem. 62, 7101-7110 (2014).
- T. Esatbeyoglu, V. Wray, P. Winterhalter. Isolation of dimeric, trimeric, tetrameric and pentameric procyanidins from unroasted cocoa beans (Theobroma cacao L.) using countercurrent chromatography. Food Chem. 179, 278-289 (2015).
- I. Mädge, L. Cramer, I. Rahaus, G. Jerz, P. Winterhalter, T. Beuerle. Pyrrolizidine alkaloids in herbal teas for infants, pregnant or lactating women. Food Chem. 187, 491-498 (2015).

Institute of Pharmaceutical Biology

Prof. Dr. Ute Wittstock

Researcher's Career
- Full Professor for Pharmaceutical Biology at the TU Braunschweig
- Project group leader at Max-Planck Institute for Chemical Ecology, Jena
- Postdoc at Plant Biochemistry Laboratory, Royal Veterinary and Agricultural University Frederiksberg, Copenhagen, Denmark
- Dr. rer. nat. at Ernst-Moritz-Arndt-Universität Greifswald, Institute of Pharmacy
- Study of Pharmacy, Greifswald

Funding
DFG, State Lower Saxony, industry

Contact
Technische Universität Braunschweig
Institute of Pharmaceutical Biology
Mendelssohnstraße 1
38106 Braunschweig
phone: +49 531 391-5681
u.wittstock@tu-braunschweig.de
www.tu-braunschweig.de/pharmbiol/

Mission Statement

To gain insight into the biosynthesis and ecological roles of plant specialized metabolites, to understand how their structural diversity has been generated during evolution, and to provide a basis for their biotechnological production and application in medicine and agriculture.

Research

Biochemistry and evolution of biosynthetic enzymes of plant specialized metabolism: We have identified different types of specifier proteins which determine structural diversity of bioactive compounds derived from glucosinolates, a class of thioglucosides found in important food crops of the crucifers and related plant families. Our current focus is the elucidation of biochemical mechanisms of specifier proteins and of the structural elements which determine their specificity.

Regulation and roles of glucosinolate breakdown in plants: Using Arabidopsis as a model plant, we study the regulation of the glucosinolate breakdown machinery and its roles in growth and development as well as plant defense against biotic and abiotic stresses.

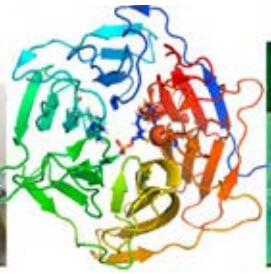
Insect adaptations to plant chemical defenses: We use the interaction between glucosinolate-containing plants and major insect pests such as the cabbage white butterfly as an example for studying how insect herbivores overcome chemical defenses produced by plants. Based on our discovery of the principal biochemical mechanism used by Pierid larvae to circumvent detrimental effects of glucosinolate breakdown products, we study the insect detoxification machinery in an evolutionary context.

Production platforms for plant specialized metabolites: In the framework of the Center for Pharmaceutical Engineering (PVZ), we establish plant-based systems for biotechnological production of plant specialized metabolites.

Pharmaceutical analytics of plant-based drugs: We collaborate with pharmaceutical companies to develop analytical techniques for quality assessment of herbal drugs and products.

Cabbage white larva

Plant cell suspension culture for metabolite production



Specifier protein crystal structure

Tropaeolum majus used as antiinfective

Publications

- Ohlen Mv, Herfurth A-M, Kerbstadt H, Wittstock U (2016) Cyanide detoxification in an insect herbivore: Molecular identification of β-cyanoalanine synthases from *Pieris rapae*. Insect Biochem Mol Biol 70:99-110
- Gumz F, Krausze J, Eisenschmidt D, Backenköhler A, Barleben L, Brandt W, Wittstock U (2015) The crystal structure of the thiocyanate-forming protein from *Thlaspi arvense*, a kelch protein involved in glucosinolate breakdown. Plant Mol Biol 89:67-81
- Kuchernig J-C, Burow M, Wittstock U (2012) Evolution of specifier proteins in glucosinolate-containing plants. BMC Evol Biol 12:127 (doi: 10.1186/1471-2148-12-127)
- Stauber EJ, Kuczka P, Ohlen Mv, Vogt B, Janowitz T, Piotrowski M, Beuerle T, Wittstock U (2012) Turning the 'mustard oil bomb' into a 'cyanide bomb': aromatic glucosinolate metabolism in a specialist insect herbivore. PLoS ONE 7(4):e35545
- Wittstock U, Burow M (2010) Glucosinolate breakdown in Arabidopsis - mechanism, regulation and biological significance. In: The Arabidopsis Book, Last R et al. (eds) (http://www.aspb.org/publications/arabidopsis/). The American Society of Plant Biologists.

3

Architecture
Civil Engineering
Environmental Engineering

Institute of Geoecology

Prof. Dr. Harald Biester

Researcher's Career

- Professor for Environmental Geochemistry
- Assistant Professor, Environmental Geochemistry, University of Heidelberg
- Post-Doc, Environmental Geochemistry, University of Heidelberg
- Habilitation, Geology, Mineralogy, University of Heidelberg
- Dr. rer.nat. University of Heidelberg
- Study of Geology, University of Heidelberg and University of Freiburg

Funding

DFG, State Lower Saxony, State Baden-Württemberg, industry

Contact

Technische Universität Braunschweig
Institute of Geoecology
Langer Kamp 19c
38106 Braunschweig
Phone: +49 531 391-7240
h.biester@tu-bs.de
www.tu-braunschweig.de/geooekologie/abteilungen/geochemie

Mission Statement

Estimating anthropogenic contributions to biogeochemical cycling of trace elements and pollutants is based on profound knowledge of biogeochemical processes and interactions in entire ecosystems.

Research

Biogeochemical Cycles: We investigate coupling of trace element and organic matter cycling on a micro- to ecosystem scale. Main emphasis is the understanding of processes of trace element organic matter interactions and their coupling to hydrological and climatic drivers, which both control release of trace element and carbon from soils to aquatic systems. Currently, we study the release of dissolved organic matter associated lead and arsenic from wetlands to drinking water reservoirs.

Geochemical Archives and Formation of Environmental Signals: We conduct several projects on the formation of environmental signals based on biogeochemical proxies. We are interested in understanding what geochemical signals indicate and how they are preserved in geo-archives such as peat bogs and lake sediments. We apply multi-element analytical methods including organic matter characterization and multivariate statistics.

Mercury Speciation and Risk Assessment: We have developed analytical methods which allow speciation of mercury phases and species in all kinds of solid matter such as soils, sediments and mining residues. We apply these methods in combination with geochemical modeling to several mercury contaminated sites worldwide for risk assessment and remediation strategies.

Remediation of Mercury Contaminated Sites: We investigate mercury contaminated sites and develop methods to stabilize or remove mercury from polluted soils or groundwater. Our current emphasis is on the species – based development and application of filtering materials for removal of mercury from contaminated groundwater and on species transformation processes which reduce mercury mobility in soils and groundwater.

Filtration experiments to remove mercury from contaminated groundwater by means of amalgamation on brass.

Investigation of particle-bound mercury transport in mercury mining areas (Idrija, Slovenia)

Studies on the release of heavy metal by dissolved organic matter from peatlands (Harz, Germany).

Publications

- Richard, J-H., Bischoff, C., Ahrens, C.G.M., Biester, H. (2016) Mercury (II) reduction and co-precipitation of metallic mercury on hydrous ferric oxide in contaminated groundwater (Article). STOTEN, 539, 36-44.
- Broder, T, Biester, H. (2015) Hydrologic controls on DOC, As and Pb export from a polluted peatland-the importance of heavy rain events, antecedent moisture conditions and hydrological connectivity. Biogeosciences, 12(15), 4651-4664.
- Biester, Y.-M., H., Knorr, K.-H., Schellekens, J., Basler, A., Hermanns, H. (2014) Comparison of different methods to determine the degree of peat decomposition in peat bogs. Biogeosciences 11, 2691-2707.
- Riedel, T., T., Zak, D., Biester, H., Dittmar. (2013) Iron traps terrestrially derived dissolved organic matter at redox interfaces. PNAS 110, 10101-10105.
- Hermanns, H., Y.-M., Biester. A 17,300-year record of mercury accumulation in a pristine lake in southern Chile. Journal of Paleolimnology 49, 547-561 (2013).

Institute of Urban Design

Prof. Uwe Brederlau

- CEO, TU Braunschweig, Department Architecture, Institute of Urban Design
- Chair, Johannes Göderitz Foundation
- Member of the Deutsche Akademie für Städtebau und Landesplanung (DASL)
- Member of the Deutscher Werkbund (DWB)

Researcher's Career

- Office BREDERLAU + HOLIK, Architecture and Urban Design, Braunschweig
- Full Professor for Urban Design, Technische Universität Braunschweig, since 2000
- Urban Planner, Chamber of Architects of Lower Saxony (Federal Republic of Germany)
- Architect, Chamber of Architects of Lower Saxony (Federal Republic of Germany)
- Assistant Professor at the Institut für Städtebau, Wohnungswesen und Landesplanung, Leibniz Universität Hannover
- Office of Urban Design and Architecture, 1993-2010, Hannover
- Meisterschüler at the Hochschule für Bildende Künste (HBK) Braunschweig
- Study of Architecture, degree Dipl.-Ing., at the Leibniz Universität Hannover

Funding
BMWi, DBU, BMBF

Contact
Technische Universität Braunschweig
Institute of Urban Design (ISE)
Pockelsstraße 3
38106 Braunschweig
Phone: +49 531 391-3538
ise@tu-bs.de
www.tu-braunschweig-ise.de

Mission Statement

The city of the future – how shall we live? How will the city of tomorrow be characterized and shaped by urban spaces, technologies and social developments? In this context, the question of designing our new urban spaces is more important than ever before. It is not just a social, economic, energetic and ecological necessity – it is our passion as well. In this context the goal of our research is that the city of the future will become the city we dream of.

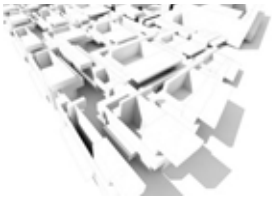
Research

"Zukunftsstadt" – The City of the Future: The Professorship of Urban Design by Univ. Prof. Uwe Brederlau is in charge of researching and testing strategies and concepts for sustainable city development, and examining current, theme-based individual aspects in terms of future town and settlement structures. Urban planning is considered to be a diverse, multidimensional and dynamic design process projected onto the future.

Sustainable Urban Design: Topics are the European contemporary city, development of urban agglomerations of international level as well as urban public spaces and countryside as a whole. This includes in particular research of urban processes and the sustainable parameters of city and settlement development. The present challenge is to approximate a future sustainable and, at best, CO_2-neutral city in an appropriately aesthetic manner.

Urbanism and Design Methods: In terms of conceptual, urban design, the creation of contemporary, urban development and transformation processes thus forms the basis of the potential design of cities. When designing urban areas, the main focus is on the experimental city planning designs, in conjunction with analog as well as digital simulation and drafting methods.

Parametric Design Processes: A particular motivation is to expand the available design methods in urban planning to parametric design processes. The opportunity of rule-based designing consists of both refining the design capability within the complexity of urban systems as well as optimizing action and intervention. This approach is especially interesting if, instead of a conventional master plan, which establishes a future development, a dynamic urban structure should be developed which is able to respond to future growth and / or shrinking processes as well as to climatic requirements.



Publications

- Brederlau, U., Jureit, A., Lubahn, S., Nestler, J. (2015): CAMPUS+STADT: Analysen, Strategien und Szenarien für die stadträumliche Entwicklung der Technischen Universität Braunschweig. ISBN 9783981735505. Braunschweig: Oedingprint GmbH.
- Brederlau, U., Jureit, A., Lubahn, S., Nestler, J. (2015). Schwerpunktthema Städtebau. In: TU Braunschweig (Hrsg.), EnEff:Campus: blueMAP TU Braunschweig: Integraler energetischer Masterplan TU Braunschweig 2020/2050. www.tu-braunschweig.de/MedienDB/igs/EnEff_Campus/booklet.pdf.
- Brederlau, U., Holik, F., Lubahn, S. (2011). Concept: Urban Visions for China. German – ChineseStudent Competition. ISBN 9783941737525.
- Brederlau, U. (2011). Parametric Design Processes in Urbanism. In: Tomas Valena with Tom Avermate and Georg Vrachliotis (Hrsg.), Structuralism Reloaded – RuleBased Design in Architecture & Urbanism. ISBN 9783936681475.Verlag Edition Axel Menges.
- Brederlau, U. (2006). Dream City – oder Städtebau und konzeptionelles Entwerfen. In: Eberhard Eckerle und Joachim WolschkeBulmahn (Hrsg.), Landschaft – ArchitekturKunst – Design. ISBN 3899750764.

Institute of Building Materials, Concrete Construction and Fire Protection – Division of Building Materials

Prof. Dr.-Ing. Harald Budelmann

Researcher's Career

- Full Professor for Building Materials and Concrete Structures, TU Braunschweig
- Executive Director of the Materials Testing Institute of TU Braunschweig
- Member of the Senate of DFG
- Member of the Berlin-Brandenburg Academy of Sciences

- Full Professor for Building Materials, University Kassel
- Professor for Building Materials, Technical College Bremen
- Doctorate Dr.-Ing, TU Braunschweig
- Studies of Civil Engineering, TU Braunschweig

Funding

DFG, BMBF, AIF, EU, State Lower Saxony, Industry

Contact

Technische Universität Braunschweig
Institute of Building Materials,
Concrete Construction and Fire Protection
Division of Building Materials
Beethovenstraße 52
38106 Braunschweig
Phone: +49 531 391-5405
h.budelmann@ibmb.tu-bs.de
www.ibmb.tu-braunschweig.de

Mission Statement

Any civil engineering structure needs well-suited materials to fulfill their diverse demands throughout their entire service life. Our mission is the development, testing and modeling of building materials with special emphasis on mineral materials, including production, processing, application to structures and structural behavior.

Research

Concrete hardening: Heat release and degree of hydration, fields of temperature distribution, deformation and restraint, mechanical properties of young concrete, consulting of sites, measurements, calculations, num. simulation of hydration, structural development, humidity distribution, cracking simulation.

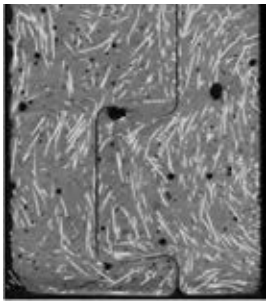
Concrete mixtures, processing, durability: fine aggregates composition, environmentally friendly concrete mixtures, performance – oriented concrete design, concrete rheology, pumping technology of concrete, new processing technologies, aging processes, durability modeling.

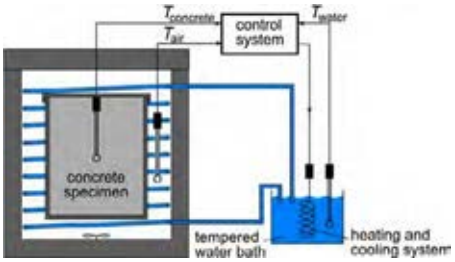
Ultra high performance concrete technology: UHPC composition, processing of UHPC, UHPC with steel fibers, structural application of UHP, directly joined linear and two-dimensional structural elements.

Strengthening of structures: strengthening of concrete structures by external reinforcement with glued carbon fiber plates and fabrics, bond behavior under static and dynamic loading, bond failure mechanisms, bond improvement measures, modeling and calculation of strengthening measures

Long term surface storage of radioactive residues: concept studies for a temporary alternative to final disposal, long term durability of concrete structures, concrete structures behavior under very fast loading.

Monitoring and life cycle management of structures: sensors for corrosion monitoring, magneto elastic stress measurement of tension elements, prediction of structural durability,





Publications

- Budelmann, H.; Dreßler, I.; Wichmann, H.-J.: Corrosion Monitoring of Reinforced Concrete Struc-tures with an Innovative rf-based Sensor. In: Proceedings NDT-CE 2015, International Symposium Non-Destructive Testing in Civil Engineering, 15-17 September 2015 Berlin, S.818-824.
- Leusmann, T.; Budelmann, H.: Geklebte Kohlefaserkunststoffe auf Beton unter schwingender Beanspruchung. In: Bauingenieur, Band 90, Dezember 2015, S.562-566.
- Krauss, H.-W.; Wachsmann, A.; Hermerschmidt, W.; Budelmann, H.; Begemann, C.; Lohaus, L.; Heidmann, M.; Wolter, A.: A new performance-based mix design concept for CO_2-reduced con-crete by the use of local raw materials. In: 14th International Congress on the Chemistry of Cement (ICCC 2015), October 13-16, 2015, Ed.: Caijun Shi and Yan Yao, Beijing, China.
- Lehmberg, S.; Ledderose, L.; Mainka, J.; Budelmann, H.; Kloft, H.: Non-Standard Joints for light-weight modular spatial and shell structures made from UHPFRC. In: Proceedings of the IASS-SLTE 2014 Symposium, 15-19 September 2014, Brasilia, Brasilien, 2014.
- Budelmann, H.; Wachsmann, A.; Holst, A.: Incorporation of Concrete Rehabilitation Measures into Life-Cycle Maintenance. In: Xila Liu; A. H-S. Ang: Proceedings of the 2014 International Conference on Sustainable Development of Critical Infrastructure. May 16-18, 2014, Shanghai, China, ASCE Council on Disaster Risk Management Monograph No. 8, page 141-148.

Institute for Sustainable Urbanism (ISU)

Prof. Dr. Vanessa M. Carlow

Architect and Planner, MAA, BDA

Researcher's Career

- Co-speaker of the research center "Future City"/"Stadt der Zukunft", TU Braunschweig
- CEO of RISU, Research Institute for Sustainable Urbanism, TU Braunschweig
- Scientific board "Social Urban Quarters", Friedrich Ebert Foundation
- Appointed Member of the German Federation of Architects (BDA)
- Advisory Board, Berlin Senate for Urban Development and the Environment (senator Michael Müller)
- Visiting Professor Pennsylvania State University, USA
- Full Professor and Director of the Institute for Sustainable Urbanism (ISU), TU Braunschweig
- Phd at the Royal Danish Academy of Fine Arts Copenhagen, Centre for Planning
- MA Urban Management, Erasmus University Rotterdam, Copenhagen University, Ca Foscari University Venice, Antwerp University, Autonomous University Barcelona
- Study of architecture and urban design at Berlin and Delft University of Technology

Funding

Alexander von Humboldt Foundation, BMBF, DAAD, MWK (Lower Saxony)

Contact

Technische Universität Braunschweig
Institute for Sustainable Urbanism (ISU)
Pockelsstraße 3
38106 Braunschweig
Phone: +49 531 391-3544
v.carlow@tu-braunschweig.de
www.isu.tu-braunschweig.de

Mission Statement

"Sustainable Urbanism." These two words represent the biggest challenge and the biggest hope of our generation. ISU explores, co-designs, engineers, and promotes all strata of sustainable development. ISU is part think-tank, part design laboratory, committed to promoting research and scholarship in an international, inter- and transdisciplinary setting.

Research

Space as Resource: Space has to be considered a valuable and limited resource that must be properly managed and used efficiently to optimal effect, just like other resources of limited supply. As we face what the UN (2006) calls the Urban Age, this idea will become increasingly true and imperative.

City in Society: Cities are where people are and people meet. At the heart of good urban design is public space, accessible and open to multiple users and uses, connecting individuals, functions, and spaces, but increasingly also formats of democratic participation in developing cities and urban regions. Urban design, both formal and process-oriented, has a role in supporting sustainable lifestyles, such as by understanding users' needs, providing environmentally friendly forms of mobility, or by enabling innovative recreational or economic activities.

Impossible Sites: Large, global-scale trends affect the local, urban-scale conditions. What was previously considered an uninhabitable or un-occupiable site, can, through a tilt in macro-political, economic, environmental, or sociological forces, become again possible, and vice versa. These forces produce particular observable and measureable phenomena that affect neighborhoods at the local scale, highlighting the inherent contradictions and excesses of globalization and its neoliberal forces.

Urban-Rural Relations: Where the city stops, the country does not begin. Cities must be considered in a broader context, encompassing their larger footprints. Cities today must thus be managed in a context lager than their compact urban cores and downtown areas, but rather in terms of their hinterlands, water- and waste-sheds, their reaches of networks of transportation and human resources. Likewise, villages are not just remote, rural places, but also providers and consumers of various forms of urban capital. These new dynamics involve processes of proximity and distance between the city and the countryside.

Sustainability Criteria: While the goal of producing socially equitable, ecologically robust, sustainable urban conditions is paramount worldwide, the means to provide them are different. Testing sustainability criteria (City for Everyone, 5-Minute City, Blue-Green and Healthy City, Mixed City, and City of Distinct Identity) in different climatic, geographic, cultural and **economic** backgrounds of fast growing societies and young democracies broadens the toolkit of sustainable development criteria.

Since its founding in 2012, ISU has worked with partners in Africa, Asia, South America, USA, and all over Europe.

Publications

- Carlow VM. (2016). Limits. Space as Resource. Jovis Verlag, Berlin.
- Carlow VM., Hong YW. (2015). Adapting design tools to produce site-specific solutions: three projects (in) Urbanization and Locality: Strengthening Identity and Sustainability by Site-specific Planning and Design. Springer Press.
- Carlow VM. (2015). Growing a City for 1,000,000: Master Plan for the City between the Forest and the Ocean. Senegal. (in) REwater. TU Braunschweig.
- Carlow VM. 2014. Limits Urban Density and Mobility Networks in West Berlin during the Period of Containment. Sustainability 6(10).
- Carlow VM. (2014). London's Green Belt – a sustainable urban landscape? (in) European Council of Landscape Architecture Schools ECLAS (eds.). Specifics. Munich: Jovis Verlag.

Institute of Applied Mechanics

Prof. Dr.-Ing. Laura De Lorenzis

Researcher's Career

- Full Professor for Applied Mechanics, TU Braunschweig
- Associate Professor for Mechanics, Università del Salento, Lecce, Italy
- Alexander von Humboldt Scholar, Leibniz Universität Hannover
- Fulbright Scholar, Massachusetts Institute of Technology, USA
- Visiting Scholar, University of Cape Town, South Africa
- Visiting Scholar, University of Texas at Austin, USA
- Visiting Scholar, Hong Kong Polytechnic University, China
- Visiting Scholar, Chalmers University of Technology, Gothenburg, Sweden
- IIFC Distinguished Young Researcher Award 2012
- RILEM L'Hermite Medal 2011
- AIMETA Junior Prize 2011
- PhD, Università di Lecce, Italy
- M.Sc. in Structural Engineering, University of Missouri - Rolla, USA
- Engineering Degree, Università di Lecce, Italy

Funding

DFG, EU, State Lower Saxony

Contact

Technische Universität Braunschweig
Institute of Applied Mechanics
Bienroder Weg 87
38106 Braunschweig
Phone: +49 0531 391-94351
l.delorenzis@tu-braunschweig.de
www.tu-braunschweig.de/iam

Mission Statement

Our work combines the theoretical formulation, numerical implementation and experimental validation of mechanics models for a broad spectrum of applications, also within interdisciplinary collaborations. Special focus is on fracture and contact mechanics, as well as on innovative multiscale methods and discretization techniques.

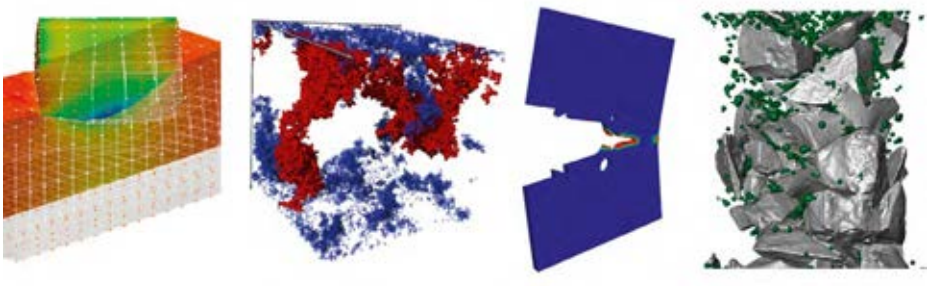
Research

Phase-field modeling of fracture: We develop new formulations and efficient numerical implementation strategies within the phase-field modeling approach to fracture. This variational framework allows for the description of arbitrarily complex crack patterns and evolutions through the solution of partial differential equations on a fixed finite element mesh in 3D. Our aim is to accurately describe fracture phenomena in brittle and ductile materials as well as in porous media.

Isogeometric discretization methods: Within isogeometric analysis, the standard shape functions of the finite element method are replaced by functions stemming from the world of CAD. We develop novel numerical methods exploiting the advantages of isogeometric basis functions, with special focus on non-smooth problems (e.g. contact mechanics) and computational efficiency (isogeometric collocation methods, within the DFG SPP174, for example).

Multiscale modeling techniques: We aim at understanding the behavior of complex heterogeneous materials (within the DFG GrK 2075, cement and concrete, for example) accounting for their features at multiple scales, through a combination of imaging techniques, mechanical modeling and efficient numerical methods. We also develop multiscale models for the behavior of complex interfaces. Within the ERC StG Interfaces, for example, we study rubber friction stemming from hysteretic phenomena at rough surfaces. From the numerical perspective, we focus (within the DFG IRTG Vivace, for example) on non-intrusive coupling and efficient multiscale computing techniques.

Coupled problems: We are interested in the coupling of mechanical behavior with transport phenomena such as diffusion and chemical reactions, to understand, for example, the interaction between cracking and degradation mechanisms of building materials or to describe the fracture behavior of porous media (DFG GrK 2075). We investigate staggered and monolithic solution schemes seeking a compromise between efficiency and robustness.



Publications

- T. Gerasimov, L. De Lorenzis (2016). A line-search assisted monolithic approach for phase-field computing of brittle fracture. Comput. Meth. Appl. Mech. Eng., in press.
- M. Ambati, R. Kruse, L. De Lorenzis (2016). A phase-field model for ductile fracture at finite strains and its experimental verification. Comput. Mech., 57(1): 149-167.
- P. Carrara, L. De Lorenzis (2015). A coupled damage-plasticity model to simulate the cyclic behavior of shear-loaded interfaces. J. Mech. Phys. Solids, 85: 33-53.
- R. Kruse, N. Nguyen-Thanh, L. De Lorenzis, T.J.R. Hughes (2015). Isogeometric collocation for large deformation elasticity and frictional contact problems. Comput. Meth. Appl. Mech. Eng., 296: 73-112.
- C. Maruccio, L. De Lorenzis, L. Persano, D. Pisignano (2015). Computational homogenization of fibrous piezoelectric materials. Comput. Mech., 55(5): 983-998.

Institute of Structural Analysis

Prof. Dr.-Ing. Dieter Dinkler

- Chair of the DFG-Graduiertenkolleg 432 – Fluid-Structure-Interaction
- Chair of the DFG-Graduiertenkolleg 2075 – Modelling of Aging of Materials and Structures

Researcher's Career
- Full Professor for "Statik", Technische Universität Braunschweig
- Full Professor for "Aeroelasticity", Universität Stuttgart
- Habilitation in "Statik", Technische Universität Braunschweig
- Dr.-Ing., Technische Universität Braunschweig
- Studies of Civil Engineering, TU Berlin, TU Braunschweig

Funding
DFG, BMWi

Contact
Technische Universität Braunschweig
Institute of Structural Analysis
Beethovenstraße 51
38106 Braunschweig
Phone: +49 531 391-3667
d.dinkler@tu-braunschweig.de
www.tu-braunschweig.de/statik

Mission Statement

Structural analysis is the basis for all kinds of civil-engineering buildings and infrastructure properties, since it holds true for the computation of the design variables. This includes the understanding of the deformation behavior of structures, the development of modern computational methods for the numerical investigation of structures and the investigation of multiphysical processes, which may rectify instability and degradation of structures.

Research

The design of future buildings and infrastructure properties will be influenced by changing environmental conditions, changing demands of our societies and the permanent development of new materials and life-cycle-engineering concepts.

Structural analysis is responsible for the modelling of all kinds of physical processes, which occur during the life-time of structures. In general, multi-physical processes are modelled by mathematical equations, which are solved by modern numerical discretization techniques. This includes the development and solution of models for initial boundary value problems describing material degradation during the long-term deformation phenomena with respect to ordinary and unscheduled effects on structures and the interaction of different physical and chemical processes on different fields.

Modelling of material behavior
Degradation of concrete. Concrete under high temperature. Low cycle fatigue and damage behavior of metals. Visco-plastic deformation behavior of asphalt. Aging of civil engineering materials and structures. Life-cycle assessment.

Investigation of structural behavior
Buckling of shells. Aeroelastic instabilities in fluid-structure-interaction phenomena. Dynamics of structures.

Particle dynamics
Modelling of the deformation behavior of solids and granular media by means of the Discrete Element Method (DEM). Thermo-elastic deformation behavior of porous media. Modelling of landsliding and silo emptying processes.

Discretization methods for initial boundary value problems
Development and application of the Finite Element Method (FEM) to multiphysical processes in the field of volume – coupled and surface – coupled field equations.

Renewable energy
Development of highly-sophisticated water wheels. Development and design of water wheels. *In-situ* measurements. Optimization of shape and performance with respect to efficiency and durability.

Publications

- I. Krukow and D. Dinkler. Flutter of circulation – controlled wings. CEAS Aeronautical Journal, 6(4):589-598, 2015.[DOI]
- F. Cramer, U. Kowalsky, and D. Dinkler. Coupled chemical and mechanical processes in concrete structures with respect to aging. Coupled systems mechanics, 3:53-71, March 2014. [DOI]
- U. Kowalsky, S. Bente, and D. Dinkler. Modeling of coupled THMC processes in porous media. Coupled systems mechanics, 3:27-52, March 2014. [DOI]
- L. Ostermann and D. Dinkler. Modelling and numerical simulation of concrete structures subjected to high temperatures. Coupled systems mechanics, 3:73-88, March 2014. [DOI]
- Ian Krukow and Dieter Dinkler. A reduced-order model for the investigation of the aeroelasticity of circulation-controlled wings. CEAS Aeronautical Journal, 5(2):145-156, 2014. [DOI]

Leichtweiß Institute (LWI) of Hydraulic Engineering and Water Resources – Division of Hydraulic Engineering

Prof. Dr.-Ing. Andreas Dittrich

Head of Division of Hydraulic Engineering
Leichtweiß Institute of Hydraulic Engineering and Water Resources

Researcher's Career

- Head of Main Division "Wasserbau und Wasserkraft" at DWA
- Leader of DWA Technical Committee WW3 "Hydraulics"
- Organizer of the River Flow 2010 Conference in Braunschweig
- Chairman of Fluvial Hydraulics Committee of IAHR
- Head of Dept. Multi-Phase Flow, Institut für Wasserwirtschaft und Kulturtechnik, University of Karlsruhe (TH), Germany
- Research Associate, Institut für Wasserbau, University of Stuttgart, Germany
- Research Fellow, Centre for Water Research, University of Western Australia, Perth, Australia
- Dr.-Ing. and Habilitation at the University of Karlsruhe (TH), Germany

Funding
Currently: EU, BMBF, BAW, Land of Lower Saxony

Contact
Technische Universität Braunschweig
Leichtweiß Institute of Hydraulic Engineering and Water Resources
Division of Hydraulic Engineering
Beethovenstraße 51a
38106 Braunschweig
Phone: +49 531 391 3940
a.dittrich@tu-braunschweig.de
www.tu-braunschweig.de/lwi/wasserbau

Mission Statement

To improve our understanding and existing formulae to better describe the morphodynamic phenomena and processes that occur in nature-like rivers and on their flood plains which are responsible for the development of the whole river corridor.

Research

Most of our research activities are carried out in the laboratory of the LWI with its excellent facilities. A selection of projects is described as follows:

Near-natural hydraulics: Determination of the turbulent flow field by measurement techniques such as LDA in coral fields and idealized structures with varying hydraulic effects of surface and form roughness as well as determination of form resistance of single structural elements by an innovative drag force measurement system. Our aim is to improve the description of the flow field above and within complex structures by using the double-averaging principle of the Navier-Stokes equations.

Morphodynamics: Experimental investigations of scouring in the wake of an inland water vessel model (scale 1:16) with various propulsion systems to develop an improved formula for scour depth. Experimental investigations about reproducing natural levee formation in a flume with half a trapezoidal compound channel and its own sediment recirculation system. The aim is to come up with a practical criterion to quantify the observed processes.

Investigations about remobilizing sediment depositions in the backwater of a small weir, as shown in the example of "Eisenbütteler Wehr" in Braunschweig, Germany, in scale model experiments.

Fluid-structure interactions:
Investigation of the interaction between submerged groynes, flow field and morphology in an s-shaped channel. The objective here is the development of design guidelines for submerged groynes.

Publications

- Dittrich, A. & Huppmann, O.; 2013: "Morphodynamics of the Rhine river between the weirs "Märkt" and "Breisach"". Mitteilungen des Leichtweiß-Instituts für Wasserbau, TU Braunschweig
- Dittrich, A., Aberle, J. & Schoneboom, T.; 2012: "Drag forces and flow resistance of flexible riparian vegetation." In: Rodi, N., Uhlmann, M. (Editors), Environmental Fluid Mechanics. Memorial Volume in honour of Prof. Gerhard H. Jirka. Taylor & Francis Group, London, pp. 195-215
- Aberle, J., Nikora, V., Henning, M. & Hentschel, B.; 2010: "Statistical characterization of bed roughness due to bed forms: A field study in the Elbe River at Aken, Germany." Water Resour.Res., W03521, doi: 10.1029/2008 WR 007406
- Aberle, J., Koll, Ka. & Dittrich, A.; 2008: "Form induced stresses over rough gravel-beds." Acta Geophysica, 56 (3), pp. 584-600
- Dittrich, A. & Järvelä, J.; 2005: "Flow – vegetation – sediment interaction." Water Engineering Research, 6 (3), pp. 123-130

Institute of Geoecology – Soil Science and Soil Physics Division

Prof. Dr. Wolfgang Durner

Researcher's Career

- Full Professor for Geoecology and Soil Science
- Research Fellow at ETH Zürich
- Dr. rer. nat. at University of Bayreuth
- Diplom-Geoökologe at University of Bayreuth

- Head of the Soil Science and Soil Physics Division at the Institute of Geoecology
- Speaker of the Department of Civil Engineering and Environmental Sciences
- Head of the Soil Physics Commission of the German Soil Science Society
- Associate Editor of five leading international Journals
- Coordinator of Vadose Zone Hydrology program at the European Geosciences Union (EGU)

Funding

DFG, DAAD, BMBF, BASt

Contact

Technische Universität Braunschweig
Institute of Geoecology –
Soil Science and Soil Physics Division
Langer Kamp 19c
38106 Braunschweig
Phone: +49 531 391-5605
w.durner@tu-braunschweig.de
www.soil.tu-bs.de

Mission Statement

Our research objective is improvement in understanding, measuring and modeling the transport of water, energy and solutes in the subsurface between atmosphere and groundwater. This is achieved by combining state-of-the-art methods in measuring and numerical modelling of flow and transport experiments on the lab and field scale.

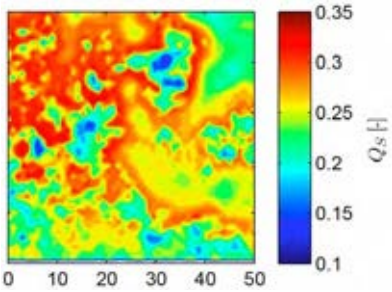
Research

Hydraulics of peatlands: In peatlands, the moisture content of the vadose zone (acrotelm) decisively controls oxygen diffusion rates, the redox state, and finally the turnover of organic matter. Thus, the water content dynamics determines whether peatlands act as sinks or sources of atmospheric carbon. Models designed to predict the carbon cycle must therefore adequately represent variably-saturated flow processes in ombrotrophic peatlands. We investigate how we can measure and model the water dynamics in peatlands in order to improve biophysical models of carbon exchange.

Biofilms in porous media: Understanding the influence of attached microbial biomass on water flow in partially water saturated soils is crucial for predicting flow in groundwater recharge basins, wastewater irrigation fields, constructed wetlands and in-situ bioremediation sites. We work on quantifying the influence of biomass on the hydraulic properties of unsaturated porous media. This is achieved through pore scale experiments and continuum scale column flow experiments with varying amounts and spatial distributions of biofilms.

Identification of hydraulic properties of porous media: A particular focus of our research lies in the general methodological development of identification tools to determine effective transport processes for water in liquid and vapour form in the unsaturated zone. To achieve this goal, we combine advanced measurement technology with state-of-the-art inverse numerical modeling using the Richards equation. This yields hydraulic properties in high resolution and quality and allows us to test existing parameterizations and to develop improved parameterizations.

Water resources and evaporation from soils: Soil plays a prominent role in the evaporation dynamics of terrestrial surfaces. After an initial phase, where the water uptake capacity of the atmosphere controls the amount of evaporation, a second evaporation stage follows where the unsaturated hydraulic conductivity of the soil and the vapor diffusion are limiting factors. Untangling the complex interactions between soil surface and atmosphere will help to assess the consequences of changing climatic conditions, e.g. on groundwater renewal rates in large arid and semi-arid areas.



Publications

- Diamantopolous, E., W. Durner, S.C. Iden, U. Weller, and H.-J. Vogel (2015): Modelling dynamic non-equilibrium water flow observations under various boundary conditions, Journal of Hydrology 529, 1851-1858.
- Hannes, M., U. Wollschläger, F. Schrader, W. Durner, S. Gebler, T. Pütz, J. Fank, G. von Unold, and H.-J. Vogel (2015): High-resolution estimation of the water balance components from high-precision lysimeters, Hydrol. Earth Syst. Sci., 19, 3405-3418.
- Peters, A., S.C. Iden und W. Durner (2015): Revisiting the simplified evaporation method: Identification of hydraulic functions considering vapor, film and corner flow, Journal of Hydrology 527, 531-542.
- Durner, W., E. Diamantopoulos, S.C. Iden, and B. Scharnagl (2014): Hydraulic properties and non-equilibrium water flow in soils, Chapter 17 in: W.G. Teixeira et al. (Eds.), Application of Soil Physics in Environmental Analyses: Measuring, Modelling and Data Integration, Progress in Soil Science Series. 2014, pp.403-434, Springer, Dordrecht. ISBN 978-3-319-06012-5.
- Iden, S.C., A. Peters, and W. Durner (2015): Improving prediction of hydraulic conductivity by constraining capillary bundle models to a maximum pore size, Advances in Water Resources 85, 86-92.

Institute of Building Materials, Concrete Construction and Fire Protection (iBMB), Department of Concrete Construction

Prof. Dr.-Ing. Martin Empelmann

Researcher's Career

- Test Engineer for structural design
- Executive Director of the Civil Engineering Materials Testing Institute MPA Braunschweig
- University Full Professor for Concrete Construction at the TU Braunschweig
- Design Manager for Major International Projects, Hochtief Construction AG, Essen
- Award of the "Friedrich-Wilhelm Preis"
- Award of the "Borchers Plakette"
- Dr.-Ing. at the RWTH Aachen University, Institute of Structural Concrete
- Research Assistant at the Institute of Structural Concrete, RWTH Aachen University
- Award of the "Springorum-Denkmünze"
- Award of the "Hünnebeck-Preis"
- Study of Civil Engineering at the RWTH Aachen University, degree Dipl.-Ing.

Funding

DFG, BMWi, BMUB, PtJ, PRB, DIBt, DBV, BASt, DAfStb

Contact

Technische Universität Braunschweig
Institute of Building Materials, Concrete Construction and Fire Protection (iBMB),
Department of Concrete Construction
Beethovenstraße 52
38106 Braunschweig
Phone: +49 531 391 5413
m.empelmann@ibmb.tu-bs.de
www.ibmb.tu-braunschweig.de

Mission Statement

The Department of Concrete Construction concerns itself with all aspects of the construction, design, maintenance and retrofit of plain concrete, reinforced and prestressed concrete structures.

Research

Innovative Concrete Girders: The institute develops alternatives to conventional concrete girders in which the stirrups are replaced by steel fibers or by an innovative perforated steel plate and beyond that ultra high performance concrete (UHPC) is applied for weight optimization. These girders are not only advantageous in economic but also various structural terms.

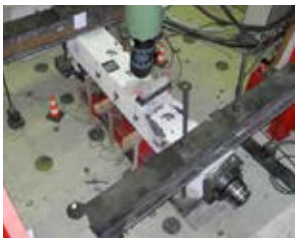
Life-Cycle-Engineering of Concrete Bridges: Since road bridges have to carry increasing traffic loads, research works on prestressed girders under dynamic stress are conducted at the institute. In addition to this, alternative concepts for future bridges, dealing with flexible reactions on varying boundary conditions, are developed. Furthermore, life cycle simulations are performed and monitoring systems for existing bridges are carried out.

Serviceability and Durability of Concrete Constructions: Cracking has an important impact on avoiding corrosion damage in the reinforcement of concrete structures. In this regard, tests on reinforced concrete shell elements are carried out and practical rules for crack width control are developed. Currently, tests with non-metallic reinforcement are being onducted.

Robust and Safe Concrete Constructions: Nowadays, not only the ultimate load, but also post-fracture behavior and robustness are of high interest for reinforced concrete constructions. For this purpose, research studies on columns with large bar diameters and on columns made of UHPC and high-strength reinforcement are conducted at the institut.

Lightweight and Ecological Concrete Constructions: The development of concrete constructions towards sustainability, energy requirement and conservation of resources leads inevitably to shape- and material-optimized constructions. As a result, thin-walled pipes of UHPC and ultra light, thin-walled, rod-shaped concrete hollow sections are developed and tested. In order to simplify and industrialize the manufacture of such pipes, studies were carried out with the spun concrete process.

Laboratory at iBMB



Thin-walled, hollow UHPC-Beam after testing

Slender spun concrete pole after testing

Publications

- Empelmann, M.; Krakowski, W.: Erweitertes Modell zur Berechnung der Rissbreite. Beton- und Stahlbetonbau 110 (2015), Journal 7, pp. 458-467
- Oettel, V.; Empelmann, M.: Überprüfung der zusätzlichen Regeln für Ø40 mm nach EC2 – Teil 3: Druckglieder. In: Beton- und Stahlbetonbau 110 (2015), Journal 9, pp. 598-608
- Remitz, J.; Empelmann, M.: Ermüdungsfestigkeit von eingebauten Spanngliedern – Versuche an Spannbetonträgern. Bauingenieur 90 (2015), Journal 12, pp. 553-561
- Oettel, V.; Empelmann, M.: Druckstrebentragfähigkeit von vorgespannten UHPFRC-Hohlkästen unter Torsion und kombinierter Beanspruchung. Beton- und Stahlbetonbau 109 (2014), Journal 3, pp. 182-192
- Empelmann, M.; Steven, G.: Gedrungene Stützen aus UHPFRC mit hochfester Längsbewehrung. Beton- und Stahlbetonbau 109 (2014), Journal 5, pp. 344-354

Institute of Building Services and Energy Design

Prof. Dr.-Ing.
Manfred Norbert Fisch

Researcher's Career

- TGA-AWARD "Energy Campus von Stiebel Eltron", Holzminden in 2016
- "Balthasar Neumann Preis" for LIFECYCLE TOWER LCT ONE, Dornbirn, AT in 2014
- environmental award "Goldener Baum" for exemplary energetical and solar planning, 2013
- energyaward "Energieeffizientes Bauen & Sanieren", joule & renexpo, 2012
- German Solar Award for Solar Building, 2008
- Founding of Steinbeis Transfer Center energy, building and solar technology (STZ-EGS), Stuttgart
- Director of the Institute for Building and Solar Technology at TU Braunschweig, 1996
- Founding of the Test and Development Center for Solar Thermal Systems
- Head of Department of Rational Energy use and Solar technology at ITW, Stuttgart
- Scientific staff member of the Institute for Thermodynamics and Thermal Engineering (ITW), Stuttgart
- Ph.D. "System studies for the use of solar energy for heating of residential buildings with air as heat carrier" in 1984
- Studies of mechanical engineering in Friedberg and Stuttgart, Germany

Funding
Currently: EU, BMWi, BMUB, DBU
MWK Lower Saxony

Contact
Technische Universität Braunschweig
Institute of Building Services and
Energy Design (IGS)
Mühlenpfordtstraße 23
38106 Braunschweig
Phone +49 531 391-3555
igs@tu-braunschweig.de
www.tu-braunschweig.de/igs

Mission Statement

The Institute focuses on the topics of renewable energy and innovative integration of sustainable energy supply to architecture – no matter if modernization, new construction, competition or research. Projects and also teaching deal with quality management, optimization of efficiency and "energyplus buildings" producing more energy than they require.

Research

Team Energy and Quality Management Development of tools for quality control and management from project idea to practical implementation

Effizienzhaus Plus Riedberg: Monitoring of a plus energy multi-family-home, Research focus is to improve building performance, optimize building operation and the high self-use of eletricity from the pv system.

EnEff:Stadt – EnergyToolkit: Development of a planning tool for the evaluation of technical and economical effects of different change scenarios in districts (including predictions of heat and electricity profiles as well as costs of development).

Team Energy Efficient Building Development of energy concepts and evaluation of consumption data and optimization

International Building exhibition Hamburg: Conception, quality management and scientific measuring for monitoring of 32 buildings of IBA Hamburg 2013. Controlling the goal of a CO_2-neutral city district by energy monitoring, accounting and reporting user behavior and acceptance.

EnEff: Campus – blueMAP TU Braunschweig: Integral energetic master plan 2020 and 2050 for the university. Optimization of energetical aspects, proving climate aims and focusing on energy supply, construction and facility management, mobility and user behavior.

EnEFF: Campus 2020: Support and monitoring of realisation, Development of long-term strategies and an integral technology research platform for reaching the goal of a CO_2-neutral campus.

Team Sustainable Energy Supply / Development of energy supply concepts and integration of renewable energies.

Energy Plus building Berghalde: Concept, Monitoring and Performance Optimization

Future solar: Feasibility study of solar energy supply systems, simulation and evaluation of 50% and 100% supply with renewable energies.

Publications

- Fisch, M. N.; Wilken, T.; EnergyPLUS – Buildings and districts as renewable energy sources, book, 2013
- Fisch, M. N.; Wilken, T.; Aktiv auf acht Geschossen, Plusenergie-Mehrgeschosser, journal, 2015
- Roth, C., Dombrowski, U., Fisch, M. N., Zukunft.Klinik.Bau., book, Springer, 2015
- Fisch, M. N.; Wilken, T.; Bockelmann, F.;Stähr, C.; Netto-Plusenergie-Gebäude mit Stromlastmanagement und Elektro-Mobilität, journal, 2015
- Fisch, M. N.;Beier, T.; Wöhrer, S.; Optimierung der Quartiersentwicklung, Integraler energetischer Masterplan TU BS 2020/2050, journal, 2015
- Fisch, M. N.; Schlosser, M.; Kellner, R.; Wirtschaftlichkeit solarer Energieversorgungssysteme, journal, 2015

Institute for Building Materials (IBMB) – Solid Construction and Fire Protection

© Fraunhofer WKI

Prof. Bohumil Kasal, PhD

Researcher's Career

- Since 2010, Director of the Fraunhofer Wilhelm-Klauditz-Institut, WKI in Braunschweig
- Prof. of Organic Materials at the Institute of Building Materials, Concrete Construction and Fire Protection (IBMB)
- Member of the DFG Graduate College focused on ageing of structural materials
- Hankin Chair of Residential Building Construction at the Pennsylvania State, University and a Director of the Pennsylvania Housing Research Center, (2005 to 2010)
- Professor at the Department of Wood and Paper Science at the North Carolina State University in Raleigh, (1993 to 2005)
- Honorary Research Fellow at the University of Bristol, (2007 to 2012)
- Professor at the Czech Technical University in Prague
- Honorary Research Associate at the University of New Brunswick, Canada
- Professorship at the North Carolina State University (associate faculty status) Fulbright Scholar

Funding

EU, DFG, AIF, MWK, industry

Contact

Technische Universität Braunschweig
Institute of Building Materials (iBMB),
Organic and Wood-Based Construction Materials
Hopfengarten 20
38102 Braunschweig
Phone: +49 531 22077-0
bo.kasal@tu-braunschweig.de

Mission Statement

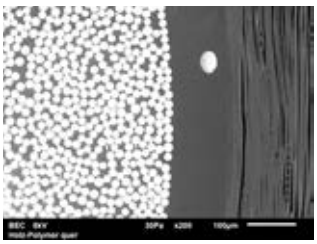
Our mission is to study and characterize organic materials used in construction including: combination of organic and inorganic materials, development of new experimental methods and techniques for material and interface

Research

Fraunhofer Center for Light and Environmentally-Friendly Structures: The newly established Center focuses on use of plant-fiber based materials in construction and optimization of their use with regard to their function in a complex system. The Center brings together the university fundamental research with the application-oriented research and development pursued by Fraunhofer WKI. Graduate and undergraduate students and faculty of Civil and Environmental Engineering and Architecture together with Fraunhofer WKI scientists address various topics ranging from modular light systems, through energy efficiency of buildings to rapid deployment systems and optimization. A new Fraunhofer research facility at the TU Braunschweig Campus will open in 2017

Activ-controlled Moment Connection with High Energy-Dissipation Potential: Moment connections with adjustable (passive and/or active) stiffness are developed. Focus is thereby being placed upon an activation of the moment connector which, in the event of an earthquake, will control the energy dissipation through friction and will prevent failure during large-magnitute earthquakes.

Characterization of wood surface property in micro- and nanometer scale with atomic force microscopy (with Dr. Jin Xin): Localized surface properties are important for technology development in topics such as adhesion, protective coating or surface functionalization. With the help of atomic force microscopy (AFM), it is not only possible to measure the true 3D surface topography in nanometer scale, but also the localized surface forces. The goal of this project is to provide a detailed analysis of surface properties of various components of the cellular wood structures and a deeper understanding of the wetting behavior as well as the ageing of adhesive/wood interface.



Industrial research and research with small and medium enterprises (SMEs): The department conducts engineering industrial research that entails durability and fatigue tests of adhesives under realistic effects in the form of dynamic loads with simultaneous exposure to solvent (e.g. cleaning agents). In addition, methods for automated bonding of components are developed. Number of projects addressing development of composite-reinforced guardrail systems, inorganic foams, and fire-resistant foams are underway. Furthermore, the department conducts experimental failure analyses of materials and connections in construction as well as in mechanical systems.

Publications and Patents

- Yan LB, Kasal B, Huang L. 2016. A review of recent research on the use of cellulosic fibres, their fibre fabric reinforced cementitious, geo-polymer and polymer composites in civil engineering. Composites Part B: Engineering (Elsevier) 2016; 92:94-132.
- Kasal, B., Friebel, S., Gunschera, J., Salthammer, T., Schirp, A., Schwab, H. and Thole, V. 2015. Wood-Based Materials. Ullmann's Encyclopedia of Industrial Chemistry. 1–56. Wiley-VCH Verlag GmbH & Co. KGaA. DOI: 10.1002/14356007.r28_r01.pub2
- Kasal, B., Guindos, P., Polocoser, T., Heiduschke, A., Urushadze, S., and Pospisil, S. 2014. Heavy Laminated Timber Frame with Rigid Three-Dimensional Beam-to-Column Connections. ASCE Journal of Performance of Constructed Facilities, Vol. 28, No. 6.
- Kasal, B., and R. Blass. 2013. Experimental and analytical investigation of crack development in composite reinforced laminated arch. Journal of Materials and Structures. Vol. 46, Issue 1-2, 173-180. DOI 10.1617/s11527-012-9892-4
- Kasal, B., Tannert, T. (Editors). 2011. In situ assessment of structural timber. RILEM State of the Art Reports, Vol. 7. Springer Verlag. ISBN: 978-94-007-0559-3. 124 p.

Chair of Infrastructure and Real Estate Management

Prof. Dr.-Ing. Tanja Kessel

- Head of Chair of Infrastructure and Real Estate Management
- Member of the Executive Board and General Partner PSPC GmbH

Researcher's Career
- Partner and CEO of PSPC GmbH
- Dr.-Ing. at the TU Berlin
- Study of Civil Engineering, TU Berlin
- Study of Civil Engineering, Loyola Marymount University, Los Angeles

Funding
BMVI, BMUB, BBSR, ZDB, HDB, Industry

Contact
Technische Universität Braunschweig
Infrastruktur- und Immobilienmanagement (IIM)
Schleinitzstraße 23 A
38106 Braunschweig
Phone: +49 531 391-3381
t.kessel@tu-braunschweig.de
www.tu-braunschweig.de/iim

Mission Statement

To meet the increasing demands of our fast moving modern society efficient management of infrastructure and real estate is needed within the whole lifecycle. Especially the aspects of sustainable development, operation, maintenance and financing become more important.

Research

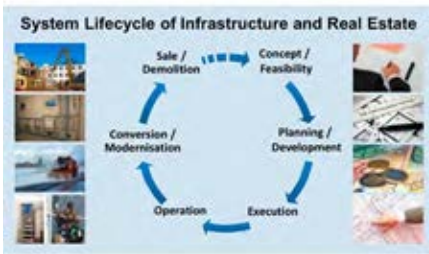
Infrastructure Management: Assessment of PPP infrastructure project conditions focusing on possibilities of participation of SME enterprises. The examination was instructed by the Zentralverband Deutsches Baugewerbe (ZDB) at the current design of PPP projects in federal highway construction and is characterized by high project volumes and long maturities, which are perceived by construction SMEs as restricting competition.

Member of the Advisory Board of the Federal Ministry of Transport and Digital Infrastructure (BMVI) for the assessment report "Alternative business and financing models in federal highway construction". Aim of the assessment is to examine what suitable development opportunities are available for the financing of federal highway PPP projects.

Expert for the Commission named "Construction and Maintenance of the Transport Network" of the Conference of State Minister of Transport, headed by Kurt Bodewig. The commission investigates potential financing and organizational models for the construction and operation of federal highways.

Real Estate Management: Evaluation of PPP real estate projects focusing on the operation phase. The examination is requested by the Hauptverband der Deutschen Bauindustrie to analyse the operative performance of PPP real estate projects which have been in use for a minimum of 2 years. The intended assessment criteria are:

- use costs
- performance quality
- innovations
- the change management / contract management
- dispute settlement
- PPP pulses
- the involvement of SMEs



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Publications

- Kessel, Tanja, Kessel, Martti: „Übertragung von Immobilienvermögen unter Berücksichtigung des Erbschafts- und Schenkungsgesetzes (ErbStG), Festschrift für Prof. Dieter Jacob", pp. 77 ff. (2015)
- Gottschling, Ines, Kessel, Tanja: „Wirtschaftlichkeitsuntersuchungen bei öffentlichen Hochbaumaßnahmen" in "Immobilien- und Bauwirtschaft aktuell – Entwicklungen und Tendenzen, Festschrift für Prof. Bernd Kochendörfer", pp. 47 ff. (2015)
- Kessel, Tanja, Völker, Wiebke: Nutzerverhalten ist wesentlich, Energieeffiziente Bauwerksbewirtschaftung, Behörden Spiegel Juni 2014, pp. 42
- Kohnke, Tanja, Riebeling, Klaus: PPP und Freibäder – zwei Praxismodelle, in: Knop, Detlef (Hrsg.), Public Private Partnership – Jahrbuch 2007, pp. 78-81 (2007)
- Kohnke, Tanja, Schauer, Werner: 3. Fallstudie PPP-Expresspaket der Stadt Köln in: Littwin, Frank/Schöne, Franz-Josef (Hrsg.), Public Private Partnership im öffentlichen Hochbau, Verlag W. Kohlhammer, pp. 416-422 (2006)

Institute of Landscape Architecture

Prof. Gabriele G. Kiefer

Researcher's Career

- 2015-2013, Dean of the Faculty of Architecture at the TU Braunschweig
- 2013-2008, Member of urban advisory council City of Salzburg
- since 2012, Jury member for the Villa Massimo-Scholarships
- since 2008, Teaching in Valdivia and Santiago de Chile, Chile
- since 2002, Professor at the Technical University of Braunschweig, Institute for Landscape Architecture
- since 1990, internatonal juries and lectures activities
- 1989, Foundation of planning office BÜRO KIEFER
- 1992-1987, research associate at the TU Berlin , Department of landscape architecture
- 1987-1979, Studies at the Technical University of Berlin, Department of landscape architecture

Funding
DAAD, BUND, City of Braunschweig, BS | Energy, local municipalities

Contact
Technische Universität Braunschweig
Institute of Landscape Architecture
Pockelsstraße 3
38106 Braunschweig
Phone: +49 531 391-2365
ila@tu-braunschweig.de

Mission Statement

Landscape architecture is a unique non-verbal communication medium for conducting dialogues about our built and natural environment. Designing characteristic places capable of endowing identities is one of the central duties of (landscape) architecture intending to offer viable and aesthetically appealing places in which people can live. We have to discuss new points of reference and models for tomorrow's open spaces.

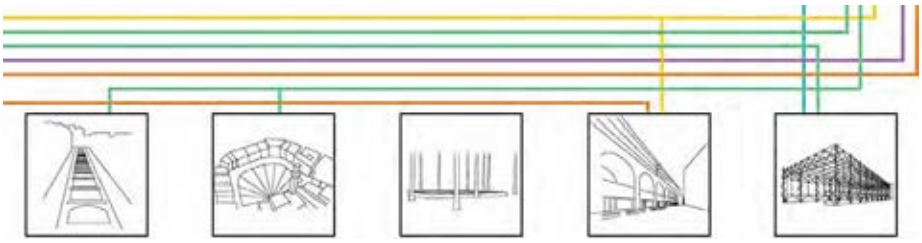
Research

Recombinations: Developing landscape hybrids with an antithetical leitmotif as an expression of total creation which is linked to the idea of nature – this is the main focus of my landscape architectural work. I do research on the hybridization of space and atmosphere and develop interfaces between productive and reproductive spaces.

Sustainable Chile: We maintain partnerships with Chilean universities to discuss and develop tools and approaches for sustainable urban developments in South American contexts at all urban scales from object to citywide concepts.

Urban Biodiversity: The flora and fauna of Central European cities has long received little attention; nature was sought after outside the cities, in the countryside or in distant regions of the world. We focus on urban contexts and develop structures for wildlife architectures and analyze requirements for evolving habitat structures.

City of the Future: Whether it be climate change, social inequality or scarcity of resources – the challenges facing our society are great. We are part of the new strategic research project at our university discussing and developing principles and models of sustainable urban development.



Analysis of spatial strategies in urban contexts

Accessible Cities: We analyse and study the effects of design and quality of urban spaces to find best-practices to render urban space more accessible, reachable, approachable, changeable and inclusive.

Publications

- Kiefer, G.: Lene Voigt Park Leipzig In: Europe City: Lessons from the European Prize for Urban Public Space, 2015
- Kiefer, G.: Landschaftspark Adlershof In: Harvard Design Studies (Hrsg.): Airport Landscape: Urban Ecologies in the Aerial Age; 2015
- Kiefer, G.: Stilisierte Leere und Möglichkeiten' In: Architekturforum Zürich (Hrsg.): Garten des Poeten G59 / 2009; 2009
- Kiefer, G.: Ist weniger mehr? Gestaltung durch Reduktion In: Initiative StadtBauKultur NRW (Hrsg.): Stadt macht Platz – NRW macht Plätze; 2006
- Kiefer, G.; Schröder, T. (Hrsg.): Büro Kiefer – Recombinations; Ulmer Verlag; 2005

Institute of Structural Design (ITE)

Prof. Dr.-Ing. Harald Kloft

- Head of the Institute of Structural Design
- Dean of Faculty Architecture, Civil Engineering and Environmental Sciences
- Spokesman of the NTH-Research Group "Generative Fabrication in Building"
- Founding Partner of the engineering consultancy "osd – office for structural design"

Researcher's Career

- Full Professor for Structural Design at TU Braunschweig
- Full Professor for Structural Design at TU Kaiserslautern
- Full Professor for Structural Design at TU Graz
- Visiting Professor for Structural Design, Städelschule Frankfurt
- Founding Partner of osd – office for structural design, Frankfurt
- Project Leader at Bollinger + Grohmann, Frankfurt
- Dr.-Ing., Institute of Statics, TU Darmstadt
- Project Management at Strabag Bau AG
- Diploma in Civil Engineering, TH Darmstadt

Funding

DFG, State of Lower Saxony (MWK), AiF, Industry

Contact

Technische Universität Braunschweig
Institute of Structural Design (ITE)
Pockelsstraße 4
38106 Braunschweig
Phone: +49 531 391-3571
h.kloft@tu-braunschweig.de
www.ite.tu-bs.de

Mission Statement

With more than 80% of the building mass, structures are the key factor for resource-efficiency in building. In continuation of the approach to lightweight-structures with a targeted focus on minimizing building mass, the aim of research at ITE is to create resource-efficient structures as an integral part of the building design.

Research

Innovative Principles of Joining Lightweight Structural Members made from UHPFRC (Ultra High Performance Fibre Reinforced Concrete)

Based on economic justifications, load-bearing structures typically consist of bending-stress and mass-intensive components in today's industrial production. The goal of future development in the construction industry will be to save mass and primary energy through innovative structures and material efficiency. The DFG-promoted research projects are embedded in the DFG SPP 1542 program and executed in close cooperation with the IBMB, Prof. Harald Budelmann and his team. The results have revealed that innovative principles were applied in the process of joining prefabricated elements of columns, slabs, walls as well as novel hybrid structural systems.

Lightweight Composite Structures for Sustainable Buildings

This ITE research is integrated in the interdisciplinary research group ZELUBA (Center of Lightweight and Sustainable Buildings). The project aims to design hybrid light-weight structural systems with a pre-defined life expectancy.

Generative Manufacturing of Resource-Efficient Concrete Elements

This transdisciplinary project is a work in progress by different six institutes from the fields of structural engineering, material technology, informatics and mechanical engineering. The research is government-funded by the state of Lower Saxony. The objective here is to develop a novel robot-controlled process for formwork-free fabrication of geometrically complex concrete elements.

Digital Building Fabrication Laboratory (DBFL)

The DBFL is a large-scale facility at ITE which allows the 1:1 fabrication of structural building elements. The concept comprises a cnc-controlled machining center used in the natural stone industry which is enlarged by an integrated industrial robot for simulating cooperative processes in building fabrication. The research topics are grouped into two main divisions: 1. Robot-controlled additive fabrications of large concrete elements. 2. Subtractive and precise machining/finishing of semi-finished industrial products.

DBFL – Digital Building Fabrication Laboratory

Publications

- Kloft, H.; Ledderose, L.: Preliminary Investigations for Magnetic rearrangement of Steel Fibers in UHPFRC, in: Reyolando M.L.R.F. BRASIL and Ruy M.O. PAULETTI (Hrsg.): Proceedings of the IASS-SLTE 2014 Symposium "Shells, Membranes and Spatial Structures: Footprints", Brasilia, Brazil
- Kloft, H.; Ledderose, L. u.a.: Neuartige Verbindungen für geometrisch komplexe Flächen- und Stabwerkelemente aus UHPFRC, in: Scheerer, S. und Curbach, M. (Hrsg.): Leicht Bauen mit Beton, Forschung im Schwerpunktprogramm 1542 Förderphase 1, TU Dresden, 2014, pp. 122-139
- Kloft, H., Hoyer, S.: Zum Entwerfen von Tragwerken. In: Stahlbau, 11/2014, Verlag Ernst & Sohn; pp. 806-814.
- Mainka, J.; Lehmberg, S.; Budelmann, H.; Kloft, H.: Non-Standard Fügeprinzipien für leichte Bauteile aus UHPFRC. In: Beton und Stahlbetonbau, 11/2013, Verlag Ernst & Sohn, pp. 763-773
- Kloft, H.: "Logic and Form – From Isler Shells to Nonstandard Structures" in: Journal of the International Assoziation for Shell and Spatial Structures (IASS), Vol. 25 (2011) No 3 September n. 169, pp. 191-199

Institute of Geoecology – Soil Science and Soil Physics

Prof. Dr. Rolf Nieder

Researcher's Career

- Coordinator of the soil science group of the "Coltan Environmental Management Project" (Sustainable Recultivation of Artisanal Tantalum Mining Wasteland in Central Africa)
- Project leader of the Sino-German project "Recycling of Organic Residues from Agriculture and Municipal Origin in China" (BMBF-Verbundprojekt)
- Project leader of the Sino-German project "Innovative Nitrogen Management Technologies to improve Agricultural Production and Environmental Protection in intensive Chinese Agriculture" (BMBF-Verbundprojekt)
- Coordinator of the nutrient cycling group, SFB 179 (DFG), TU Braunschweig
- Extraordinary professor of soil science, TU Braunschweig
- Dr. rer. nat. habil., TU Braunschweig
- Postdoc, Geologisches Landesamt Northrhine-Westphalia, Krefeld
- Dr. rer. nat., Leibniz Universität Hannover
- Study of agricultural sciences, University of Göttingen

Funding

BMBF, BMWi, DFG, Volkswagen Foundation

Contact

Technische Universität Braunschweig
Institute of Geoecology
Langer Kamp 19c
38106 Braunschweig
Phone: +49 531 391 5917
r.nieder@tu-braunschweig.de
www.tu-braunschweig.de/geooekologie

Mission Statement

Our activities focus on investigating transformation and transport processes in the soil-plant-atmosphere continuum and on combining environment-related research with technology transfer.

Research

Agricultural nitrogen cycle (Germany and China): We calculate nitrogen (N) balances and analyze nutrient use efficiencies in agricultural ecosystems as indicators for N emissions to the environment. Model experiments on processes such as N mineralization, microbial N dynamics and ammonium fixation are being conducted in the laboratory and in the field for quantifying N transformations. Measurements of ammonia (NH_3) volatilization following application of mineral or organic fertilizers in situ are being carried out for quantifying gaseous N losses. Simulation of N transformations and N losses using a dynamic, process-oriented model further contributes to ecosystem understanding. On this basis, we elaborate real-time, model-based N fertilizer recommendations. Establishing demonstration experiments on farmers' field sites for optimized N management and for testing of innovative N fertilizers enables knowledge transfer to practitioners.

Effects of intensive animal husbandry on ecosystems: For evaluating the status quo of nutrients in livestock systems, we calculate farm-gate balances for major nutrients and assess the soil nutrient status. We develop strategies for recycling of organic residues from agricultural origin (e.g. farmyard manure, liquid manure, composts) and for optimized organic residue treatment and use. Recycling of biogas effluent, green manure and straw is also in the focus of our research.

Long-term carbon and nitrogen dynamics in soils: We quantify carbon (C) and N accumulation in deepened plough layers and investigate the behavior (sequestration and stabilization) of "buried" soil organic matter (e.g. deep ploughing experiments, medieval concave fields) using C fractionation procedures. Further, we evaluate land use system-specific (e.g. arable land, grassland, forest) C and N dynamics in soils and their relevance for the climate.

Recultivation of artisanal tantalum mining wasteland in sub-Saharan Africa: We conduct greenhouse and field experiments for the improvement of soil quality within and outside of tantalum mining areas using locally available organic and inorganic nutrient resources. In the context of screening for toxic elements in mining areas, we systematically sample and analyze waters, stream sediments, soils and plants from mining-influenced sites compared to reference sites.

Overuse of mineral fertilizers in China

Carbon sequestration in deep ploughed soils in North Germany

Soil fertility problems on tantalum mining wasteland in Rwanda

Publications

- Heimann L, Roelcke M, Hou Y, Ostermann A, Ma WQ, Nieder R (2015) Nutrients and pollutants in agricultural soils in the periurban region of Beijing: Status and recommendations, Agriculture, Ecosystems and Environment 209 (Special Issue), 74-88.
- Hofmeier M, Roelcke M, Han Y, Lan T, Bergman H, Böhm D, Cai ZC, Nieder R (2015) Nitrogen management in a rice-wheat system in the Taihu Region: Recommendations based on field experiments and surveys, Agriculture, Ecosystems and Environment 209 (Special Issue), 60-73.
- Nieder R, Weber TKD, Paulmann I, Muwanga A, Owor M, Naramabuye FX, Gakwerere F, Biryabarema M, Biester H, Pohl W (2014) The geochemical signature of rare-metal pegmatites in the Central Africa Region: Soils, plants, water and stream sediments in the Gatumba tin-tantalum mining district, Rwanda. Journal of Geochemical Exploration 144, 539-551.
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Leichtweiß-Institute for Hydraulic Engineering and Water Resources (LWI) – Division Hydromechanics and Coastal Engineering

Prof. Dr.-Ing. Hocine Oumeraci

Researcher's Career

- Full Professor for Hydromechanics and Coastal Engineering at TU Braunschweig
- Head of Division Hydromechanics and Coastal Engineering at LWI
- Member Board of Directors Leichtweiß-Institute for Hydraulic Engineering and Water Resources (LWI)
- Member Board of Directors Coastal Research Centre (FZK)
- Researcher on Breakwaters at Franzius-Institute of Leibniz University Hannover
- Harbour and Coastal Engineer in consulting and construction companies
- Dr.-Ing. in Hydraulic Engineering at TU Dresden
- Dipl.-Ing. in Civil Engineering at TU Dresden

Funding

EU, DFG, BMBF, BMU, DAAD, public institutions e.g. BAW, HPA, NLWKN, StALU-MM and industry

Contact

Technische Universität Braunschweig
Leichtweiß-Institute for Hydraulic Engineering and Water Resources (LWI)
Beethovenstraße 51a
38106 Braunschweig
Phone: +49 531 391-3930
h.oumeraci@tu-braunschweig.de
www.tu-braunschweig.de/lwi/hyku

Mission Statement

Understanding and predicting the interactions of water waves, man-made/natural structures and seabed, mainly using physical/numerical modelling; elaborating knowledge base, design tools/guidance for coastal/harbour/offshore engineering practice; developing innovative structures/concepts to meet the new challenges associated with the impact of climate changes in coastal zones.

Research

Reliability and risk-based analysis: Our goal is to develop and implement approaches to cope with the unpredictability of the local impact of climate change on storm surges/wave loads. We are accomplishing this by explicitly evaluating uncertainties and to bridging the gap between technical and non-technical decision-makers through explicit assessment of the consequences of failures and flood hazards.

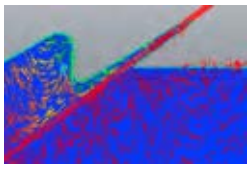
Wave damping structures and breakwaters: We are developing tools for modelling/analysis of wave loads and hydraulic performance (wave reflection, damping, transmission and overtopping) to support structural/functional design, with a focus on innovative wave damping concepts.

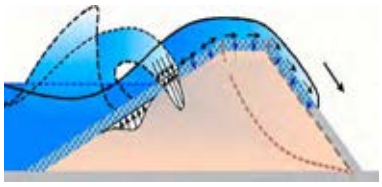
Interactions of sea waves, marine structures and soil foundations: Physical and CFD-CSD modelling of wave loads on marine structures and their transfer to the seabed are crucial for safety assessment and require close collaboration between fluid, structural and soil dynamics, and computational engineering.

Extreme storm surges, tsunami and flood risk: Predicting extreme events and potential damage by floods and erosion is vital for both people and infrastructures. This includes shore protection concepts, which may differ for storm surges and tsunamis, so that risk mitigation measures against storm surges cannot readily be transferred to tsunamis.

Coastal morphology and sediment transport: Coastlines are highly dynamic systems under permanent flux. Therefore, understanding and predicting the processes underlying nearshore sediment transport and subsequent morphological changes is crucial, particularly under the impact of climate change. This includes modelling of beach and dune profiles during storms and breaching of coastal barriers, and includes the underlying processes and mechanisms.

Offshore structures: With the rapid increase of interest in marine renewable energy and potential use of the sea for further purposes (e.g. artificial islands, ocean cities), a new era of offshore engineering is expected. From both basic research and projects for the industry, a large reservoir of experience has being gained in modelling wave loading and dynamic response of structures such as piles and pile groups, caisson-type and jacket-type structures, innovative structures, including new concepts for scour protection.





Publications

- Oumeraci, H.; Kortenhaus, A.; Burzel, A.; Naulin, M.; Dassanayake, D.R.; Jensen, J.; Wahl, T.; Mudersbach, C.; Goennert, G.; Gerkensmeier, B.; Froehle, P. and Ujeyl, G. (2015): XtremRisK – Integrated Flood Risk Analysis for Extreme Storm Surges at Open Coasts and in Estuaries: Methodology, Key Results and Lessons Learned. Coastal Engineering Journal Vol. 57, No. 01.
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- Tayel, M. and Oumeraci, H. (2015): A hybrid approach using hydrodynamic modelling and artificial neural networks for extreme storm surge prediction. Coastal Engineering Journal Vol. 57, No. 01.
- Strusinska-Correia, A.; Husrin, S.; Oumeraci, H.: Tsunami damping by mangrove forests (2013): A laboratory study using parameterized trees. Natural Hazards and Earth System Sciences 13, 483-503.
- Oumeraci, H. (2012): More than 20 years experience using the Large Wave Flume (GWK): Selected Research Projects. Die Küste, Archiv für Forschung und Technik an der Nord- und Ostsee, 77, 179-239.

Institute of Railway Systems Engineering and Traffic Safety (IfEV)

Prof. Dr.-Ing. Jörn Pachl

- Dean of Studies and chair of the examination committee of the Mobility & Transportation study program

Researcher's Career

- University professor and head of the Institute of Railway Systems Engineering and Traffic Safety
- Dr.-Ing. at TU Braunschweig, external candidate
- Project manager at German Railways
- Research assistant at the Institute of Traffic Safety at the Dresden College of Transportation
- Study of Transportation Engineering at the Dresden College of Transportation, degree Dipl.-Ing.

Funding

Industry, government authorities, DAAD

Contact

Technische Universität Braunschweig
Institute of Railway Systems Engineering and Traffic Safety (IfEV)
Pockelsstraße 3
38106 Braunschweig
Phone: +49 531 391-94451
j.pachl@tu-braunschweig.de
www.tu-braunschweig.de/ifev

Mission Statement

In many parts of the world, there is a growing demand for rail transportation. Our mission is to provide excellent expertise in railway operations and signalling to support the revitalisation and modernisation of railway systems wordwide. A key element of this is international knowledge transfer.

Research

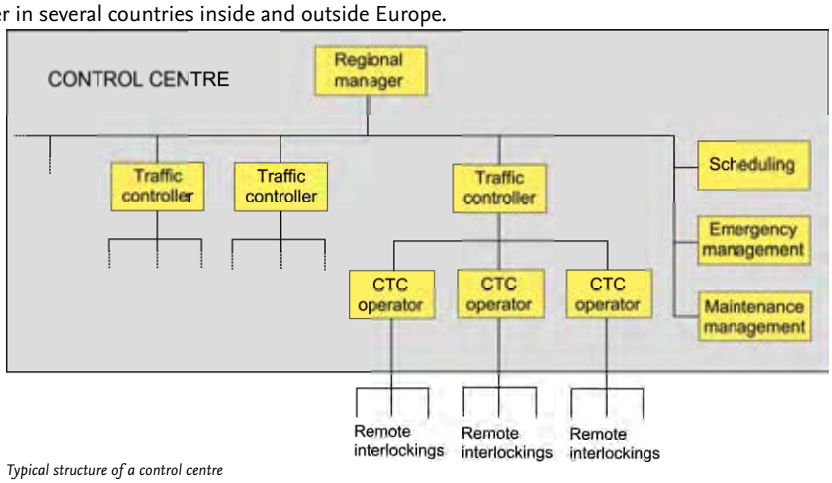
Centralisation: A main challenge is the change from rail traffic control by locally staffed control stations to operation control centres with a very high degree of centralisation. Beside new control technologies, there is a need for new operating rules and procedures that are designed for highly centralised control. A key element in this is an efficient procedural policy for degraded-mode operations.

Interoperability: Another challenge is to improve the international interoperability of the national railway systems. For historical reasons, the national railway systems differ significantly in their control systems, operating rules, and procedures. The differences are even relevant for very basic definitions. An important step in overcoming these differences is international knowledge transfer and comparative analysis of technologies and procedures.

Human Factors: Both challenges are closely connected with the design of user interfaces in control centres and locomotive cabs. So, human factors in these areas have become a key element in our research. Typical research questions are the evaluation of situation awareness and the optimum design of user interfaces for safe and efficient rail traffic control.

Laboratory: A key facility for our research is the Virtual Railway Operations Laboratory. In this laboratory, railway traffic is simulated in a virtual network controlled by distributed control stations. The control stations are equipped with user interfaces as used in real control centres. Several networks including samples from foreign railways and light rail systems can be simulated. In addition to the network control simulation, the laboratory also has a locomotive cab simulator, which is based on a real locomotive interior.

Knowledge transfer: Beside generating knowledge through research, knowledge transfer is one of our key activities. This is mainly done by providing lectures as a visiting professor or invited lecturer in several countries inside and outside Europe.



Typical structure of a control centre

Publications

- Pachl, J.: Systemtechnik des Schienenverkehrs - Bahnbetrieb planen, steuern und sichern. 8th ed., Springer Vieweg, Wiesbaden 2016
- Pachl, J.: Railway Operation and Control. 3rd ed., VTD Rail Publishing, Mountlake Terrace (USA) 2014
- Hansen, I. A.; Pachl, J. (editors): Railway Timetabling & Operations. 2nd ed., Eurailpress Hamburg 2014
- Pachl, J.: Betriebsführung der Infrastruktur. in: Fendrich, L.; Fengler, W. (editors): Handbuch Eisenbahninfrastruktur. 2nd ed., Springer Vieweg, Wiesbaden 2013, pp. 405-440
- Pachl, J.: Das Sperrzeitmodell in der Fahrplankonstruktion: Anwendung – Spezialfälle – Alternativen. Springer essentials, Springer Vieweg, Wiesbaden 2015

Institute of Industrial Building and Construction Design (IIKE)

Prof. Carsten Roth

Researcher's Career
- Member of the Freie Akademie der Künste in Hamburg
- Visiting professor for Design at the college in Kassel
- Leader of his own studio in Hamburg
- Fulbright scholarship at Virginia Polytechnic Institute in Blacksburg and Alexandria/USA
- Study of architecture at the Academy of Fine arts in Vienna
- Study of architecture at the Technical University of Braunschweig

Funding
BBSR, BMBF, BMWI

Contact
Technische Universität Braunschweig
Institute of Industrial Building and Construction Design (IIKE)
Pockelstraße 3
38106 Braunschweig
Phone: +49 531 391-2544
iike@tu-braunschweig.de
www.tu-braunschweig.de/iike

Mission Statement

The IIKE regards itself as a think tank that places emphasis on the exploration and implementation of innovative methods, technologies and theories in architecture at all scales. Dedicated research groups along with a network of specialists exchange ideas regarding building the framework for the interdisciplinary research activities of the institute, focusing on the fields of industrial and healthcare building.

Research

Industrial Building

The IIKE holds core expertise in investigating typological and constructive aspects of industrial and functional building, as well as industrial construction. Recently, focus has been placed on the increasingly complex requirements and influential factors of industrial building.

In several research projects, the institute has successfully collaborated on research partnerships with specialists from the fields of plant design, city planning, business management and building services engineering, as well as key players from the private sector. In this way the institute is able to offer expert advice to the industry.

Recent Projects: Urban Factory: This interdisciplinary research project investigates the symbiosis of cities and industrial production under the aspect of resource efficiency. It aims to develop an innovative, interactive knowledge base that can be used by all key players involved in maximizing integration potentials.

OI BAU: The initiation of planning requirements for complex building projects is analyzed and tools are developed that determine the decisions in the early phases of design.

Architecture for Health

The biggest challenge in the health sector is to achieve a balance between the best possible medical care and associated costs. The aspect of hospital construction has been identified to play a key role in establishing an equilibrium.
The transfer of highly efficient planning and construction methods utilized in everything from industrial buildings to health care buildings is another research focus of the institute. In various research projects related to this matter, the IIKE has researched ways to optimize the planning process, to develop new building structures and to provide a higher level of infection protection in hospitals. Successful collaborations with hospital operators and healthcare companies have been established in the process, working jointly on various innovative research projects, research contracts and reports.

Recent Projects: Praxis Krankenhaus: The aim of this research project is to explore and characterize new building structures in health care building and to optimize the planning processes to be more efficient and sustainable.

Hybau: The aim of this research project is to optimize construction types, from materials to methods in construction, as well as functional processes, in order to create a safer hospital environment under the aspect of hygiene.

Infect Control: During this project a consortium of representatives from various companies and academic institutions develops new strategies for the early recognition, control and abatement of infectious diseases. The IIKE's expertise and focus lies on all building related aspects.

Publications

- Roth C, Dombrowski U, Fisch N, Holzhausen J, Knöfler P, Riechel C, Sunder W, Zukunft.Klinik.Bau. Strategische Planung von Krankenhäusern, Springer Vieweg Verlag Wiesbaden, 1. Auflage 2015, 212 Seiten
- Roth C, Dombrowski U, Sunder W, Riechel C. Zukunftsfähige Gebäudestrukturen und Planungsorganisation von Krankenhäusern. Das Krankenhaus 2013, 2: 170-174

Institute of Geoecology – Landscape Ecology and Environmental Systems Analysis

Prof. Dr.
Boris Schröder-Esselbach

- Coordinator TUBS-Research Focus Future Cities (Stadt der Zukunft)
- Member of Berlin-Brandenburg Institute of Advanced Biodiversity Research

Researcher's Career

- Full Professor for Environmental Systems Analysis, TU Braunschweig
- Liaison lecturer of the German National Academic Foundation (Vertrauensdozent der Studienstiftung), TU München
- Associate Professor for Landscape Ecology, TU München
- Guest Professor Environmental Modelling, Potsdam University
- Assistant Professor Landscape Ecology, Potsdam University
- Postdoc, Carl von Ossietzky University of Oldenburg
- Dr. rer. nat. habil. Potsdam University, Institute of Geoecology
- Dr. rer. nat. TU Braunschweig, Institute of Geoecology
- Study of Geoecology and Philosophy, TU Braunschweig

Funding
DFG, BMBF, BfG, MWK State Lower Saxony, DBU

Contact
Technische Universität Braunschweig
Institute of Geoecology
Division of Landscape Ecology and Environmental Systems Analysis
Langer Kamp 19c
38106 Braunschweig
Phone: +49 531 391-5629
boris.schroeder@tu-braunschweig.de
www.tu-braunschweig.de/geooekologie

Mission Statement

Understanding the relationships between patterns, processes, and functions in dynamic landscapes is the basis for the development of models for the conservation and sustainable management of plant and animal species, landscapes, and related ecosystem functions and services.

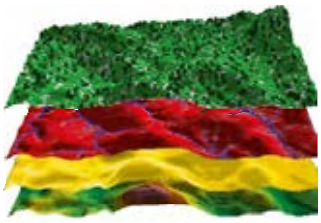
Research

Quantitative Landscape Ecology and Biogeography: We use advanced statistical and machine learning methods to understand the drivers of spatiotemporal dynamics of species and communities and to predict the effects of environmental change on plants, animals and ecosystem functions across scales. The same approaches are used for soil landscape modelling as well as landslide modelling (DFG research unit FOR 816). Currently, we link species distribution models and mechanistic (meta)population models to develop mechanistic niche models**.**

Ecohydrology: We conducted experiments and developed models to understand the effects of ecosystem engineers on hydrological processes. Within the DFG research unit 1598 (catchments as organised systems CAOS), we study the effects of earthworms generating macropores on water dynamics in the soil at catchment scale. We also analyse the response and effect traits of plant species in estuaries responding to and affecting ecohydraulic dynamics.

Conservation Biology, Ecosystem Service Science, Sustainable Land Management: We developed integrated landscape models linking hydrological, ecological and socio-economic models to study the effects of environmental change on species and to provide management options for conserving biodiversity. Currently, we are studying the effects of sea level rise and climate change on ecosystem services and biodiversity as well as their trade-offs in Germany's coastal regions in the joint BMBF-project COMTESS. In the joint MWK-project METAPOLIS we analyse trade-offs in ecosystem services of urban and rural areas in Lower Saxony.

Landscape Epidemiology: We study the distribution patterns and interrelationships of ticks, their hosts and pathogens causing tick-borne diseases such as Lyme disease with a focus on abiotic and biotic controlling factors in order to assess infection risks and derive prevention and intervention strategies to reduce such risks. Currently, we are focusing on tick-borne diseases in urban areas by studying transmission foci in public green infrastructure and private gardens.



Set of environmental predictors controlling species distribution patterns (top)

Ixodes ricinus, vector tick of Lyme disease
© F-R Matuschka, Potsdam

Tidal reeds at the Elbe estuary

Publications

- Carus J, Paul M, Schröder B. 2016. Vegetation as self-adaptive coastal protection: Reduction of current velocity and morphologic plasticity of a brackish marsh pioneer. Ecology and Evolution 6(6): 1579-1589
- Beudert B, Bässler C, Thorn S, Noss R, Schröder B, Dieffenbach-Fries H, Foullois N, Müller J. 2015. Bark beetle outbreaks in protected mountain forests increase biodiversity while maintaining high drinking water quality. Conservation Letters 8: 272-281
- Schibalski A, Lehtonen A, Schröder B. 2014. Climate change shifts environmental space and limits transferability of treeline models. Ecography 37: 321-335.
- Zurell D, Grimm V, Rossmanith E, Zbinden N, Zimmermann NE, Schröder B. 2012. Uncertainty in predictions of range dynamics: Black grouse climbing the Swiss Alps. Ecography 35: 590-603.
- Wintle BA, Bekessy SA, Keith DA, Van Wilgen BW, Cabeza M, Schröder B, Carvalho S, Falcucci A, Maiorano L, Regan TJ, Rondinini C, Boitano L, Possingham HP. 2011. Ecological-economic optimization of biodiversity conservation under climate change. Nature Climate Change 1: 355-359.

Institute of Geosystems and Bioindication (IGeo)

Prof. Dr. Antje Schwalb

- Professor for Geology and Geosystems
- Director IGeo

Researcher's Career

- Member Board of Trustees Federal Institute for Geosciences and Natural Resources (BGR) and Volkswagen Foundation; Council member Universität Trier
- Member DFG Senate, Joint Committee; Review Board Member Geology/ Paleontology
- Dr. sc. habil., Universität Göttingen
- BMBF Junior Group Leader, Universität Heidelberg, Institute of Environmental Geochemistry
- Scientific Coordinator, Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences
- DFG Research Fellow and Research Associate, Universität Göttingen, Institute and Museum for Geology and Paleontology
- Swiss NSF Research Fellow, University of Minnesota, Limnological Research Center, Minneapolis, and Visiting Scientist, U.S. Geological Survey, Denver (USA)
- Geologist, Service d'Archéologie du Canton de Neuchâtel (CH)
- Dr. sc., Université de Neuchâtel (CH)
- Dipl.-Geol., Universität Göttingen

Funding

DFG, BMBF, DAAD, State Lower Saxony

Contact

Technische Universität Braunschweig
Institute of Geosystems and Bioindication (IGeo)
Langer Kamp 19c
38106 Braunschweig
Phone: +49 531 391-7241
antje.schwalb@tu-braunschweig.de
www.tu-braunschweig.de/igeo

Mission Statement

The sustainable use of our environment, and especially water resources, depends on a thorough understanding of the processes that shape and alter our habitats. Our research focuses on the interactions between climate, environmental dynamics and human impact on different time scales.

Research

Water quality assessment: Our team uses aquatic organisms such as diatoms, ostracodes and chironomids as bioindicators and hydrochemical parameters to assess human impact in both urban and remote, pristine regions.

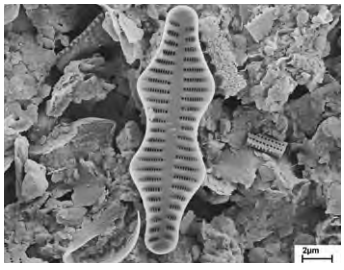
Water quality protection: We exploit bioindicators and geochemical parameters archived in lake and estuarine sediments to trace human impact through time and to define reference states of aquatic ecosystems and water quality that should be (re-) established.

Assessment of the regional impact of global climate change: Using lake sediments from climatically sensitive regions such as, for example, the Tibetan Plateau, Central Asia, Central Europe as well as Central and South America, we evaluate how climate change has altered the regional hydrological cycles and water supply to landscapes and humans.

Long-term monitoring of environmental change: As members in several international scientific drilling program (ICDP) projects we have established an interdisciplinary network of international cooperation partners to recover long sediment cores from large lakes reaching back several hundred thousand years in time. This allows us to detect changes in the long-term environmental evolution, discover patterns of natural climate variability and frequency of climate extremes, as well as to search for causes for changes in biodiversity and human activities and dispersal. Our approaches contribute to the development of concepts for environmental management and protection, especially under the aspects of future climate change and increasing land use.

Tibetan Lake Nam Co and Nyainqentanglha mountains, with peaks reaching over 7000 metres (Photo: D. Sachse).

Collection of sediment cores with a multicorer (Photo: S. Böddeker).



15,000-yr-old algae from Jeetzel river valley sediments in Lower Saxony (Photo: A. Schwarz).

Publications and Patents

- J. Escobar, D.A. Hodell, M. Brenner, J.H. Curtis, A. Gilli, A.D. Müller, F.S. Anselmetti, D. Ariztegui, D.A. Grzesik, L. Pérez, A. Schwalb, and T.J. Guilderson. A ~43-ka record of paleoenvironmental change in the Central American lowlands inferred from stable isotopes of lacustrine ostracods. Quaternary Science Reviews 37, 92-104. doi:10.1016/j.quascirev.2012.01.020, 2012.
- L. Pérez, J. Lorenschat, J. Massaferro, C. Pailles, F. Sylvestre, W. Hollwedel, G.-O. Brandorff, M. Brenner, G. Islebe, S. Socorro Lozano, B. Scharf, and A. Schwalb. Bioindicators of climate and trophic state in lowland and highland aquatic ecosystems of the northern Neotropics. International Journal of Tropical Biology and Conservation. Revista de Biologia Tropical 61, 2, 603-644, 2013.
- T. Rosenberg, F. Preusser, D. Fleitmann, A. Schwalb, K. Penkman, T.W. Schmid, M.A. Al-Shanti, K. Kadi, and A. Matter. Humid Periods in Southern Arabia: Windows of Opportunity for Modern Human Dispersal. Geology 39, 12: 1115–1118. doi: 10.1130/G32281.1, 2011.
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- Zhu, L., Lü, X., Wang, J., Peng, P., Kasper, T., Daut, G., Haberzettl, T., Frenzel, P. Li, Q., Yang, R., Schwalb, A., and R. Mäusbacher. Climate change on the Tibetan Plateau in response to shifting atmospheric circulation since the LGM. Scientific Reports 5:13318. DOI: 10.1038/srep13318, 2015.

Institute of Foundation Engineering and Soil Mechanics

Prof. Dr.-Ing. Joachim Stahlmann

Researcher's Career

- Full Professor and Head of the Institute for Soil Mechanics and Foundation Engineering, Department of Civil Engineering at the Technische Universität Braunschweig
- Functions in private enterprises: Engineer in charge, Project manager, Head of branch office, Unit manager in geotechnics and underground openings
- Dr.-Ing. at the RWTH Aachen
- Research Assistant at the Institute of Foundation Engineering, Soil Mechanics, Rock Mechanics and Water Way Construction, RWTH Aachen
- Study of Civil engineering (Dipl.-Ing.) at the Technische Universität Braunschweig

Funding

BMBF, BMWi, BMUB, DFG, Industry

Contact

Technische Universität Braunschweig
Institute of Foundation Engineering
and Soil Mechanics
Beethovenstraße 51 b
38106 Braunschweig
Phone: +49 531 391-62000
j.stahlmann@tu-braunschweig.de
www.igb-tubs.de

Mission Statement

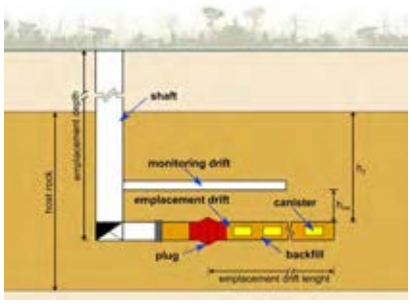
Geotechnics, the modern term for Soil Mechanics and Foundation Engineering, is an essential part of Civil Engineering, present in each engineering project. Due to the fact that all constructions are in interaction with the subsoil, the knowledge about the soil behavior and the soil-structure interaction is crucial. The complexity of the naturally-formed underground requires continuing research.

Research

Offshore Wind Energy: Offshore wind energy is an important factor in the field of renewable energy. Due to the lack of construction experience, intensive research in the field of horizontal and vertical bearing capacity of the foundation structures (mainly pile foundations) is carried out. Furthermore, another research field came up as a consequence of hydro sound emission during the installation process of these pile foundations. Impact pile driving causes acoustic waves in the water which injure marine mammals such as porpoises. The development and optimization of noise mitigation systems and the new method for installation of large piles through vibration are important research tasks. For this purpose, various in situ measurements were carried out followed by large-model scale tests at our test site.

Deep geological disposal of radioactive waste: What is the most suitable host rock for deep geological disposal? Which deep repository safety level is safe enough? How could monitoring data help to take the decision of retrieval? To answer these questions from a geotechnical point of view, intensive research regarding stress-strain and creep behavior of rock salt for geological repositories of radioactive waste are carried out. In order to test the long term safety requirement, the constitutive model TUBSsalt was developed, which is capable of considering the different phases of creep and failure of rock salt. Furthermore, different concepts for deep geological disposal of HLW with retrievability provisions and near field monitoring during the operational phase are being developed for some host rocks such as: rock salt, clay, claystone and crystalline hard rock.

Test site in Cuxhaven © VIBRO-project



Generic model of a deep geological repository of HLW

Publications

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- Gährken, A.; Missal, C.; Stahlmann, J.: A thermal-mechanical constitutive model to describe deformation, damage and healing of rock salt, Proceedings of the Conference on Mechanical Behavior of Salt, Saltmech VIII, 26-28 May 2015, South Dakota School of Mines and Technology, Rapid City, SD, USA, 2015
- Stahlmann, J.; Missal, C.; Gährken, A.: Interaktionen zwischen Abdichtungsbauwerk und Wirtsgestein im Steinsalz, Bautechnik, 92. Jahrgang, Heft 5, S. 370-376, Ernst & Sohn, Berlin, 2015
- Stahlmann, J.; Missal, C.; Edel, T.; Hahn, P.: Sustainable Lining in Incompetent Rock Mass using the Example of Konrad Mine, Proceedings of the European Rock Mechanics Symposium EUROCK15 / 64. Geomechanik Kolloquium, 07.-10. Oktober 2015, Salzburg, Österreich, 2015
- Stahlmann, J.; Gattermann, J.; Bruns, B.; Kuhn, C.; Stein, P.: Untersuchung und Erprobung von Hydro-Schall-Dämpfern (HSD) zur Minderung von Unterwasserschall bei Rammarbeiten für Gründungen von OWEA, Abschlussbericht, FKZ 0325365, 2015

Institute of Steel Structures

Prof. Dr. Klaus Thiele

- Head of Institute of Steel Structures, TU Braunschweig
- Acting Head of Institute for Building Preservation

Researcher's Career

- Full Professor for Steel Structures, TU Braunschweig
- Head of Design and Construction Office at Max Bögl Stahl- und Anlagenbau GmbH & Co. KG, Neumarkt
- Dr. sc. techn. at IBK, ETH Zürich
- M.E.Sc. at Boundary Layer Wind Tunnel Laboratory, University of Western Ontario, London, Canada
- Dipl.-Ing., Civil Engineering, TH Darmstadt

Funding

DFG, AiF, DAAD, Industry

Contact
Technische Universität Braunschweig
Institute of Steel Structures
Beethovenstraße 51
38106 Braunschweig
Phone: +49 531 391-3373
k.thiele@stahlbau.tu-braunschweig.de
www.stahlbau.tu-braunschweig.de

Mission Statement

Steel plays an increasingly important role for light-weight and wide-spanning Civil Engineering Structures with advantages in economy and sustainability. Our work includes fundamental research as well as application-oriented research – also in fields connected to Steel Construction such as Wind Engineering and Building Preservation

Research

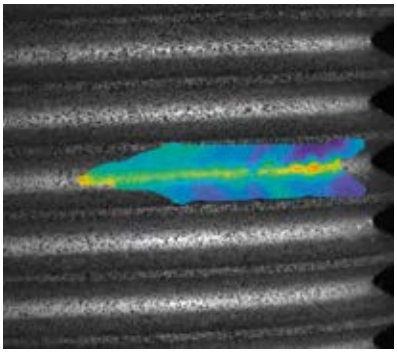
Remaining Service Life of Steel Structures: For existing bridges and crane structures, quantification of the expected remaining service life time is of great importance. No in-situ method is available to date for identification of pre-crack material ageing. Several approaches are investigated within this project.

Material Properties under very high strain velocity: High speed loading explosions impose severe damage to structures. Design methods are to be developed to ensure safe evacuation of buildings after such events. The current project classifies typical construction steel due to its properties under high speed loading to predict structural robustness.

Design of silo structures with eccentric discharging: Today's design of silo structures is not in all cases done with safe load assumptions. A numerical model for eccentric discharging behavior of silo content is developed. With this information, an engineering model for relevant loading of the silo structure ist to be developed.

Light Composite structures for housing and office buildings: As part of the Center for Light and Environmentally-Friendly Structures, Zeluba, new construction elements of steel or composite material are developed to meet goals of sustainability, as modular construction, rapid deployment, prefabrication, etc.

Three dimensional full-scale wind measurements on a 344 m high guyed mast: Until now, wind speed and wind direction have been described using line like arrangement of wind sensors vertically or horizontally. A new extended wind measuring system based on 48 3d-ultrasonic anemometers is installed along the guys of the mast. From these measurements, improved models are developed to describe the structure of the atmospheric boundary layer.



Publications

- Minuth-Hadi, F., Thiele, K.: Zur Durchführung von Hochgeschwindigkeitszugversuchen mit Hilfe servohydraulischer Schnellzerreißmaschinen an Baustählen. 20. DASt-Forschungskolloquium (2016), pp. 56-61.
- Pons, J., Thiele, K.: Entwicklung eines räumlichen Flächentragwerkes aus dünnwandigen Blechen. 20. DASt-Forschungskolloquium (2016), pp. 118-122.
- Höbbel, T., Thiele, K.: Three dimensional full-scale wind meaurements on a 344 m high guyed mast. 14th International Conference on Wind. Porto Alegre, Brazil (2015).
- Unglaub, J., Reininghaus, M., Thiele, K.: Zur Ermüdungsfestigkeit von feuerverzinkten Zugstäben mit Endgewinden. Stahlbau 84 (2015), p. 584.
- Unglaub, J., Reininghaus, Mathias und Thiele, Klaus: Betriebsfestigkeit von Zugstäben mit Endgewinden. 19. Dast-Forschungskolloquium (2014), pp. 154-157.

Institute of Geoecology – Climatology and Environmental Meteorology

Prof. Dr. Stephan Weber

- Dean of studies Geoecology/ Environmental Sciences (2013-2017)

Researcher's Career

- Full professor Climatology and Environmental Meteorology, TU Braunschweig
- Post-Doc, Applied Climatology and Landscape Ecology, University of Duisburg-Essen
- Dr. rer. nat. at the University of Duisburg-Essen
- PhD student, Applied Climatology and Landscape Ecology, University of Duisburg-Essen
- Diploma Thesis at Royal Netherlands Institute for Sea Research, Texel, Netherlands
- Study of Physical Geography and Climatology, Ruhr University Bochum

Funding
DFG, BMBF, State lower Saxony (MWK), industry

Contact
Technische Universität Braunschweig
Climatology and Environmental Meteorology, Institute of Geoecology
Langer Kamp 19c
38106 Braunschweig
Phone: +49 (0)531 391-5607
s.weber@tu-braunschweig.de
www.tu-braunschweig.de/geooekologie/institut/klima/

Mission Statement

Our group uses measurements and modelling to explore exchange processes of energy and mass between urban and non-built surfaces and the atmosphere. We study relationships between urban particle emission and meteorological influence to assess exposure variability of humans towards pollutants.

Research

Surface-atmosphere exchange and boundary layer processes: The atmospheric boundary layer is characterised by important exchange processes of energy, mass and pollutants between the surface and the atmosphere. These fluxes influence climate, the state of ecosystems or human well-being. We use the state-of-the-art eddy covariance technique to quantify exchange fluxes. The work in our group focuses on urban environments, but takes place also in natural ecosystems. Currently, we are studying exchange processes of heat, water and CO_2 between the urban atmosphere and green roofs as well as at a mountainous peatland site.

Urban Climatology: The climate of urban areas is significantly modified in comparison to non-built urban surroundings. The urban heat island is the most well known phenomenon of urban climate effects. We are interested in studying modifications of near-surface climate processes in urban environments and in analysing the relationship with urban structure and morphology. Our research addresses basic aspects of urban climatology but also looks into applied questions, e.g. benefits and urban ecosystem services of green infrastructure (cf. Figure).

Air quality and Aerosol research: Pollutants that are emitted into the atmosphere from different sources react and/or transform during atmospheric transport and residence. Due to a large number of sources especially in urban areas, the exposure towards particles is characterised by a large spatio-temporal variation. We assess particle exposure by using state-of-the-art measurement and modelling approaches to resolve particle concentration variability on the local urban scale. A current work models the transformation of particle number size distributions during atmospheric transport from roadside into the urban background.

Publications and Patents

- Heusinger J., Weber S. (2015). Comparative microclimate and dewfall measurements at an urban green roof versus bitumen roof. Building and Environment, 92: 713-723.
- von Bismarck-Osten C., Birmili W., Ketzel M., Weber S. (2015). Statistical modelling of aerosol particle number size distributions in urban and rural environments – a multi-site study. Urban Climate, 11: 51-66.
- Birmili, W., Sun, J., Weinhold, K., Merkel, M., Rasch, F., Wiedensohler, A., Bastian, S., Löschau, G., Schladitz, A., Quass, U., Kuhlbusch, T.A.J., Kaminski, H., Cyrys, J., Gu, J., Kusch, T., Flentje, H., Meinhardt, F., Schwerin, A., Bath, O., Ries, L., Gerwig, H., Wirtz, K., Weber, S. (2015). Atmospheric aerosol measurements in the German Ultrafine Aerosol Network (GUAN) - Part III: Black Carbon mass and particle number concentrations 2009-2014, Gefahrstoffe – Reinhaltung der Luft 11/12, 479-488
- Ruths M., von Bismarck-Osten C., Weber S. (2014). Measuring and modelling the local-scale spatio-temporal variation of urban particle number size distributions and black carbon. Atmospheric Environment, 96: 37-49
- Hussein T., Mølgaard B., Hannuniemi H., Martikainen J., Järvi L., Wegner T., Ripamonti G., Weber S., Vesala T., Hämeri K. (2014). Finger-Prints of Urban Particle Number Size Distribution in Helsinki – Finland: Local versus Regional Characteristics. Boreal Environment Research, 19: 1-20

Braunschweig Pavement Engineering Centre

Prof. Dr. Michael P. Wistuba

- Full Professor of Pavement Engineering, TU Braunschweig

Researcher's Career

- Head of Braunschweig Pavement Engineering Centre, TU Braunschweig
- Board member of the accredited testing laboratory for road-building materials according to the German guidelines RAP-Stra, Braunschweig
- Steering group member of the European Asphalt Technology Association (EATA)
- Scientific board member of Deutsches Asphaltinstitut (DAI)
- Scientific board member of the Swiss Expert Association for Road and Transport Engineering (VSS)
- Board member of Christian Doppler Laboratory for performance based optimization of flexible road pavements, TU Wien, 2003-2008
- Post-Doc research associate at Ecole polytechnique fédérale de Lausanne (EPFL, Switzerland), 2002-2003
- Ph.D. in Civil Engineering, TU Wien, 2002
- Research Associate at TU Wien, 1988-2008
- Diploma in Civil Engineering, TU Wien, 1989

Funding

EU, BMVBS, BASt, AiF, FFG, DAAD, Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute for Pavement Engineering Centre
Beethovenstraße 51 b
38106 Braunschweig
Phone: +49 531 391-62050
m.wistuba@tu-braunschweig.de
www.tu-braunschweig.de/isbs

Mission Statement

The major requirements of modern road pavements are safety, functionality and sustainability. Our research work focuses on these requirements, emphasizing the increase in durability of asphalt pavements by means of structural optimization for making the design, selection of materials and construction, rehabilitation & recycling techniques as fully perfect and effective as possible.

Research

Laboratory testing of road building materials: We run a well-equipped laboratory for testing asphalt materials, in particular for identifying the characteristics of the individual components (aggregate and bitumen) as well as of the composed mixtures. We use the latest test methods and are developing new performance-based methods. Thus, new recipes can be optimized, and asphalt quality can be assured.

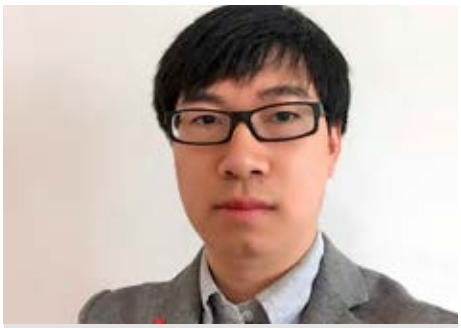
Modeling behavior of road materials and pavement structures: With help of the results from laboratory testing and by means of computer simulation of road pavement behavior under controlled climate conditions and under repeated loading, we predict short- and long-term performance of road materials and pavement structures. Our objective is to support the development and optimization of new road building materials and new methods for pavement design and road construction, rehabilitation & recycling techniques, considering the actual growth in heavy vehicle traffic, new trends in the automobile and tire industries, the effects of climate, as well as the changing availability of bitumen and the strong need for re-using reclaimed asphalts.

Developing tools for systematic pavement management: We are developing methods for pavement condition assessment and evaluation, as well as for systematic road maintenance. A major research focus is dedicated to improving the performance prediction functions within Pavement Management Systems (PMS) by considering the individual properties of the actual pavement materials and structures.

Publications and Patents

- Cannone-Falchetto, A., Moon, K. H. & Wistuba, M. 2014. Microstructural Analysis and Rheological Modeling of Asphalt Mixtures Containing Recycled Asphalt Materials. Materials, Int. Journal, MDPI editions, Special Issue Recycled Materials vol. 7, pp. 6254-6280, open access publication, doi:10.3390/ma7096254, ISSN 1996-1944, www.mdpi.com/journal/materials.
- Cannone Falchetto, A., Wistuba, M. & Marasteanu, M. Size effect in asphalt mixture at low temperature: Type I and Type II. Proc., Association of Asphalt Paving Technologists Annual Meeting, March 13-16, 2016, Indianapolis.
- Büchler, S., Wistuba, M. & Cannone-Falchetto, A. 2015. Evaluation of crack propagation in asphalt mixture through photoelasticity. Proc., 8th Int. RILEM SIB Symposium, Testing and Characterization of Sustainable & Innovative Bituminous Materials, October 7-9, 2015, Ancona, Italy.
- Isailović, I., Cannone-Falchetto, A. & Wistuba, M. 2015. Energy Dissipation in Asphalt Mixtures Observed in Different Cyclic Stress-Controlled Fatigue Tests. Proc., 8th Int. RILEM SIB Symposium, Testing and Characterization of Sustainable & Innovative Bituminous Materials, October 7-9, 2015, Ancona, Italy.
- Wistuba, M., Weninger-Vycudil, A., Ringleb, A., Mladenovic, G. & Litzka, J. 2013. "InteMat4PMS" – Integration of material-science based performance models into life-cycle-analysis processed in the frame of pavement management systems. Final report, No 832708, ERAnet-Road II.

Institute for Building Materials, Solid Construction and Fire Protection
Department of Organic and Wood-based Construction Materials



Prof. Dr. Libo Yan

- Assistant Professor of Department of Organic and Wood-based Construction Materials, iBMB, TU Braunschweig

Researcher's Career

- Assistant professor of Department of Organic and Wood-based Construction Materials at Institute of Building Materials Concrete Construction and Fire Protection (iBMB) at Technical University of Braunschweig
- PhD in Civil Engineering, University of Auckland, New Zealand
- Master of Science in Structural Engineering from Cardiff University, United Kingdom
- Bachelor of Engineering in Civil Engineering from Chongqing University, China
- Recipient of several international/national awards, such as Vice-Chancellor's Prize for Best Doctoral Thesis (2014) from the University of Auckland, Chinese Government Award for Outstanding Self-financed Student Abroad from China Scholarship Council (2014)

Funding
DFG

Contact
Technische Universität Braunschweig
Dep. of Organic and Wood-Based Construction Materials
Hopfengarten 20
38102 Braunschweig
Phone: +49 531 22077-25
l.yan@tu-braunschweig.de
www.ibmb.tu-braunschweig.de/index.php/fachgebiet-fgo.html

Mission Statement

We are devoted to developing an designing future environmentally-friendly construction and building materials and structures with lower carbon footprint from construction and building demolition and agricultural wastes.

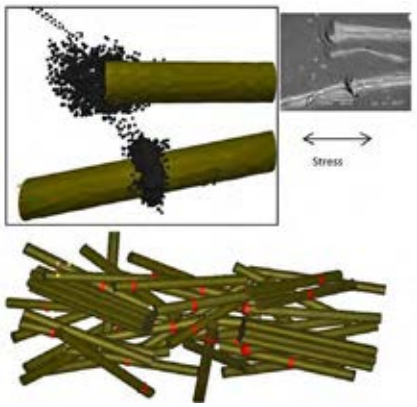
Research

Application of Construction and Agricultural Wastes in Infrastructure: Our group is one of the leading German institutes to utilize agricultural waste, i.e. plant-based natural fibres and their reinforced polymer composites, for infrastructure application. Our research covers material characterization, structural design and numerical simulation of natural fibre reinforced composite materials and the application of these materials to replace synthetic fibre reinforced composite materials. Currently we are also focusing on reuse and recycle of construction and building demolition wastes.

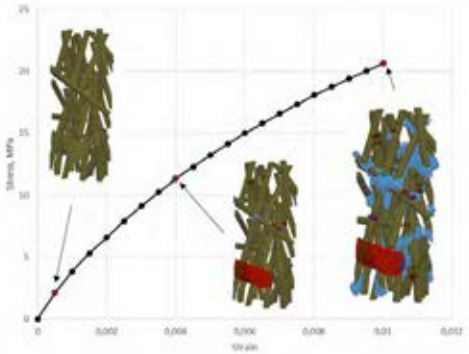
Design and Modeling of Hybrid Structures in Infrastructure: We design, model and characterize hybrid structures combining Fibre Reinforced Polymer (FRP) composite materials with conventional construction and building materials such as steel, concrete and timber to be light-weight and environmentally-friendly structures with high performance.

Crashworthiness Design of Composite Structures for Automotive Engineering: We develop, design and model crashworthy structures with lightweight and high strength composite materials for automotive engineering application. Currently we are using composite materials such as glass, basalt and flax FRP composites.

Ageing Investigation of Construction and Building Materials: We focus on the durability and ageing investigation of conventional and novel construction and building materials such as natural fibre, natural fibre reinforced polymer and natural fibre reinforced cementitious composites, concrete and recycled aggregate concrete. Currently we are studying the long-term durability of natural fibre and their fibre reinforced polymer and cementitious composites subjected to various accelerated environmental weathering conditions.



Numerical simulation of short natural fibre reinforced polymer composites in tension



Publications

- Yan LB*, Chouw N, Huang L, Kasal B. Effect of alkali treatment on microstructure and mechanical properties of coir fibres, coir fibre reinforced-polymer composites and reinforced-cementitious composites. Construction and Building Materials 2016;112:168-182
- Yan LB*, Kasal B, Huang L. A review of recent research on the use of cellulosic fibres, their fibre fabric reinforced cementitious, geo-polymer and polymer composites in civil engineering. Composites Part B: Engineering 2016;92:94-132
- Huang L, Yin P, Yan LB*, Kasal B. Behavior of hybrid GFRP-porous-steel tube-encased concrete column under uniaxial compression. Composite Structures 2016;142:313-324
- Huang L, Yan B, Yan LB*, Tan HZ, Kasal B. Reinforced concrete beams strengthened with externally bonded natural flax FRP plates. Composites Part B: Engineering 2016;91:569-578
- Sliseris J, Yan LB*, Kasal B. Numerical modelling of flax short fibre reinforced and flax fibre fabric reinforced polymer composites. Composites Part B: Engineering 2016;89:143-154.

Institute for Building Materials, Concrete and Fire Protection (iBMB)

Prof. Dr.-Ing. Jochen Zehfuß

Researcher's Career

- Full Professor for Fire Protection at Institute for Building Materials, Concrete Structures and Fire Protection (iBMB), TU Braunschweig
- Convenor of DIN standard committee for Fire Safety Engineering
- Member of CEN standard committees for Fire safety Engineering
- Member of management and shareholder of hhpberlin fire safety engineers
- PhD at TU Braunschweig, Department of Civil Engineering
- Scientific Assistant at Institute for Building Materials, Concrete Structures and Fire Protection, TU Braunschweig
- Study of Civil Engineering at TU Braunschweig

Funding

DFG, BMBF, BMWi, AiF, industry

Contact

Technische Universität Braunschweig
Institute for Building Materials, Concrete and Fire Protection (iBMB)
Division of Fire Protection
Beethovenstraße 52
38106 Braunschweig
Phone: +49 531 391-5441
j.zehfuss@tu-braunschweig.de
www.ibmb.tu-braunschweig.de/index.php/fachgebiet-fgb.html

Mission Statement

The focus of our work is the development of fire-safe buildings. Therefore we combine experimental research as well as numerical modelling in the field of structural fire engineering and fire dynamics.

Research

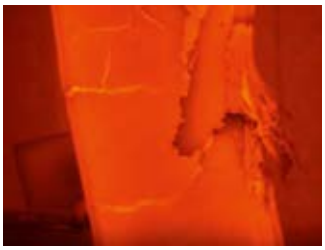
Research of fire propagation and heat release of combustible substances: We investigate experimentally the pyrolysis, fire propagation and development of pollutants during real fires. The experimental results will be used for further development and validation of numerical models for fire propagation and evacuation.

Fire behavior of renewable building materials: Lightweight construction and usage of renewable materials ensure sustainable buildings. With regard to the fire protection lightweight constructions rapidly heat up, renewable materials are combustible. We examine suitable constructions and protective materials to achieve the protection objectives of sustainability as well as fire safety.

Fire behavior of façade systems: A rapid fire propagation through façades can make a fire uncontrollable. Combustible substances in the façade system have to be protected through appropriate measures. The above-mentioned measures are researched through experimental and numerical examinations.

Natural fires and safety concepts for fire safety design: Examination of the influencing parameters and development of natural fires and their modelling as well as development of a safety concept comprising the design approach is a research area.

High-temperature behavior of concrete elements: The loss of strength of high-performance concrete and ultra-high-performance concrete at higher temperatures is progressing faster than normal concrete and the tendency of spalling increases. We perform basic studies on thermal and thermomechanical behavior of high- and ultra-high-performance concrete. Also, the material behavior during the cooling phase of fire, which has not been widely studied, is the subject of research at iBMB.



Publications

- Zehfuß, J.; Riese, O.; Northe, C.; Küppers, J.: Experimentelle und numerische Erkenntnisse zum Brandverhalten von WDVS-Fassaden auf Polystyrol-Basis. In: Bauingenieur 90 (2015), december.
- Zehfuß, J.; Siemon, M.: Numerische Analyse brandbeanspruchter Stützen aus ultrahochfestem Beton (UHPC). In: Bautechnik 92 (2015), Journal 5, Bautechnik 92 (2015), pp. 335-345.
- Zehfuß, J.; Riese, O.: Anwendung von Brandsimulationsmodellen für die Berechnung der thermischen Einwirkungen im Brandfall und der Rauchableitung. In: Fouad, N. (Hrsg.):Bauphysik Kalender 2015. Verlag Ernst & Sohn, Berlin.
- Zehfuß, J.; Felix, D.: Fire behaviour of precast prestressed concrete floor slabs : theoretical and expermental evaluation = Brandverhalten von Spannbeton-Fertigdecken : theoretische und experimentelle Untersuchungen. In: BFT International 81(2015), H. 2, pp. 106-107.
- Zehfuß, J.; Klinzmann, C.; Paliga, K.: Performance-Based Fire Safety Design of Special Structures in Germany. In: Journal of Structural Fire Engineering 5(2014), no. 2 (June), pp.125-134.

4

Mechanical Engineering

Chair of Entrepreneurship

Prof. Dr. Reza Asghari

- Director of Entrepreneurship Center
- CEO Academic Ventures GmbH & CO KG

Researcher's Career

- Regular professorship of joint chair for Entrepreneurship at Technische Universität Braunschweig and Ostfalia University, Braunschweig/Wolfenbüttel
- Endowed Professorship Entrepreneurship and Business Creation at Technische Universität Braunschweig and Ostfalia University, Braunschweig/Wolfenbüttel
- Professor for business administration, internet economy and e-business at Ostfalia University, Wolfenbüttel
- Research assistant at the Institute for Economics, Braunschweig
- Study of Business Administration Computer Science, Braunschweig

Funding

BMWI, State Lower Saxony,
Local Gorvernments, Private Sector

Contact

Technische Universität Braunschweig
Entrepreneurship Center
Schleinitzstraße 20 | Raum 224
38108 Braunschweig
Phone: 0531 391-4263
r.asghari@tu-braunschweig.de
www.entrepreneurship-center.de

Mission Statement

Developing and implementing an entrepreneurial mindset. Development of skills and methods to conceptualize and implement innovative business models. Linking the research results with knowledge application through disruptive start-ups

Research

Technology Entrepreneurship: The process of commercialization of research results runs through several protracted stages in which the technology has to accommodate itself to customer requirements.
We analyze and develop methods to transfer the technology knowledge into innovative products and services.

Institutional Analysis of Entrepreneurship: The entrepreneurship process needs an appropriate institutional framework which enables the individuals to implement their creative ideas fluently into the market. Entrepreneurial mindset, entrepreneurship governance, availability of venture capital and tax rules belong to the main institutional determinants.

Entrepreneurial University: In the context of a knowledge driven economy we analyze the role and function of universities and research centers in the process of creative destruction. Holistic concepts which empower universities to breed innovative spin-offs are in the focus of our research work. Appropriate entrepreneurship education plays a key role for entrepreneurial universities. University entrepreneurship rules contribute to accelerate the entrepreneurship transformation.
Green Entrepreneurship: We take those university spin-offs under focus which contribute to energy saving, recycling technologies and environment protection. We analyze the business model requirements for Green Start-ups and research on specific requirements with respect to customer segment and price models.

Technology Business Model
istock © kemalbas

Publications

- Asghari, R. Political Entrepreneurship, in: Handbuch Entrepreneurship, Günter Faltin (Hrsg.), Springer Verlag, 2016
- Asghari, R., Erol, O. The role of universities in fostering knowledge-intensive start-ups, International Conference on Industrial Management 2015, Singapore
- Asghari, R., Wilgeroth, D. Crowd Funding, How German Start-ups evaluate Crowd-Funding, An Empirical Research, 2015
- Asghari, A., Gedeon, S. Significance and Impact of Internet on the Entrepreneurial Process: E-Entrepreneurship and Completely Digital Entrepreneurship In: Kakouris, A. - Proceedings of the 5th European Conference on Innovation and Entrepreneurship ECIE 2010, Athens (Greece), 2010
- Asghari, R., Becks, M. Konventionen unbedingt brechen: Bestimmungsfaktoren nachhaltiger Unternehmensgründung. In: economag, Wissenschaftsmagazin für Betriebs- und Volkswirtschaftslehre. 07/2010

Maria-Goeppert-Mayer Professorship for "Gender, Technology and Mobility"

Prof. Dr.-Ing. Corinna Bath

Researcher's Career

- Maria-Goeppert-Mayer Professor for "Gender, Technology and Mobility" at the Institute for Flight Guidance TUBS and at the Ostfalia University for Applied Sciences
- Guest Professor for Gender Studies in Engineering at TU Berlin
- Postdoctoral Researcher in the DFG doctoral research program "Gender as a Category of Knowledge" at HU Berlin
- Dr.-Ing. University of Bremen, Computer Science
- Research fellow at the IAS-STS Graz and the University of Lancaster
- Research projects and teaching at German and Austrian universities
- Study of mathematics, computer science and political science at FU Berlin and CAU Kiel

Funding

MWK, BMBF, Volkswagenstiftung

Contact

Technische Universität Braunschweig
Institute for Flight Guidance
Hermann-Blenk-Str. 27
38108 Braunschweig
Phone: 0531 391-9835
c.bath@tu-braunschweig.de
www.tu-braunschweig.de/gtm

Mission Statement

Located in mechanical engineering, "Gender, Technology and Mobility" research provides solutions for societal, scientific and economic challenges by drawing upon innovative, sociotechnical methodologies. We understand gender as socially diverse, i.e. entangled with other categories of social inequality such as age, ability, race and class.

Research

Research at the intersection of gender, technology and mobility mediates between engineering and gender analyses. Gender Studies uncovers and questions gender stereotypes in engineering. Technology research & innovation inevitably entails in-/exclusions of particular users and their life worlds. Product development requires decisions for certain functions, features and designs over alternatives. Our research aims at enhancing research and innovation in engineering in order to build socially sustainable technologies for a mobile society.

Diffractive Design: The aim is to develop a methodology for designing technological artifacts that integrates fields such as gender and queer studies, science and technology studies, and participatory design.

GenderING: Gender Studies into Engineering Sciences: The project aims at integrating gender studies into engineering courses. This shift in the content of courses requires a didactical reconceptualization based on research-oriented and problem-based learning. The project was first realized in 2014/15 in the course lecture "Introduction to car body development" at the Institute for Engineering Design.

Interferences (diffractions) as a metaphor for a non-hierarchical entanglement of gender studies and engineering.

Source: www.piqs.de. Photo Scott Robinson, Constructivve Interference, CC-Lizenz (BY2.0)

Gendered mobility patterns and sociotechnical challenges of fully automated driving: Mobility shows several gendered patterns. City planners and technology designers tend to assume that people commute from home to work and back. Individuals caring for the elderly or children usually follow chains of travel and are often overlooked. Another gendered pattern relates to affect in driving. Such aspects are explored in an ethnographic study on self-driving car research.

Gender knowledge in and between disciplines: Using an interdisciplinary comparative approach, this joint research project with the University of Oldenburg (ZGS) analyses how implicit and explicit knowledge of gender was integrated or rejected from fine arts, musicology, biology, and computer science.

Publications

- Bath, C./Both, G./Lucht, P./Mauß, B./Palm, K. (eds) (2016): rebootING. Handbuch Gender-Lehre in den Ingenieurwissenschaften. LIT-Verlag
- Bath, C./Draude, C. (2015): Diversifying a Car Body Development Course. Integrating Intersectional Gender Studies Expertise in Engineering Education. In: 43rd Annual SEFI-Conference June 29-July 2, 2015 Orléans, France
- Bath, C. (2014): Diffractive Design. In: Marsden, N./Kempf, U. (Eds.): GENDER-UseIT. HCI, Usability und UX unter Gendergesichtspunkten. De Gruyter, Oldenbourg, S. 27-36
- Bath, C./Meißner, H./Trinkaus, S./Völker, S. (2013): Geschlechter Interferenzen. Wissensformen – Subjektivierungsweisen – Materialisierungen. LIT-Verlag
- Bath, C. (2013): Searching for methodology. Feminist technology design in computer science. In: Ernst, W./Horwath, I. (Eds.): Gender in Science and Technology. Interdisciplinary Approaches, transcript, Bielefeld, 57-78

Institute for Traffic Safety and Automation Engineering

Managing Director
Dr.-Ing. Uwe Becker

Researcher's Career

- Head of Institute of Traffic Safety and Automation Engineering
- Member of the Automotive Research Centre Niedersachsen (NFF)
- Dr.-Ing. at TU Braunschweig
- Research- and Development Engineer FWM Mainz
- Dipl.-Ing., Mechanical Engineering, TU Braunschweig

Funding

DFG; BMBF; BMWi; EU; Industry

Contact

Technische Universität Braunschweig
Institute for Traffic Safety and
Automation Engineering
Hermann-Blenk-Straße 42
38108 Braunschweig
Phone: +49 531 391-66300
u.becker@tu-braunschweig.de
www.iva.ing.tu-bs.de

Mission Statement

Traffic safety and automation engineering are essential for mobility and economics. The mission of the institute is to contribute to traffic safety by adapting automation principles to road and rail, and make use of the most advanced technologies, description means, methods and tools.

Research

Traffic is a highly complex form of expression of modern society, that encompasses human, technological, economic, political, and environmental relevance, as well as scientific aspects. Consequently, traffic safety is in itself a very comprehensive term, which needs to be carefully analyzed and specified in its complexity. Traffic safety must be developed methodically in order to achieve an integral approach for research and teaching based on systems thinking. The institute develops an approach based on structural and methodical concepts from the terminology of traffic safety, its goals and perspectives. Therefore, the institute performs research in the following fields:

- Examination of safety characteristics, potential risks of automation and assistance systems in land traffic. Especially the interdependency of local and global functions, i.e. technological and operator executed functions, are the objective of research.
- Investigation of economic and legal questions related to construction degree, heterogeneity, technology migration, commitment and surveillance, financing, and organization responsibility.
- Improvement of safety through information and communication technologies regarding different criteria of traffic safety. These must be qualified, quantified and disclosed in a functional interactive structure of the control systems involved. The aim is an inherent stabilization of traffic flow through decentral realization and automation.
- Methodical analysis and qualification of traffic control and safety systems and applications in combination with quality assurance and its development. This encompasses research of practical use of formal techniques for construction and certification of reliable and safe systems in combination with the development of safety relevant requirements. The aim is to generate safety from the development process onwards.

Experimental vehicle „CarLa"

Publications

- Diekhake, P.; Kurczveil, T.; Becker, U. (2016): Modelling and simulation of distributed time critical communication and control systems in vehicles or vehicle networks. 14-th IFAC Symposium on Control in Transportation Systems, Istanbul, Türkei.
- Manz, H.; Spiegel, D.; Becker, U. (2016): Certification of a satellite based localization unit for safe localisation unit in railways based on according requirements. 2016 European Navigation Conference, Helsinki, Finnland
- Hosse, R. S.; Becker, U. (2015): Entwicklung der Straßenverkehrssicherheit bis ins Jahr 2020 – Eine Prognose mittels Grey Systems Theory. Zeitschrift für Verkehrssicherheit. 2015(03)
- Quiroga, L. M.; Becker, U.; Schnieder, E. (2014): Das Petrinetz Modellierungs- und - analysetool Pi-Tool. at - Automatisierungstechnik. 62(6), pp. 436-445
- Becker, U.; Schori, M.; Böhme, T. J.; Schultalbers, M. (2013): Verfahren zur Lösung von hybriden Optimalsteuerungsproblemen und deren Anwendung auf den Betrieb von Hybridfahrzeugen. at - Automatisierungstechnik. 61(12), pp. 831-839

Institute of Solid Mechanics

Prof. Dr.-Ing. Markus Böl

Researcher's Career

- Full Professor for Solid Mechanics at the TU Braunschweig
- Temporary head of the Institute of Solid Mechanics at the TU Braunschweig
- Postdoc research at the Stanford University
- Assistant professor for Polymer Mechanics, Biomechanics, and Numerical Mechanics at the TU Braunschweig
- Postdoc research at the Stanford University
- Postdoc research at the TU Braunschweig
- Dr.-Ing. at the Ruhr University of Bochum
- Research Assistant at the Chair of Numerical Mechanics and Simulation Technique, Ruhr University of Bochum
- Study of civil engineering, degree Dipl.-Ing. Technical University of Dortmund

Funding

DFG, State Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute of Solid Mechanics
Schleinitzstraße 20
38106 Braunschweig
Phone: +49 531 391-7052
m.boel@tu-braunschweig.de
www.tu-braunschweig.de/fm

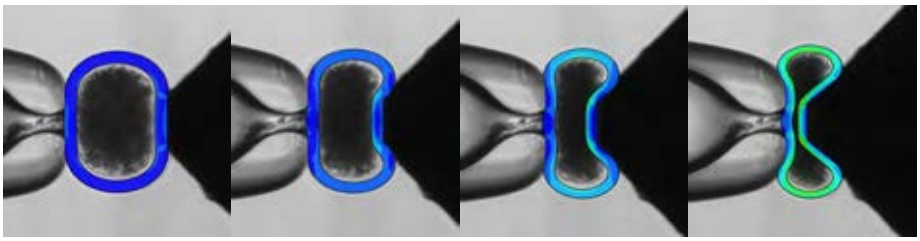
Mission Statement

Based on novel multi-scale experimental techniques used at various levels from micro to macro scale we develop capable multi-scale/multi-field numerical models for the description of different partly living materials.

Research

Multi-scale/multi-field modelling: For most biological materials it is essential to consider beside different length scales also different fields, like temperature, electrical potentials, or chemical variables. For example, in the contraction process of smooth muscle cells, different fields such as an electrical potential and various chemical variables such as calcium are involved. To describe the contraction process of such muscles in an adequate way, these fields (multi-field) have to be considered at different length scales (multi-scale).

Multi-scale/multi-field experiments: The numerical description of biological materials such as skeletal muscles, smooth muscles, or various soft tissues need the knowledge of their structural behaviour at different length scale and under different states, e.g. during growth processes or under passive and active conditions. Therefore, novel and advanced experimental techniques are indispensable for measuring the mechanical characteristics at all required length scales.



Homogenisation Techniques: An essential point in the framework of multi-scale/multi-field modelling is knowledge about the transfer of information between the different length scales for various fields. Therefore, the development of adequate homogenisation techniques is necessary.

Growth modelling: One special feature of biological, living materials is their ability to grow. Growth phenomena are of special interest, since during growth various processes take place. Here we focus on volume growth and remodelling effects, as well as their influence on the mechanical behaviour at different length scales.

Publications

- M. Böl, K. Leichsenring, M. Ernst, C. Wick, R. Blickhan, T. Siebert, Novel microstructural findings in m. plantaris and their impact during active and passive loading at macro level, J Mech Behav Biomed Mater, 51, 25-39, 2015
- T. Siebert, K. Leichsenring, C. Rode, C. Wick, N. Stutzig, H. Schubert, R. Blickhan, M. Böl, Comprehensive rabbit calf muscle properties for simulation studies, PloS ONE, 10, e0130985, 2015
- M. Böl, A. E. Ehret, K. Leichsenring, C. Weichert, R. Kruse, On the anisotropy of skeletal muscle tissue under compression, Acta Biomater, 10, 3225-3234, 2014
- M. Böl, A. Bolea Albero, On a new model for inhomogeneous volume growth of elastic bodies, J Mech Behav Biomed Mater, 29, 582-593, 2014
- A. Bolea Albero, A. E. Ehret, M. Böl, A new approach to the simulation of microbial biofilms by a theory of fluid-like pressure-restricted finite growth, Comput Methods in Appl Mech Eng, 272, 271-289, 2014

Institute of Joining and Welding (ifs)

Prof. Dr.-Ing. Klaus Dilger

- CEO of the Open Hybrid LabFactory
- Member of the working group „Klebtechnik" (adhesive bonding technology) of Deutsches Institut für Bautechnik (DIBt – German institute for structural engineering)
- Chairman of Clausthaler Zentrum für Materialtechnik (CZM- Clausthal center for material technology)
- Member of the board of Produktionstechnisches Zentrum Niedersachsen (PZN – production technology center Lower Saxony)
- Board member iTUBS GmbH (Transfergesellschaft TU Braunschweig)

Researcher's Career

- Director of the Institut für Füge- und Schweißtechnik (Institute of Joining and Welding) of the TU Braunschweig.
- Appointed Professor for Adhesive Bonding Technology at the RWTH Aachen
- Manager of NRW TC-Kleben GmbH
- Research assistant at the Institute of Joining Technology, TU Munich
- Study of mechanical engineering at the TU Munich

Funding
DFG, BMBF, EU, State Lower Saxony, Industry

Contact
Technische Universität Braunschweig
Institut für Füge- und Schweißtechnik (ifs)
Langer Kamp 8
38106 Braunschweig
Phone: +49 391-95500
ifs-bs@tu-braunschweig.de
www.ifs.tu-braunschweig.de

Mission Statement

Joining of different parts and different materials is essential for modern products and a modern production. Especially in the field of lightweight design the joining technique is of special importance. The ifs incorporates relevant knowledge into the education of Bachelor's and Master's Degree students and is one of the leading research institutes in this field.

Research

Adhesive Bonding: The research in this field focuses on the bonding process and the properties of bonded parts. Here the whole process chain is a core research item. Bonded parts can be characterized comprehensively. Numerical simulation is used to predict the behavior of bonded parts under complex conditions.

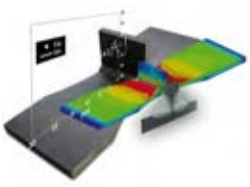
Composite Technologies: Main research subjects are: Pre-forming; binder activation; surface activation of fiber composites; joining and failure behavior of sandwich structures; quick process-integrated fixation and handling of pliable textiles.

Strength and Component Behaviour: The whole range from small samples to complete parts can be tested under various loads. Reliable determination and prognosis of residual stresses in components are used to improve the fatigue properties.

High-Pressure Die Casting: Welding and adhesive bonding of aluminum die casted parts; investigations into the service life of die casting molds; energy balance of die-casting processes are investigated in this research field.

Beam Technology: Electron and laser beam welding - among others – is used to weld duplex materials, aluminum die casted parts, nickel-based materials. Laser beam welding under vacuum is investigated, lasers are also being used for different surface preparations.

The institute is a member of the Open Hybrid LabFactory as well as the Battery LabFactory. In addition, the long-time research activities in the field of joining technologies for aluminum die casting components are concentrated in the light metal center Soltau founded in 2014.

Publications and Patents

- Stammen E, Dilger K. Adhesive bonding of textiles applications. In: Jones I, Stylios GK. Joining textiles: principles and applications. Oxford [u.a.]: Woodhead Publ.; p. 275-308, 2013
- Dilger K, Kreling S. Adhesive bonding techniques for advanced high-strength steels (AHSS). In: Shome M, Tumuluru M, editors. Welding and Joining of Advanced High Strength Steels (AHSS). Cambridge, UK: Woodhead Publishing; 2015. p. 167-79.
- Dilger, K.: Automobiles. In: Adams RD. Adhesive bonding : science, technology and applications. Boca Raton [u.a.]: CRC Press [u.a.]; 2005. p. 357-385. ISBN 1 85573741 8
- Dilger, K.: Selecting the right joint design and fabrication techniques. Advances in structural adhesive bonding. D. A. Dillard. Boca Raton, Fla. [u.a.], CRC Press [u.a.]: 295-315. ISBN 978-1-4398-0217-5, 2010
- C. Schwenk, M. Rethmeier, K. Dilger, V. Michailov: Sensitivity Analysis of Welding Simulation depending on Material Properties value Variation. Hrsg: Cerjak, H., Bhadeshia, H.K.D.H., E. Kozeschnik.: Mathematical Modelling of Weld Phenomena Bd. 8, Verlag der Technischen Universität Graz

- DE 102007009124 B4 2011.11.03 – Induction-assisted production method
- DE 000004436701 A1 – Machine-readable optical coding for transfer of information
- DE 10 2007 006 702 B4 2015.10.01 – Method for the evaluation of the preform quality for fibre-reinforced parts

Institute for Advanced Industrial Management

Prof. Dr.-Ing. Uwe Dombrowski

Researcher's Career

- Executive Director, Institute for Advanced Industrial Management, TU Braunschweig
- Chairman of the board for the German conference on After Sales Service, Chairman of the Braunschweig Symposium on Lean Production Systems and board member of the German conference for factory planning
- Board member of the Association for Organisation (GFO)
- Board member of the the Academic Society for Work and Industrial Organization (WGAB)
- Chairman of the VDI working group on Lean Production Systems
- Vice President of the European Academy for Industrial Management (AIM)
- Dr.-Ing. at the University of Hanover
- Study of mechanical engineering at the University of Hanover

Funding

DFG, BMUB, AiF

Contact

Technische Universität Braunschweig
Institute for Advanced
Industrial Management
Langer Kamp 19
38106 Braunschweig
Phone: +49 531 391-2710
ifu@tu-braunschweig.de
https://www.tu-braunschweig.de/ifu

Mission Statement

We undertake continuous, dedicated and application-oriented research and teaching in the fields of Factory Planning (digital planning tools) and Ergonomics (Human- Machine-Cooperation), Lean Production Systems and After Sales Service and successfully put our knowledge into practice.

Research

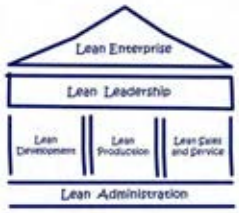
The IFU is an integral part of the institutes of production and systems engineering within the Department of Mechanical Engineering. It undertakes application-oriented research in cooperation with industrial partners.

Research at the IFU is focused on the following three subjects: "Factory Planning and Ergonomics", "Lean Production Systems" and "After Sales Service". The support functions of "Information Management and Systems", "Simulation" and "Business Process Analysis and Optimization" are constant cross sectional functions throughout all three areas of research. Due to close cooperation with the industrial partners all research activities are aimed at practical solutions.

Factory planning and ergonomics deals with the systematic design of factories from enterprise analysis to production ramp-up, taken into consideration human factors and ergonomics. Research fields are "Digital factory, Digital tools in factory planning", "Simulation and virtual reality in factory planning", "Flexible, versatile, temporary and mobile factories". In addition, fields of research are "Examination of the applicability of virtual reality in work system design", "Application of ergonomic methods in the implementation of lean production systems" and "Age-appropriate design of work systems".

The research field Lean Production Systems deals with a company's organisational processes. The essential topics in this area are process management, knowledge management, project management and quality management and their integration. The aim is to develop the company to a lean enterprise in which all company areas are using concepts for Continuous Imrovement Processes. Areas of research are "Integration of knowledge and process management", "Conception of lean production systems", "Lean Leadership" and "Lean Development"

The working group "After Sales Services" focuses on the service and logistics of the after-market. From a customer point of view, the field gains more and more importance and is a crucial reason for buying. Fields of research in this working group are "Lean After Sales Service", "Development of strategies for SMEs in the field of after-series supply", "Lean logistics", "Forecasting methods for defective parts" as well as "Strategies for spare parts supply".



Publications

- Dombrowski, U. (Ed.): Lean Development: Aktueller Stand und zukünftige Entwicklungen, Springer-Verlag, Berlin, 2015
- Dombrowski, U.; Mielke, T. (Ed.): Ganzheitliche Produktionssysteme: Aktueller Stand und zukünftige Entwicklungen. Springer-Verlag, Berlin, 2015
- Dombrowski, U.; Intra, C.; Zahn, T.; Krenkel, P.: Manufacturing Strategy – A Neglected Success Factor for Improving Competitiveness. 48th CIRP Conference on Manufacturing Systems, 24.06.-26.06.2015, Ischia (Naples), Italy
- Dombrowski, U.; Malorny, C.: Lean After Sales Service – An Opportunity for OEMs to Ensure Profits In: Grabot, B.; Vallespir, B.; Gomes, S.; Bouras, A.; Kiritsis, D.: Advances in Production Management Systems. Innovative and Knowledge-Based Production Management in a Global-Local World (Part II), Springer Verlag, Berlin, 2014
- Dombrowski, U.; Mielke, T.: Lean Leadership: 15 rules for a sustainable lean implementation. 47th CIRP Conference on Manufacturing Systems, 2014

Institute of Machine Tools and Production Technology (IWF)

Prof. Dr.-Ing. Klaus Dröder

- AiF reviewer in “Design and Manufacturing”
- Board member of the Automotive Research Centre Niedersachsen (NFF)
- Founding director of the Open Hybrid LabFactory e.V.
- CEO of Institute of Machine Tools and Production Technology (IWF)

Researcher’s Career

- Full professor for Production Technology and Process Automation, TU Braunschweig
- Head of “Vehicle Research”, R&D, Volkswagen AG
- Director of the Automotive Research Centre Niedersachsen (NFF) in Braunschweig
- Head of “Manufacturing technology and Production concepts”, R&D, Volkswagen AG
- Project Manager, R&D, Volkswagen AG
- Promoted to Dr.-Ing. at Institute of Metal Forming and Forming Machines, Leibniz Universität Hannover
- Studies in Mechanical Engineering at TU Braunschweig and Leibniz Universität Hannover, specialization: production technology and automotive engineering, degree Dipl.-Ing. at Leibniz Universität Hannover

Funding

BMBF, BMWi, DFG, State Lower Saxony, EFRE, Industry

Contact

Technische Universität Braunschweig
Institute of Machine Tools and Production Technology (IWF)
Langer Kamp 19 B | 38106 Braunschweig
Phone:+49 531 391 7600
k.droeder@tu-braunschweig.de
www.iwf.tu-bs.de

Mission Statement

Besides the thorough knowledge of technology, the demand for high flexibility with rising requirements on quality and productivity is a major driver for innovation and our research. Aiming at achieving cost efficient, convertible factories and production, we cooperate with leading national and international universities and companies to explore future production technology.

Research

Manufacturing Technologies: In order to meet the challenges of modern production, we do research on machining, starting with chip formation through to systems engineering. Our research includes process simulation, control and analysis, and the examination of dynamic and thermal machine behavior including the necessary measurement and sensor technology. In order to achieve products with multiple features we develop processes and machine tools for the manu-
facturing of functionalized surfaces, e.g. micro-cutting, -grinding, -drilling, polishing and superfinishing. Furthermore, we also focus on honing processes and the development of micro machine tools. Finally, we are one of the few institutes being concerned with the machining of wood and composite materials. We collect and classify dust and chips and evaluate machining processes acoustically.

Production Automation of Manufacturing Processes: Due to globalization, production faces completely new conditions, which lead to new economic and technological requirements for processes and machines. We develop new solutions in the research fields automation for hybrid lightweight construction and battery production, for robots and humans in production, for sensor-controlled and precision assembly. We have developed wide-ranging system competence for highly dynamic and high-precision applications. Our strengths lie in conceptual design, modelling and construction, automation-oriented process design, control and algorithm development, technical equipment evaluation and didactics for automation and assembly concepts.

Lightweight Production and Mold Technologies: With the growing pressure for action to implement sustainable products and production processes in many technology fields such as automotive engineering, aerospace or civil engineering, the implementation of lightweight construction strategies becomes increasingly important. In the field of lightweight production, we examine hybrid components as well as the necessary intelligent and functionalized tooling and mold technologies in order to implement new production technologies of function-integrated lightweight components. Our focus is on manufacturing processes and process chains, mechanical pre-treatment processes, subsequent machining and simulation along the



Publications

- T. Große, M. Winter, S. Baron, H.-W. Hoffmeister, C. Herrmann, K. Dröder. Honing with polymer based cutting fluids. In: CIRP Journal of Manufacturing Science and Technology, Elsevier, 2015, 11, pp. 89–98, DOI 10.1016/j.cirpj.2015.09.001.
- H. Kunz, C. Löchte, F. Dietrich, A. Raatz, F. Fischer, K. Dröder, K. Dilger. Novel form-flexible handling and joining tool for automated preforming. In: Science and Engineering of Composite Materials, deGruyter, 2015, 22(2), pp. 199-213, ISSN 2191-0359.
- K. Wegener, W. H. Chen, F. Dietrich, K. Dröder, S. Kara. Robot Assisted Disassembly for the Recycling of Electric Vehicle Batteries. In: CIRP Conference on Life Cycle Engineering, Sydney, 2015.
- K. Dröder, T. Gebken, A. Arne, T. Große, A. Plath: Simulation of Process-Induced Failure Behavior in Cutting Operations of Hybrid FRP-Metal Composites by Means of FEM. In: ICCS18 – International Conference on Composite Structures, Lissabon, 2015.
- K. Dröder, M. Kühn, M. Brand, P. Dreessen, A. Gerdes, T. Große, S. Schulze, S. Huinink. Effects of geometrical interface architectures in hybrid metal-plastic structures manufactured through LFT injection molding. In: 2nd international MERGE Technologies Conference, 2015, pp. 327-330.

Institute of Internal Combustion Engines (ivb)

Prof. Dr.-Ing. Peter Eilts

Researcher's Career

- Dipl.-Ing. (MSc) at University of Hannover in 1984
- Dr.-Ing. (PhD) at University of Hannover in 1990
- 1991 to 2007 Engine Development at MAN B&W Diesel in Augsburg in several positions. Last position: Head of Thermodynamics and Injection System Development.
- From 2007 Head of the Institute of Internal Combustion Engines at Technical University of Braunschweig
- Focus on Engine Thermodynamics, Supercharging, Combustion, Emissions

Funding

FVV (BMWi), BMBF, Industry

Contact

Technische Universität Braunschweig
Institute of Internal Combustion Engines
Hermann-Blenk-Straße 42
38108 Braunschweig
Phone: +49 531 391-66900
p.eilts@tu-braunschweig.de
www.tu-braunschweig.de/ivb

Mission Statement

The internal combustion engine is the backbone of our mobility and can be expected to continue playing this role for the next few decades, though the electric drive may become a serious competitor in some applications. Our mission is to continue developing it to increased efficiency and improved environmental friendliness.

Research

The research objectives of ivb are the development and research of combustion processes for conventional and alternative fuels, of gas exchange, charging and exhaust aftertreatment systems. Engines are investigated in connection with the vehicle-system to optimize the thermal vehicle management. Operating strategies for hybrid vehicles are investigated with focus on the reduction of emissions and fuel consumption.

- Optimization of exhaust emissions
- Engine management by in-cylinder pressure measurements
- Energy and thermal management
- High pressure charging of vehicle engines
- Combustion process optimization for DI-Otto- and Diesel-engines

Research facilities

The ivb owns a comprehensive test area and keeps licences for current software tools that are used for engine development. The institute runs 16 modern test beds, some of them capable of hardware-in-the-loop tests, for engines up to 440 kW and 1,500 Nm. Engine components can be tested on additional component test beds. The test area is completed with a laser-optic laboratory with a pressure chamber and a gas testing laboratory for exhaust after treatment systems. A broad range of measurement systems for exhaust emissions is available. The institute holds up-to-date soft- and hardware for operating development engine ECUs (engine control unit) and some free programmable ECUs. The measuring results are supported by the use of simulation software for the engine working process and 3D-CFD.

- Engine test beds for stationary and processor-controlled instationary engine operation
- Climate chamber test bed (down to -25 °C)
- Gas testing laboratory for exhaust gas aftertreatment systems
- High-pressure-high-temperature injection chamber
- Optical measurement systems
- Measurement systems for combustion chamber pressure indication
- Comprehensive equipment for exhaust gas measurement
- Injection Analyzer
- Flow-analysis test bench for flow rate and swirl measurements on cylinder heads

Publications

- Herbst, F. and Eilts, P.: Experimental Investigation of Variable Geometry Compressor for Highly Boosted Gasoline Engines, SAE Technical Paper Series (2015-01-1289), 2015, doi:10.4271/2015-01-1289
- Siedentop, A., Schech, J., Bradenstahl, A. and Eilts, P.: Thermodynamic, Optical and Numerical Investigation of a Small Direct Injection Spark Ignition Engine, 24. Aachener Kolloquium Fahrzeugtechnik, Aachen, October 7, 2015
- Kovács, D.; Eilts, P.: Potentials of the Miller Cycle on HD Diesel Engines Regarding Performance Increase and Reduction of Emissions, SAE Technical Paper Series (2015-24-2440), 2015
- Kovács, D.; Eilts, P.: „Investigation of alternative fuels on a HD diesel engine equipped with a variable valve actuation system", Advanced Fuels For Sustainable Mobility International Conference, Nürburgring, 2014
- Albrecht, M., Rieping, M., and Eilts, P.: Investigations on alcohols in a DISI engine, 2. International Conference TMFB, Aachen, 17.06.2014

Institute of Mobile Machines and Commercial Vehicles

Prof. Dr. Ludger Frerichs

Researcher's Career

- Full professor and director of the Institute of Mobile Machines and Commercial Vehicles at the Technische Universität Braunschweig
- Director Product Development, STILL GmbH, Hamburg
- Head of Advanced Engineering (last position), CLAAS Selbstfahrende Erntemaschinen GmbH, Harsewinkel
- Part time lectureships "Agricultural Engineering", Institute of Automotive Engineering, RWTH Aachen University
- Research Assistant at the Institute of Agricultural Engineering, University of Hohenheim
- Study mechanical engineering at the Technische Universität Braunschweig
- Study mechanical engineering at the University of Applied Science Osnabruck

Funding

DFG, EU, BMWI, Lower Saxony, DBU, BLE, VDMA, AIF, DAAD, Industry

Contact

Technische Universität Braunschweig
Institute of Mobile Machines and Commercial Vehicles
Langer Kamp 19 a
38106 Braunschweig
Phone: +49 531 391 2670
ludger.frerichs@tu-braunschweig.de
www.tu-braunschweig.de/imn

Mission Statement

Our Mission and objective is to lay the methodical and technical foundation for the next generation of mobile systems considering processes, drive-lines, machines and procedures. In this systemic context, approaches to increasing efficiency and intelligent cross-linking are investigated in particular.

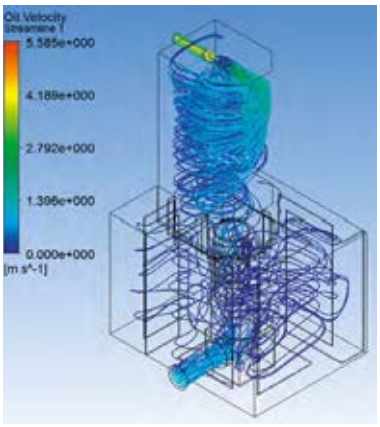
Research

For the investigation of **Processes in Mobile Machines** one focus lies on the research work regarding new process technologies for cutting and transportation of stalks. For basic research the Discrete Element Method (DEM) is applied to simulate processes in detail and to investigate the influence of different system and design parameters.

Mobile Hydraulics is an important research field and deals with electro-hydraulic circuits and systems as well as efficient hydraulic supply units and the mechanical design of selected components. Research topics are for example CFD analysis to improve deairation in hydraulic tanks, multi-pump topologies, closed-loop control of independent metering valves.

In the area of **Drive-line Technology** innovative drive systems and topologies including mechanical, electrical and hydraulic drives are under investigation including the evaluation of possible applications. Thereby system-oriented operating strategies play a crucial role, due to the fact that drive systems in mobile machines and often in commercial vehicles have to power the driving function as well as complex process technology.

The topic **Vehicles and Systems** is dedicated to research on methods for the costumer-specific evaluation of vehicles and machinery including technical and economic parameters. Industry driven and based on a systemic approach, research activities are running to reduce CO_2-emissions from agricultural and construction machinery considering machine efficiency, process efficiency, operation efficiency and alternative energy sources.



Last but not least, the group of **Assistance and Robotic Systems** is working on questions concerning general assistance systems, the cooperative work of multiple machines, communication structures as well as automation and autonomisation of machines in outdoor environments. The applied methods in all research topics comprise modeling and simulation, laboratory investigations and field tests.

Publications and Patents

- Frerichs, L; Thielke, L.: New concepts of energy supply for sustainable agricultural systems, Landtechnik 70(4), 2015, 167-176
- Wegener, J.K.; Frerichs, L.; Kemper, S.; Suemening, F.: Wood chipping with conical helical blades – Practical experiments concerning the impact of the infeed angle on the power requirement of a helical chipper, Biomass and Bioenergy 80 (2015) p. 173-178
- Hanke, S.; Frerichs, L.; Fleck, B; Nacke, E.: Method for determining CO_2 emissions of agricultural machinery in a process chain, Proceedings 72nd International Conference Agricultural Engineering, 2014, VDI-Verlag, pp. 309-314
- Untch, J.; Frerichs, L.: Leistungsverzweigter Fahrantrieb mit integrierter Versorgung der Arbeitsantriebe eines Gabelstaplers, 16. Antriebstechnisches Kolloquium (ATK), March 3-4, 2015, Aachen, proceedings p. 355-368
- Kattenberg, T.; Vollmer, T.; Frerichs, L.: Recuperation and distribution of brake energy on truck-trailer combinations. In: 13. Symposium: Hybrid- und Elektrofahrzeuge. Braunschweig, 2015

Institute of Jet Propulsion and Turbomachinery (IFAS)

Prof. Dr.-Ing. Jens Friedrichs

Researcher's Career

- Member of AG Turbo Program Management
- Dean of the faculty of Mechanical Engineering
- Member SATA (Subsonic Aerodynamic Testing Association)
- Member of scientific comittee "Compressors Users International Forum"
- TU Braunschweig, Full Professor, Director Institute of Jet Propulsion and Turbomachinery
- Several positions in jet engine industry, focused on engine maintenance and repair
- Dr.-Ing. TU Braunschweig, Faculty of Mechanical Engineering
- Research assistant at TU Braunschweig, Pfleiderer-Institute
- Dipl.-Ing. TU Braunschweig, Mechanical Engineering

Funding

DFG, BMBF, AIF, European Industry

Contact

Technische Universität Braunschweig
Institute of Jet Propulsion and Turbomachinery
Hermann-Blenk-Straße 37
38108 Braunschweig
Phone +49 531 391-94200
j.friedrichs@ifas.tu-bs.de
www.ifas.tu-bs.de/index.php

Mission Statement

Turbomachinery and its main components are the focus of IFAS. The understanding and description of fundamental physical effects define the basis for new methods and technologies. At IFAS this is done not only to support new designs but also do improve components and full systems during maintenance and repair.

Research

Jet propulsion: The field of jet engines and propulsion focuses on the design and operational behaviour of the overall system as well as the associated components. One area of focus is the development of design recommendations for future engines using advanced design and calculation methods. The research at component level also forms an important focus area. Great significance is given to the wear diagnostics and development of repair techniques for the engine.

New engine concepts and their integration into the aircraft can be examined in a one of a kind fan test rig. For this purpose, a 40 x 8 x 12m test facility has been built, in which future propulsor concepts will be investigated.

The Institute uses a modern test engine IAE V2500-A1 (A320 family), which allows research on engine and component wear mechanisms as well as maintenance, diagnostics and condition monitoring. With the help of mathematical models and worn out engine components, specific wear mechanisms are identified and described. Through this, specific maintenance measures can be defined, by which existing aircraft can operate more efficiently in the future.

Turbomachinery: The field of turbomachinery covers especially research on centrifugal and axial pumps, low-pressure axial fans and adaptive turbomachinery seals. For the investigation of pumps, test rigs with a diameter of up to 500 mm are available. In these the performance of all pumps up to 170 kW can by analyzed using a wide range of instrumentation also within the rotating reference frame. In addition, adaptive seals and especially brush seals in steam turbines for sealing high pressure differences are examined at the institute. For this purpose, the brush seals are supplied and operated with live steam under realistic conditions in the heat and power station. Subsequently, the analysis of sealing behavior can be carried out at the specifically constructed measuring and testing facility at the Institute.

Publications

- EBMEYER, C.; WENSKY, T.; FRIEDRICHS, J.; ZACHAU, U.: Evaluation of Total Engine performance Degradation based on Modular Efficiencies. Proceedings of ASME Turbo Expo 2011. Power for Land, Sea and Air, GT2010-45839. June 6-11, 2011, Vancouver, Canada.
- RABEN, M.; SCHWARZ, H.; FRIEDICHS, J.: Operating Performance and Wear Investigations of Brush Seals for Steam Turbine Applications. Proceedings of ASME Turbo Expo 2013, GT2013, June 3-7, 2013, San Antonio, USA
- ATALAYER, C.; WULFF, D.; FRIEDRICHS, J.: Computational Flow Analysis of a Turboprop S-Duct Inlet Geometric Sensitivity for Flow Distortion Effects, 50th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 2014, Cleveland, Ohio
- KRONE, J.-H.; FRIEDRICHS, J.: Generation of Intake Distortion due to Angle of Attack for a high Bypass Turbofan Model. IMECE2014, 14.-20. November 2014, Montreal, Canada
- BECK, N.; RADESPIEL, R.; LENFERS, C.; FRIEDRICHS, J.; REZAEIAN, A.: Aerodynamic Effects of Propeller Slipstream on a Wing with Circulation Control. Journal of Aircraft, 1-15, 10.2514/1.C032901

Institute for Particle Technology – Nanomaterials

Prof. Dr. Georg Garnweitner

Researcher's Career

- Full Professor for Nanomaterials, TU Braunschweig
- Junior Professor for Nanoparticles and Nanocomposites, TU Braunschweig
- Postdoc at Max Planck Institute of Colloids and Interfaces, Potsdam
- Dr. rer. nat. at University of Potsdam and Max Planck Institute of Colloids and Interfaces, Potsdam
- Study of Technical Chemistry, Vienna University of Technology, Austria

Funding

DFG, BMWI, AIF, State Lower Saxony, Industry

Contact

Technische Universität Braunschweig
Institute for Particle Technology
Volkmaroder Straße 5
38104 Braunschweig
Phone: +49 531 391 9615
g.garnweitner@tu-braunschweig.de
www.ipat.tu-braunschweig.de

Mission Statement

The Institute for Particle Technology strives for excellence in research and teaching in selected fields of mechanical process engineering and particle technology. The particle-particle interactions and the control of interfaces thereby play a key role and are investigated in great detail.

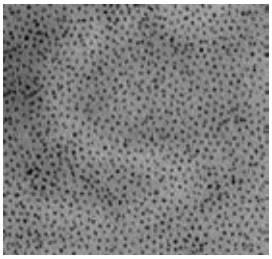
Research

The branch "Nanomaterials" investigates the fabrication, stabilization and application of nanoparticles and nanostructures.

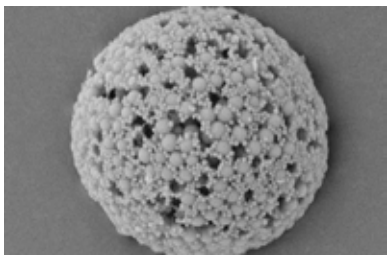
Nanoparticle synthesis: We have strong expertise in the field of "bottom-up" synthesis, with a focus on the nonaqueous synthesis in organic solvents. Via this method, the preparation of small nanoparticles (2-20 nm in size) with narrow size distribution and high sample homogeneity and crystallinity is possible. Due to their high stability and diversity of properties, we concentrate on the synthesis of inorganic materials, in particular metal oxides and quantum dots. Through a thorough understanding of formation mechanisms and process interrelations, we achieve the synthesis of complex metal oxide nanostructures with high homogeneity even at pilot plant scale.

Surface modification and functionalization: In addition to the synthesis, the colloidal stabilization and functionalization of nanoparticles is a crucial issue for applications and thus is investigated in detail. Due to their very large specific surface area, nanoparticles are prone to agglomeration, but they can be stabilized by coverage with organic molecules, for example. This also allows one to influence many other properties, such as the chemical behavior, catalytic acitivity, or optical properties. We study in detail the adsorption and exchange of organic molecules at the particle surface and develop strategies for a rational tailoring of the nanoparticle surface chemistry.

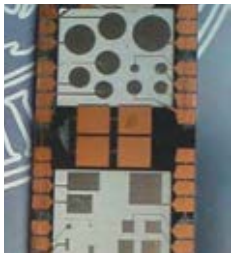
Applications of tailored nanomaterials: Nanomaterials with defined structural and chemical properties are further processed for novel applications. Our main interests thereby include the fields of polymer nanocomposites with optimized mechanical and functional properties, hierarchical and self-assembled structures from nanoparticle building blocks, nanoparticulate and nanocomposite thin films, nanostructured materials for electrochemical energy storage as well as magnetic nanomaterials for selective separation and purification.



ZrO_2 nanocrystals



porous spray dried aggregate of SiO_2 nanoparticles



thin-film capacitors fabricated from ZrO_2 nanocrystals

Publications

- S. Zellmer, G. Garnweitner, T. Breinlinger, T. Kraft & C. Schilde (2015): Hierarchical structure formation of nanoparticulate spray-dried composite aggregates, ACS Nano, 9, 10749-10757.
- A. Kockmann, J. Hesselbach, S. Zellmer, A. Kwade & G. Garnweitner (2015): Facile surface tailoring of metal oxide nanoparticles via a two-step modification approach, RSC Adv., 5, 60993-60999.
- G. Garnweitner, D. Gebauer & M. Niederberger (2015): Fundamentals of nanocrystal formation, CrystEngComm, 17, 6778-6779.
- I.-C. Masthoff, A. Gutsche, H. Nirschl & G. Garnweitner (2015): Oriented attachment of ultra-small $Mn_{(1-x)}Zn_xFe_2O_4$ nanoparticles during the non-aqueous sol-gel synthesis, CrystEngComm, 17, 2464-2470.
- I.-C. Masthoff, F. David, C. Wittmann & G. Garnweitner (2014): Functionalization of magnetic nanoparticles with high-binding capacity for affinity separation of therapeutic proteins, J. Nanopart. Res., 16, 2164.

Institute of Flight Guidance (IFF)

Prof. Dr.-Ing. Peter Hecker

- Managing Director of the Institute of Flight Guidance (IFF)
- Member of the SESAR JU Administrative Board representing the Scientific Community
- Member and chairman of the Clean Sky Scientific Committee
- Member of the Board of Directors of the "Association for Scientific Development of ATM in Europe" (ASDA)
- Member of the Board of Directors of the Aeronautics Research Centre Niedersachsen (NFL)
- Member of the Board of Directors of the Braunschweig Research Airport e.V.
- Member of the Scientific Advisory Board of the "German Institute of Navigation" (DGON)

Researcher's Career

- Full Professor for Flight Guidance, TU Braunschweig
- Head of the Department "Pilot Assistance", DLR Institute of Flight Guidance
- Dr.-Ing. at TU Braunschweig
- Research Scientist, DLR Institute of Flight Guidance
- Dipl.-Ing., Electrical Engineering, TU Braunschweig

Funding

EC, National Government (BMWi, BMBF), DFG, Industry

Contact

Technische Universität Braunschweig
Institute of Flight Guidance
Hermann-Blenk-Straße 27
38108 Braunschweig
Phone: +49 531 391-9801
p.hecker@tu-braunschweig.de
http://www.tu-braunschweig.de/iff

Mission Statement

The discipline of flight guidance addresses principles and technical means to support the human in guiding aircraft safely gate to gate. Subjects of research are functions, systems and operations for assisting the aircrew, the air traffic controller or other stakeholders involved in the air transportation system. The objective of research is to enable a safe, efficient and environmentally friendly flight.

Research

Air Traffic Management:

- Assistance Systems (Cockpit, Ground)
- Air Traffic Guidance (Ground, Air)
- Airline Operations and Cabin Management

Navigation:

- Localisation (Algorithms, Sensors, Filters)
- Data fusion und Processing
- Airborne Metrology and Platforms

Flight Guidance Systems and Flight Mechanics:

- Flight Control and Flight Mechanics
- Flight Safety and Certification
- Flight Guidance Systems

Airborne Meteorology and Measurement Technique:

- Airborne Meteorology
- Atmospheric Research
- Airborne Measurement Techniques

More than 50 staff members with professional background in aerospace, electrical engineering, meteorology and computer science are working in project teams in order to face this challenge. Our interdisciplinary teams develop and apply tools and solutions, comprising, for example, on-board avionics and cockpit assistant systems as well as weather data, positioning and navigation, ground based systems for air traffic control, airports or airlines.

Moreover, measuring methods for aviation applications are developed, applied and validated. The institute has an outstanding infrastructure including research aircraft, flight simulators and unmanned aerial systems; these are used for research and in the scope of student education. The institute is a member of the Aeronautics Research Centre Niedersachsen (NFL).

Publications

- Feuerle, T.; Steen, M.; Hecker, P.: New Concept for Wake-Vortex Hazard Mitigation Using Onboard Measurement Equipment, in Journal of Aircraft, 2014
- Krüger, T.; Nowak, S.; Hecker, P.: Towards Autonomous Navigation with Unmanned Ground Vehicles Using LiDAR, in The Institute of Navigation, Proceedings of the ION ITM 2015, Dana Point, USA, pp. 778-788, January 2015
- Rauskolb, F.; Berger,K.; Lipski, C.; Magnor, M.; Cornelsen,K.; Effertz, J.; Form, T.; Graefe, F.; Ohl, S.; Schumacher , W.; Wille, J.; Hecker, P.; Nothdurft, T.; Doering, M.; Homeier, K.; Morgenroth, J.; Wolf, L.; Basarke, C.; Berger, C.; Gülke, T.; Klose, F.; Rumpe, B.: An Autonomously Driving Vehicle for Urban Environments, Journal of Field Robotics 25, 9, 674-724, 2008
- Schönhals, S.; Steen, M.; Hecker, P.: Towards wake vortex safety and capacity increase: the integrated fusion approach and its demands on prediction models and detection sensors; Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering 227, 1, 199-208, 2013
- Schönhals, S.; Steen, M.; Hecker, P.: Wake Vortex prediction and detection utilising advanced fusion filter technologies; The Aeronautical Journal, Vol. 115, no. 1166, Royal Aeronautical Society, 2011

Institute of Machine Tools and Production Technology (IWF)

**Prof. Dr.-Ing.
Christoph Herrmann**

- Dr.-Ing. at TU Braunschweig
- Chair of Sustainable Manufacturing & Life Cycle Engineering

Researcher's Career

- Full professor for Sustainable Manufacturing & Life Cycle Engineering
- Co-director of IWF, Institute of Machine Tools and Production Technology
- Co-director of Joint German-Australian Research Group "Sustainable Manufacturing and Life Cycle Engineering"
- Member of the International Academy for Production Engineering (CIRP)
- Mentor professor for the Klaus Murmann Fellowship Programme at the Foundation of German Business (Stiftung der Deutschen Wirtschaft, sdw)
- Research Career
- Scientific director of NFF (Automotive Research Center Niedersachsen)
- Scientific director of KERP Center of Excellence Environment & Electronics, Vienna Austria
- Associate Professor for Product- and Life-Cycle-Management at TU Braunschweig

Funding
AiF, BMBF, BMUB, BMWi, DAAD, DBU, EU, Industry, NI

Contact
Technische Universität Braunschweig
Institute of Machine Tools and Production Technology (IWF)
Langer Kamp 19b
38106 Braunschweig
Phone: +49 531 391-7149
c.herrmann@tu-braunschweig.de
www.tu-braunschweig.de/iwf

Mission Statement

Sustainability in manufacturing aims for cost-efficient products and processes with minimal environmental impact over the entire life cycle. Within our research we strive for technologies which minimize the use of resources as well as methods and tools to support design of systems and to educate sustainable system thinking.

Research

Sustainable production technologies: Our research focuses on production technologies maximizing energy and resource efficiency. We investigate alternative cutting fluids towards the vision of a mineral oil free factory.

Integrated Computational Production and Life Cycle Engineering: We combine complementary modelling and simulation paradigms to analyse and assess complex dynamic systems on process, process chain, factory or even life cycle level. Using multi-scale approaches we aim for a deep understanding of product-process interdependencies and leverages to minimize cost and the use of material and energy.

Cyber-Physical Production Systems and Factories of the Future: We develop solutions addressing the increasing convergence of industrial production with digital technologies. This includes the dynamic integration of innovative data gathering and analytics with model based control and decision support for different stakeholders. We recognize the potentials of urban factories.

Circular Economy and Industrial Symbiosis: By analysing products and processes through the entire life cycle we are able to optimize products for disassembly, develop new recycling systems and substitute non-renewable resource and investigate strategies to improve eco-efficiency. Lightweight Structures and Green Batteries: Within the Open Hybrid LabFactory our research focuses on life cycle engineering of function integrated structures for applications in today and future vehicles. With our research towards 'green batteries' with minimal environmental impact we contribute to research activities of the Battery LabFactory Braunschweig.

"Die Lernfabrik" and Engineering Education: Our learning factory provides a unique infrastructure to disseminate our findings as well as inspire new ideas. Innovative teaching methods like game-based learning help students and professionals to acquire a deeper understanding of sustainability in engineering and corresponding concepts, methods and tools.

Publications

- J. R. Duflou, J. W. Sutherland, D. Dornfeld, C. Herrmann, J. Jeswiet, S. Kara, M. Hauschild, K. Kellens, Towards energy and resource efficient manufacturing: A processes and systems approach, CIRP Annals – Manufacturing Technology, 61(2), 587-609.
- C. Herrmann, S. Thiede, Process chain simulation to foster energy efficiency in manufacturing, CIRP Journal of Manufacturing Science and Technology, 1(4), 221-229.
- C. Herrmann, Ganzheitliches Life Cycle Management: Nachhaltigkeit und Lebenszyklusorientierung in Unternehmen, 2009, Springer-Verlag
- S. Thiede, G. Posselt, C. Herrmann, SME appropriate concept for continuously improving the energy and resource efficiency in manufacturing companies, CIRP Journal of Manufacturing Science and Technology, 6(3), 204-211.
- Y. Umeda, S. Takata, F. Kimura, T. Tomiyama, J. W. Sutherland, S. Kara, C. Herrmann, J. R. Duflou, Toward integrated product and process life cycle planning, An environmental perspective, CIRP Annals – Manufacturing Technology, 61(2), 681-702.
- T. Gutowski, J. M. Allwood, S. Sahni, C. Herrmann, A Global Assessment of Manufacturing: Economic Development, Energy Use, Carbon Emissions, and the Potential for Energy Efficiency and Materials Recycling, Annual Review of Environment and Resources, 38, 81-106.
- C. Herrmann, C. Schmidt, D. Kurle, S. Blume, S. Thiede, Sustainability in Manufacturing and Factories of the Future, International Journal of Precision Engineering and Manufacturing-Green Technology, 1(4), 283-292.

Institute of Aircraft Design and Lightweight Structures (IFL)

Prof. Dr.-Ing. Peter Horst

Researcher's Career

- Oceanography, University Hamburg, 1975-1978
- Mech. Engg., special field of Aeronautics, 1978-1984, TU Braunschweig
- PhD: TU Braunschweig 1990 in Mech. Engg.
- 1984-1990, Research Assistant, Inst. f. Flugzeugbau und Leichtbau, TU Braunschweig
- 1990-1998, Airbus Deutschland, last position: Head of "Structure, Repair, Engineering"
- 1998-present: Universityprofessor of "Aircraft Design and Lightweight Structures" and Head of the Institute of Aircraft Design and Lightweight Structures, TU Braunschweig

- Studies of Oceanography, University Hamburg

Funding

DFG, EU, BMWi, Industry

Contact

Technische Universität Braunschweig
Institute of Aircraft Design and Lightweight Structures (IFL)
Hermann-Blenk-Straße 35
38108 Braunschweig
Phone: +49 531 391-9901
p.horst@tu-braunschweig.de
www.tu-braunschweig.de/ifl

Mission Statement

In aerospace applications as well as many other technical areas ecologically and environmentally efficient and therefore light solutions are needed. This may only be achieved by taking into account multidisciplinary aspects and sophisticated methods. The institute provides both in many fields.

Research

The different groups of the institute working in aerospace science cover five main subjects, namely, Conceptual Design of Aircraft, Numerical Methods/Multiphysics, Damage Mechanics, New Building Blocks and Experiments.

Multiphysics (headed by Dr. M. Haupt) are dealing with subjects like fluid-structure-interaction, thermomechanical and electromagnetic interactions. An in-house code named ifls is used to couple the different codes used to find solutions in several areas like structures, aerodynamics etc.

Damage Mechanics cover both metallic as well as composite materials and structures. In all cases experimental and theoretical approaches are followed. Due to the large difference in scale, simulation models, specimens and testing tools have to be versatile.

New Building Blocks are searched for by methods of structural optimization, again ranging from complete aircraft to particular panels. This work is often performed in conjunction with other scientists from subjects such as production, for example, in order to find methods for economically and ecologically efficient structures.

Aircraft Conceptual Design (headed by Dr. W. Heinze) is an inherently multi-disciplinary optimization problem, taking into account many disciplines. A solution may only be found by an extensive computer code. The in-house code PrADO has been developed in recent decades. Special attention has been paid to unconventional concepts (such as blended wing body aircraft), green aircraft or aircraft using extremely high lift.

As already visible in the above mentioned areas, experimental data and validation by experiments play a crucial role in the work done at the institute. The institute therefore has a broad experimental basis, which allows for testing complete aircraft parts like sailplane wings etc. down to microcracking in small composite specimens.

Publications and Patents

- Häusler, S.M., Lindhorst, K., Horst, P., Combination of the material force concept and the extended finite element method for mixed mode crack growth simulations, Int. J. for Numerical Methods in Engg., 85, pp. 1522-1542, 2011
- Möhle, E., Haupt, M.C., Horst, P., Coupled Numerical Simulation and Experimental Validation of the Electro Impulse De-Icing Process, J. of Aircraft, Vol. 50, pp. 96-102, 2013
- Hansen, L.U., Horst, P.: Multilevel Optimization in Aircraft Structural Design Evaluation, Computers & Structures, 86, pp. 104-118, 2008
- Unger, R.; Haupt, M.C.; Horst, P.: Application of Lagrange Multipliers for Coupled Problems in Fluid Structure Interactions , 4th MIT Conference, 13-15 June 2007. Computers & Structures Vol. 85, pp. 796-809, 2007
- Adden, S., Horst, P.: Stiffness degradation under fatigue in multiaxially loaded non-crimped-fabrics, International Journal of Fatigue 32, pp. 108-122, 2010

Institute for Surface Technology (IOT) – Plasma Chemistry and Polymers

Prof. Dr. Claus-Peter Klages

Researcher's Career

- 1975-1979, PhD study in physical-organic chemistry, Inst. f. Org. Chemie, University Hamburg
- Sept. 1976, Attendance: Charles Coulson Theoretical Chemistry Summer School, Oxford
- 1975-1976, Sholarship, Fonds der Chemischen Industrie
- 1977-1979, Sci. Ass., Org. Chem., Univ. Hamburg
- 1979-1990, Scientist, Philips Research Laboratories, Hamburg
- 1990-today, Department Head, Fraunhofer Institute for Surface Technology and Thin Films (IST); since 2003 as secondary employment
- 1999-2003, Deputy Director of Fraunhofer IST
- 1993-1996, Visiting Professor, Physics Dept., University of Lanzhou, Lanzhou, PR China
- 1998-2000, Consultant Professor, Shanghai University, Shanghai, PR China
- 1998, Habilitation (Thin Film and Surface Technology), TU Braunschweig,
- Appointment as private lecturer
- 2003, Appointment as Professor, Institute for Surface Technology, TU Braunschweig

Funding

DFG, BMBF, BMU, Industry

Contact

Technische Universität Braunschweig
Institute for Surface Technology (IOT)
Bienroder Weg 54 E
38108 Braunschweig
Phone: +49 531 2155 510
c-p.klages@tu-braunschweig.de
www.tu-braunschweig.de/iot

Mission Statement

Plasma-chemical processes based on atmospheric-pressure gas discharges facilitate tailoring of physico-chemical surface properties. Polymers are of particular interest, both as substrates as well as thin film materials. The chemical characterization of plasma-modified surfaces is still presenting substantial challenges.

Research

Studies of plasma-surface interaction: Plasma-chemical processes in non-equilibrium gas discharges can nowadays be modeled in great detail, thanks to the exact knowledge of a large number of elementary gas-phase reactions. The interaction of plasmas with surfaces, on the other hand, especially plasma-chemical reactions with polymers, and the deposition of thin films by plasma-assisted chemical vapor deposition are much less well understood. The chemical nature of polymer surfaces after contact with a plasma is often largely unknown.

FTIR-ATR *in-situ*: Using Fourier-transform infrared spectroscopy in the attenuated-total-reflection mode, surfaces of dielectrics can be studied with high sensitivity during their contact with reactive species generated in atmospheric-pressure gas discharges. In this way chemical changes of surfaces upon plasma contact may be studied at an early stage and chemical gas-phase derivatization reactions may be applied *in-situ* to explore the presence of functional groups qualitatively and quantitatively.

Combinatorial studies of plasma-chemical surface modification processes: While combinatorial methods are established in chemistry and biochemistry, they are relatively rare in studies of plasma-based surface coating or modifications processes. At the IOT, novel combinatorial methods are being studied within several DFG-funded projects, utilizing feeding of plasma reactors with gas streams carrying a transversal gradient of gaseous species to obtain continuous thin films or micro-spot arrays with a gradient of chemical composition and physico-chemical properties. In a recently started project, an orthogonal gradient of electrical power density dissipated in the discharge will also be employed to attain 2D libraries of plasma-modified surfaces (see figure).

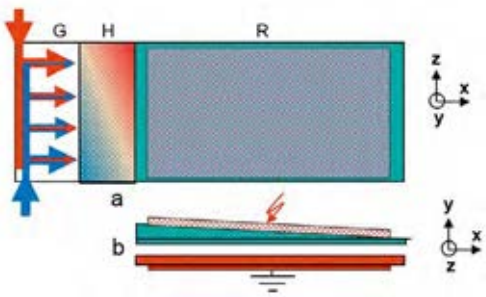


Figure: Schematic of an atmospheric-pressure plasma reactor employing orthogonal gradients of gas composition and power density

Polyelectrolyte multilayers: Depositing polyelectrolyte multilayer thin films by alternating adsorption of polyanions and polycations from aqueous solutions is a captivating method. In close cooperation with the Fraunhofer Institute for Surface Technology and Thin Films (IST) new surface-technological applications of this method are being studied.

Publications and Patents

- L. Hecht, J. Philipp, K. Mattern, A. Dietzel, C.-P. Klages, Controlling wettability in paper by atmospheric-pressure microplasma processes to be used in µPAD fabrication, Microfluid. Nanofluid. 2016, 20, 25.
- P. Vasanthakumari, Z. Khosravi, V. V. R. Sai, C.-P. Klages, PMMA surface functionalization using atmospheric pressure plasma for development of plasmonically active polymer optical fiber probes, Plasma Chem. Plasma Process. DOI 10.1007/s11090-016-9717-2.
- J. Philipp, A. K. Czerny, C.-P. Klages, Plasma polymerization at atmospheric pressure with a new type of DBD reactor for combinatorial studies: Classification of precursor concentration dependencies, Plasma Process. Polym. 2016, 13, 509.
- Z. Khosravi and C.-P. Klages, Nucleophilic derivatization of polyethylene surfaces treated in ambient-pressure N_2-H_2 DBD post-discharges, Plasma Chem. Plasma Proc. 2014, 34, 661.
- S. Hartwig, C.-P. Klages, Ordered 2D nanopores in nickel electrodeposits - A self-organization phenomenon, J. Electrochem. Soc. 2014, 161, D243.
- M. Eichler, H. Dillmann, L. C. Reim, M. Thomas, C.-P. Klages, Temporary wafer bonding by polyelectrolyte interlayers, ECS Transactions 2014, 64(5), 179.

Thermal science laboratory (IfT)

Prof. Dr.-Ing. Jürgen Köhler

Researcher's Career

- Full Professor for Thermodynamics at Braunschweig University of Technology
- Lead Author of a RTOC/UNEP working group
- German Environmental Award 2007 of the German Environmental Foundation (DBU)
- Visiting Scientist at the Department of Mechanical Engineering of the Massachusetts Institute of Technology (MIT), USA
- Self-employed consultant engineer. Consulting work in the field of thermal sciences, air conditioning, and refrigeration
- Head of the R&D department of a manufacturer of mobile refrigeration and air conditioning systems
- Habilitation in the field of thermodynamics from Darmstadt University of Technology
- Doctoral research work and graduation (Dr.-Ing.) from Darmstadt University of Technology
- Mechanical engineering study and graduation (Dipl.-Ing.) from Darmstadt University of Technology

Funding
DFG, BMBF, BMWi, DBU, EU, Lower Saxony, industry

Contact
Technische Universität Braunschweig
Thermal science laboratory (IfT)
Hans-Sommer-Straße 5
38106 Braunschweig
Phone: +49 531 391 2625
juergen.koehler@tu-braunschweig.de
http://www.ift-bs.de/

Mission Statement

Understanding thermal energy conversion, storage, transport and interaction from the molecular to the system level is the key for developing and improving energy efficient thermal systems.

Research

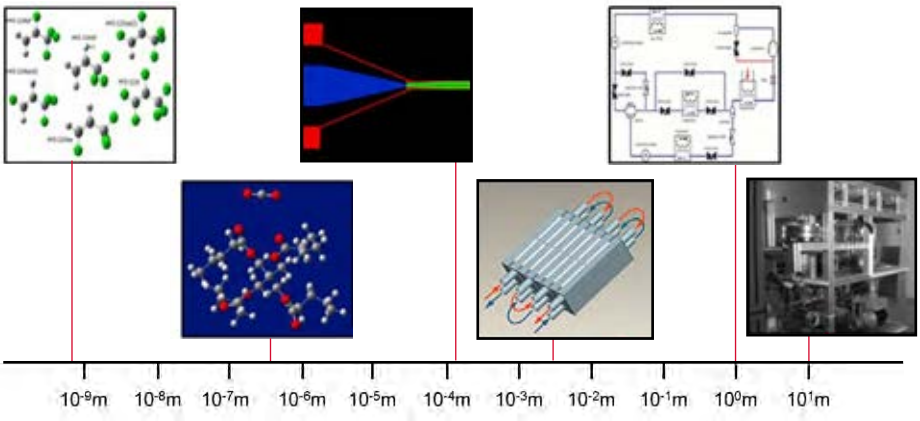
Molecular Simulation of Thermophysical Properties (Dr.-Ing. Gabriele Raabe): The research on molecular modelling and simulation is aimed at providing reliable predictions on thermophysical properties of poorly known compounds, and to gain a molecular level understanding of these properties. The studies cover various components such as novel working fluids for thermal systems, ionic liquids or drug candidates.

Dynamic System Simulation (Dr.-Ing. Wilhelm Tegethoff): High performance analysis, optimization and control of thermal systems, such as automotive thermal management systems, fuel cell systems, power plants or industrial processes. Working on international standards for the interoperability of different languages and simulators.

Refrigeration Components and Systems (Dr.-Ing. Nicholas Lemke): Experimental investigation of refrigeration components (compressor, heat exchanger, expansion device, accumulator, ...) and systems (mobile HVAC, household, residential heat supply, ...). Design and layout of test rigs. Development of complex control strategies. System analysis (measurement and simulation).

Thermal Heat Engines with Waste Heat Recovery (ORC): The good old steam engine cycle recently experiences a revival by being used for waste heat recovery in industrial and internal combustion engine processes. New approaches are used, for example to determine thermophysical properties of new working fluids and improve energy efficiency of the transient behavior of the whole cycle.

Fuel Cells, Batteries, Photovoltaic and Thermoelectric Systems: Fluxes of matter, heat and electricity can occur parallel, interact, and affect together energy conversion and storage. This is investigated with a special focus on system integration, transient behavior, and energy efficiency.



Publications

- Schulze, C.; Raabe, G.; Tegethoff, W.; Köhler, J.: Transient evaluation of a city bus air conditioning system with R-445A as drop-in – From the molecules to the system, International Journal of Thermal Sciences Volume 96, Pages 355-361, October 2015
- Smith, J.; Hinterberger, M.; Hable, P.; Köhler, J.: Simulative method for determining the optimal operating conditions for a cooling plate for lithium-ion battery cell modules, Journal of Power Sources, Volume 267, pp. 784-792, 2014
- Horst, T.; Tegethoff, W.; Eilts, P.; Köhler, J.: Prediction of dynamic Rankine Cycle waste heat recovery performance and fuel saving potential in passenger car applications considering interactions with vehicles' energy management, Journal of Energy Conversion and Management, Volume 78, pp. 438-451, 2014
- Lucas, C.; Köhler, J.: Experimental investigation of the COP improvement of a refrigeration cycle by use of an ejector, International Journal of Refrigeration, Volume 35, Issue 6, pp. 1595-1603, 2012
- Junior, C.; Chen, G.; Köhler, J.: Modeling of a new recuperative thermoelectric cycle for a tumble dryer, International Journal of Heat and Mass Transfer, Volume 55, Issues 5-6, pp. 1536-1543, 2012

Institute of Energy and Process Systems Engineering

Prof. Dr.-Ing. Ulrike Krewer

- Head of Institute of Energy and Process Systems Engineering
- Director, Battery Labfactory Braunschweig
- Director, Energy Research Hub EFK-BS
- Steering committee member, Center of Pharmaceutical Engineering
- Board member, International Max Planck Research School for Advanced Methods in Process and Systems Engineering

Researcher's Career

- Full professor for Energy and Process Systems Engineering, TU Braunschweig
- Junior-Professor for Portable Energy Systems, University of Magdeburg
- Head of Otto Hahn research group, Max Planck Institute for Dynamics of Complex Technical Systems
- Senior Engineer, Energy Research Center, Samsung SDI, South Korea
- Ph.D. degree in Process and Systems Engineering, University of Magdeburg
- Research assistant, Max Planck Institute for Dynamics of Complex Technical Systems
- Studies of Chemical Engineering, University of Erlangen-Nuremberg

Funding

DFG, BMBF, BMWI, AIF, Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute of Energy and Process Systems Engineering
Franz-Liszt-Straße 35
38106 Braunschweig
Phone: +49 531 391-3043
u.krewer@tu-braunschweig.de
www.tu-braunschweig.de/ines

Mission Statement

Shaping the way we will produce or store energy in the future is one of the main fields of work of the institute. We are also passionate about modelling and analysing complex systems, such as fuel cells, batteries, dynamic power plants and pharmaceutical production processes.

Research

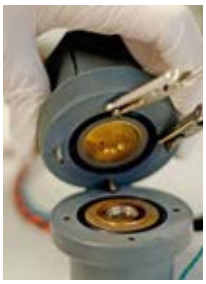
The Institute of Energy and Process Systems Engineering (InES) conducts research on various established electrochemical systems, such as Li-Ion batteries and DMFCs, as well as next generation cells, such as Zn-air batteries and alkaline fuel cells. Research also covers power-to-ammonia, combustion-based power plants and pharmaceutical processes.
Analysis and optimisation of all these systems is conducted using models on various scales, from surface models based on kinetic Monte Carlo to system models, system analysis tools as well as experiments.

Li-ion batteries: The main aim of research is on one hand optimisation of battery performance by investigating innovative materials, cell geometries and influences of the production process. On the other hand, the mechanisms of degradation in lithium-ion cells are examined in order to extend battery life times and to avoid unexpected thermal runaway of lithium-ion cells. InES is a member of the Battery LabFactory Braunschweig (BLB) which allows manufacturing of custom-made lithium-ion cells.

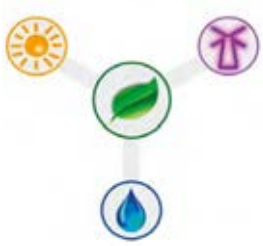
Next-generation batteries exhibit high theoretical energy densities. We investigate with our research the extent to which environment impacts the operation of metal-air cells. Our research work also includes the simulation of processes which occur inside Li-S and all-solid-state batteries with the aim of understanding and optimising the design and operation of electrodes and cells, including also experimental work to validate and calibrate the models applied.

Alkaline fuel cells/Microbial fuel cells: The use of non-acidic fuel cells opens up the possibility of using a large variety of Pt-free catalysts. Our research focuses on improving and optimising performance. Therefore, we investigate factors limiting performance, such as reaction kinetics, ionic conductivity of catalyst layers, diffusivity of reactants through the catalyst layer etc., by simulation and experiment.

Pharmaceutical Process Engineering:
We use process systems engineering tools (modelling, optimisation and control) to design novel, cost-effective, and intensified continuous processes to produce poorly soluble drugs. Innovative Uncertainty Analysis concepts help to identify critical parameters and to account for model-related variability within the process design phase. InES is member of the Center of Pharmaceutical Engineering (PVZ).



Battery



Power to X

Publications

- Schröder, D., Laue, V. and Krewer, U., Numerical simulation of gas-diffusion-electrodes with moving gas–liquid interface: A study on pulse-current operation and electrode flooding. Computers & Chemical Engineering, 84, pp.217-225, 2016.
- Torchio, M., Wolff, N.A., Raimondo, D.M., Magni, L., Krewer, U., Gopaluni, R.B., Paulson, J.A. and Braatz, R.D., 2015, July. Real-time model predictive control for the optimal charging of a lithium-ion battery. In American Control Conference (ACC), 2015 (pp. 4536-4541). IEEE.
- Jenssen, D., Berger, O., and Krewer, U., Anode flooding characteristics as design boundary for a hydrogen supply system for automotive polymer electrolyte membrane fuel cells. Journal of Power Sources, 298, pp 249-258, 2015.
- Khadke, P.S., Krewer, U., Performance Losses at H_2/O_2 Alkaline Membrane Fuel Cell, Electrochemistry Communications, Volume 51, pp. 117-120, 2015.
- Weinzierl, C., Krewer, U., Model based Analysis of Water Management in Alkaline Direct Methanol Fuel Cells, Journal of Power Sources, 268, pp. 911-921, 2014.

Institute of Automotive Engineering (IAE)

Prof. Dr. Ferit Küçükay

- Director of the Institute of Automotive Engineering (IAE), TU Braunschweig
- Board member of "Automotive Research Centre Niedersachsen" (NFF)
- Chairman of the International Symposium "Innovative Automotive Transmissions, Hybrid and Electric Drives" (CTI)

Researcher's Career

- 1986 qualified with "Habilitation" (university lecturer) in mechanics
- Between 1985 and 1997 manager for "Chassis Pre-Development" and "Powertrain Development" at BMW
- 1981 Ph.D. at the Technical University of Munich

Funding

DFG, BMBF, BMWi, EU, industry

Contact
Technische Universität Braunschweig
Institute of Automotive Engineering
Hans-Sommer-Straße 4
38106 Braunschweig
Phone: +49 531 391-2610
iffzg@tu-bs.de
www.iae.tu-bs.de

Mission Statement

The 3D parameter space is the core of all research and development activities at the IAE. Consisting of the three interacting modules driver, driven vehicle and driving environs it allows the systematic acquisition and simulation of customer use regarding vehicles and components under all relevant operation and service conditions.

Research

Transmission, hybrid and electric drives: Identification of customer requirements. Optimization of topology and structure of hybrid and electric drives. Measurement, simulation and optimization of losses. Test rig automation. Shift quality of AT, DCT, AMT and drivetrain analyses. Analysis of operation strategy, drivetrain and transmission calibration are important topics.

Driver assistance systems and Automated Driving: Identification of driving style and driver performance. Adaptive lateral and longitudinal control assistance. Autonomous driving. System benchmark and customer studies are key issues. ACC, AEB-Benchmark and optimization. Functional safety.

Chassis / Driving dynamics: Driving dynamics. Active chassis systems. Monitoring of vehicle state and disturbances. Stability analyses for control systems. MBS simulation / optimization. Driving dynamics tests and component testing. Optimization and preparameterization of EMS in steering-HiL applications.

Vibrations / Acoustics: Vertical dynamics. Identification of damper characteristics on overall vehicle and component level. Controlled dampers. Analysis of gear rattle. Analysis of the transmission behavior of rolling, damping and brake noise. Semiactive and active control systems.

Body: Analysis of overall vehicle and component deformations. Optimization of seating position, arrangement of control elements. Evaluation of haptics & visual appearance of the interior. Objectification of shift and clutch operation comfort.

Requirements engineering: Evaluation of transmission test specifications, for example. Identification of customer requirements on commercial vehicles. Representative load spectra for chassis and transmissions.

Objectification of subjective characteristics: Objectification of shift and pull-off quality, for example. Driver performance. Evaluation of handling characteristics (e.g. based on driver modelling).

Measurement, simulation: Automated optimization of shift quality, for example. Analysis of effects of driving dynamics.

Automated Driving Research

Publications and Patents

- Caliskan, K., Kaldas, M., Henze, R., Küçükay, F. (2016): "Performance Analysis of the Rule-Optimized Fuzzy-Logic Controller for Semi-active Suspension". SAE Paper No: 16M-0041.
- Schudeleit, M., Küçükay, F. (2015): Customer-optimised Dimensioning of Hybrid Electric Drivetrains. IEEE Transactions on vehicular Technology
- Pawellek, T., Liesner, L., Krauns, F., Henze, R., Küçükay, F. (2015): Design and Application of an ACC Controller Including an Objectification Study. WKM-Symposium, 23.-24. July 2015, Munich.
- Sonka, A.; Liesner, L.; Pawellek, T.; Krauns, F.; Henze, R.; Küçükay, F. (2015): Motion Measurement and Prediction of Surrounding Objects in Traffic. Future Active Safety Technology forward zero-traffic-accidents,FASTzero' 15, Sweden.
- Büyükyildiz, G.; Pion, O.; Henze, R.; Küçükay, F. (2015): Driver models based on lateral dynamics for adaptation of assistance systems. Future Active Safety Technology forward zero-traffic-accidents, FASTzero' 15, Gothenburg, Sweden

Institute for Engineering Design

Prof. Dr.-Ing.
Sabine Christine Langer

- Professor for Vibroacoustics

Researcher's Career

- University Professor for Vibroacoustics (W2), Technical University Braunschweig
- Deputy Professorship Mechanics, Technical University Braunschweig
- Deputy Professorship Solid Mechanics, Technical University Clausthal
- Assistent Professor (W1) Wave Propagation and Building Acoustics
- Dr.-Ing. Technical University Braunschweig
- Research Assistant, Institute of Applied Mechanics, Technical University Braunschweig
- Study of civil engineering, degree Dipl.-Ing. Technical University Braunschweig

Funding
DFG, DAAD, industry

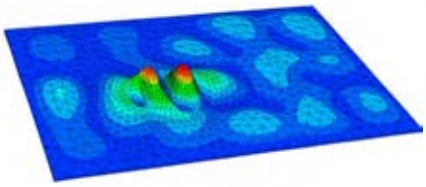
Contact
Technische Universität Braunschweig
Institute for Engineering Design
Langer Kamp 8
38106 Braunschweig
Phone: +49 531 391-7101
s.langer@tu-braunschweig.de
www.tu-braunschweig.de/ik

Mission Statement

Life expresses itself through movement, vibration, sound, and potentially noise.
Our mission is to calm our technical environment with the help of adequate modeling, reliable prognoses, intrinsic acoustical design, and optimization. We are aiming at the unfolding of further dimensions of life – as for the future, one aspect would be living together more quietly inside as well as outside.

Research

The Group 'Vibroacoustics' at the Institute for Engineering Design is doing its research in the following fields: Design for Acoustics, Qualification in Acoustics, Computational Acoustics, and Higher Dimensional Acoustics.



Design for Acoustics: We provide acoustic forecasting possibilities for the early phases of product development and integrate acoustic functions into components, assemblies, and products. We aim at an acoustic optimization and an intrinsic acoustic construction in all phases of product development.

Qualification in Acoustics: We deal with various aspects of modeling and, in particular, the evaluation and uncertainty analysis of models. Moreover, we concern ourselves with the validation of models, using metrological characterization.

Computational Acoustics: Based on discretization methods, we develop the in-house research code elPaSo. One research focus is laid on hybrid numerical methods in which disadvantages of certain methods are compensated by coupling. Thus, we provide reliable methods for the simulation of airborne and structure-borne sound.

Higher Dimensional Acoustics: We deal with the effect and perception of sound. Our research focus covers the potential of acoustic black holes as well as mathematical, technical, and ethical issues regarding acoustic cloaking.

Publications

- S.C. Beck, S.C. Langer: Numerical assessment of the vibration control effects of porous liners on an over-the-wing propeller configuration, CEAS Aeronautical Journal, DOI 10.1007/s13272-016-0186-3
- E. Protopapadakis, M. Schauer, E. Pierri, A.D. Doulamis, G.E. Stavroulakis, J–U. Böhrnsen, S. Langer: A genetically optimized neural classifier applied to numerical pile integrity tests considering concrete piles, 162, pp. 68–79, Computers & Structures 2016.
- Sisámon, A.E.; Beck, S.C.; Langer, S.C.; Cisilino, A.P.: Inverse scattering analysis in acoustics via the BEM and the topological-shape sensitivity method, Journal of Computational Mechanics. DOI 10.1007/s00466-014-1051-z, 2014.
- Beck, S. C.; Langer S.: Modeling of flow-induced sound in porous materials, International Journal of Numerical Methods in Engineering, DOI:10.1002/nme.4622, 2014.
- Schauer, M.; Roman, J.E.; Quintana-Ortí, E.S.; Langer, S.: Parallel Computation of 3-D Soil-Structure Interaction in Time Domain with a Coupled FEM/SBFEM Approach, DOI: 10.1007/s10915-011-9551-x, Journal of Scientific Computing, 2012.

Institute of Dynamics and Vibrations

Prof. Dr.-Ing. Georg-Peter Ostermeyer

- Executive board member of Drilling Simulator Celle
- Speaker of research collaboration gebo
- Steering board member of Eurobrake, International Friction Forum, Celle Drilling

Researcher's Career

- Full Professor for Dynamics and Vibrations, TU Braunschweig
- Speaker of SFB 605
- Full Professor for Mechanics, Interfacial and Friction Physics, TU Berlin
- Research engineer in vehicle technology, Volkswagen AG, Wolfsburg
- Assistant Professor at TU Braunschweig
- Habilitation, venia legendi for Mechanics (TU Braunschweig)
- PhD-thesis on unilateral constraints in Mechanics (Dr.-Ing.,TU Braunschweig)
- First state examination for teaching in Physics and Mathematics (TU Braunschweig)
- Diploma in Mathematics (TU Berlin)

Funding
DFG, BMWi, DAAD, Lower Saxony, Volkswagen Foundation, Industry

Contact
Technische Universität Braunschweig
Institute of Dynamics and Vibrations
Schleinitzstraße 20
38106 Braunschweig
Phone: +49 531 391-7000
gp.ostermeyer@tu-braunschweig.de
www.ids.tu-braunschweig.de/

Mission Statement

Our mission is problem-oriented solving of dynamical problems in mechanical and electromechanical systems by identification, modeling, simulation, measurement and control. Our motivation in research is the generation of transdisciplinary system competence. The institute has a strong background in tribology, measurement and innovative simulation techniques.

Research

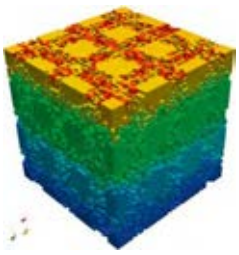
Modeling and Simulation: For a description of mechanical, electronic, electromechanical systems (multi physics) classical methods (Lagrange-Hamilton method) and discrete methods (FEM, BEM, MKS, CA, DEM) are used and developed. With tailored models and appropriate simulation techniques, we generate solutions to optimize dynamical systems.

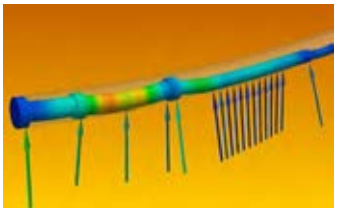
Tribology and NVH: Friction is a highly dynamic process, which is effected by a wide range of influencing factors. We develop new insights into the elementary mechanisms of friction and towards the better description and control of the dissipation processes between two bodies in frictional contact and the resulting wear debris dynamics. With respect to its significance for friction-induced vibrations, one major application is the technical brake system and the investigation of NVH-phenomena.

Lubricated Contacts (PD Dr.-Ing. M. Müller): The interaction of flow and structural dynamics are investigated with novel modeling techniques and measurements. Special focus is on systems under starved lubrication and the transition from boundary lubrication to mixed lubrication.

Vibrations and Acoustics: Properties of dynamical systems such as mode shapes, frequency spectra, sound pressure level or power density spectra, are analyzed by measurement. By simulation with appropriate models and sensitivity studies vibrations and acoustics could be controlled at an early stage.

Drill String and Reservoir Dynamics: We consider and investigate the complex matter of drill string and reservoir dynamics using multiscale techniques as well as adaptive problem-specific model complexity with a flexible, modular model setup, even for Real-Time applications.





Publications

- Bode, K., Ostermeyer, G.-P.: A Comprehensive approach for the simulation of heat and heat-induced phenomena in friction materials, Wear 311/1-2 (2014), pp. 47-56
- Ostermeyer, G.-P.: On tangential friction induced vibrations in brake systems. SAE Int. J. Passeng. Cars – Mech.Syst. 1(1): 1251-1257, 2008
- Ostermeyer, G.-P.: On the dynamics of the friction coefficient, 280. WE-Haereus Seminar, Ilmenau 2002, Wear 254 (2003) 852-858
- Ostermeyer, G.-P.: Selbstorganisation im Verkehr – Neue Wege der Beschreibung und Messung der Fahrer-Fahrer-Interaktion, In: Integrierte Sicherheit und Fahrerassistenzsysteme, VDI Berichte 1864, Düsseldorf 2004, 361-380
- Ostermeyer, G.-P.: Software Tools and their Verification by Experiments, "Vehicle System Dynamics", Vol 22 (1993), Number 3-4, pp. 123-139
- Ostermeyer, G.-P.: On the influence of elastic rails on the hunting motion of bogies, in: Proceedings of the first Polish-German Workshop on "Dynamical Problems in Mechanical Systems", (Editors R. BOGACZ, K. POPP), pp. 75-86, Instytut Podstawowych Problemów Techniki, Polska Akademia Nauk, Warszawa 1989
- Ostermeyer, G.-P.: Zur numerischen Behandlung von elastischen Stößen in Mehrkörpersystemen, Ing.-Archiv 58 (1988), S. 67-79

Institute of Fluid Mechanics

Prof. Dr.-Ing. Rolf Radespiel

- CEO, Aeronautics Research Centre, Niedersachsen
- Coordinator, DFG Collaborative Research Centre SFB 880 “Fundamentals of High Lift of Future Civil Aircraft”
- Co-Coordinator, DFG Collaborative Research Centre SFB TRR-40 “Rocket Propulsion”
- President OSTIV

Researcher’s Career

- Full Professor for Fluid Mechanics, TU Braunschweig
- Head of High-Speed Aircraft Branch, Institute of Aerodynamics and Flow Technologies, DLR
- Technology Engineer, Daimler-Benz Aerospace Airbus GmbH
- Head Aerothermodynamics Branch, Institute of Design Aerodynamics, DLR
- Visiting Scientist, NASA Langley Research Center
- Research Scientist, Institute of Design Aerodynamics, DLR
- Doctor of Engineering, TU Braunschweig
- Studies of Mechanical Engineering, TU Braunschweig

Funding
DFG, BMBF, BMWi, State Lower Saxony, EU, DLR, industry

Contact
Technische Universität Braunschweig
Institute of Fluid Mechanics
Hermann Blenk Straße 37
38108 Braunschweig
Phone: +49 531 391-94251
r.radespiel@tu-braunschweig.de
www.tu-braunschweig.de/ism

Mission Statement

Fluid mechanical processes govern the performance of industrial goods, noise emissions, power consumption and energy conversion. Our work combines fundamental research in fluid mechanics theory, experiments and numerical simulation with advanced application areas in aerospace, automotive and energy technologies.

Research

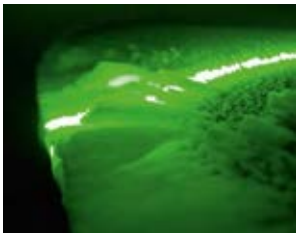
Aerodynamics of Aircraft: Flow simulation of complex aerodynamic processes is the key to improved design. Our research addresses new high-fidelity physical models of turbulence and boundary-layer transition to enhance future flow simulations of aircraft and space vehicles. We aim at improving performance parameters of aircraft by providing new design options to enhance lift and to reduce drag.

Measurement and Manipulation of Flows: We develop and utilize new methods for active and passive control of flows. The goals are to effectively control turbulent separations for high lift or low drag, and to control laminar-turbulent transition. The research group focuses on generating high-quality experimental datasets for airfoils, aircraft components, automotive geometries and generic configurations.

Scale-Resolving Simulation of Acoustic Sources: Significant part of the noise emissions from aircraft and automotive has its origin in turbulent shear flows. We develop scale-resolving simulations of aero-acoustic sources for noise prediction and physical analysis of noise sources. The focus is on external flow problems.

Multiphase Flows and Icing: Multiphase flows and icing are relevant for aircraft, automotive and wind turbine performance. Our research group operates a unique wind tunnel facility where dynamical interactions of flow, super-cooled droplets and ice crystals with technical surfaces can be measured. New numerical simulations reveal physical insight into complex processes.

Flow Modelling and Control: Closed-loop flow control has great potential in providing future flow processes with adaptivity, robustness and optimum performance. Therefore we develop tools for flow state estimation and suited algorithms for closed-loop flow control applications. We address key challenges of turbulence control from the inherent nonlinearity of actuation mechanism to noise in experiments.



Publications

- R. Radespiel, M. Burnazzi, M. Casper, P. Scholz: Active flow control for high lift with steady blowing, The Aeronautical Journal, Vol. 120, pp. 171-200, 2016.
- R.A.D. Akkermans, R. Ewert, S.M.A. Moghadam, J. Dierke, N. Buchmann: Overset DNS with Application to Sound Source Prediction, in: Progress in Hybrid RANS-LES Modelling, Notes on Numerical Fluid Dynamics and Multidisciplinary Design, Vol. 130, pp. 59-68, 2015.
- R. Cecora, R. Radespiel, B. Eisfeld, A. Probst: Differential Reynolds-Stress Modeling for Aeronautics, AIAA Journal, Vol. 53, pp.739-755, 2015.
- X. Gong, S. Bansmer: 3-D ice shape measurements using mid-infrared laser scanning, Opt. Express, vol. 23, pp. 4908-4926, 2015
- F. Munoz, D. Heitmann, R. Radespiel: Instability Modes in Boundary Layers of an Inclined Cone at Mach 6. Journal of Spacecraft and Rockets, Vol. 51, pp. 442-454, 2014.

Institute for Materials

Prof. Dr. Joachim Rösler

Researcher's Career

- Since 1996: Full Professor for Materials, Technical University Braunschweig
- 1991-1996: Project Leader, Group Leader, Department Head, Asea Brown Boveri AG, Baden, Switzerland
- 1990-1991: Project Leader, Max-Planck-Institute for Metals Research, Stuttgart
- 1988-1990: Assistant Research Engineer, Materials Department, University of California, Santa Barbara, USA
- PhD at Max-Planck-Institute for Metals Research, Stuttgart
- Study of Material Science/ Metal Science at Friedrich-Alexander University Erlangen-Nürnberg/ University Stuttgart

Funding
DFG, BMWi, EU, State of Lower Saxony, industry

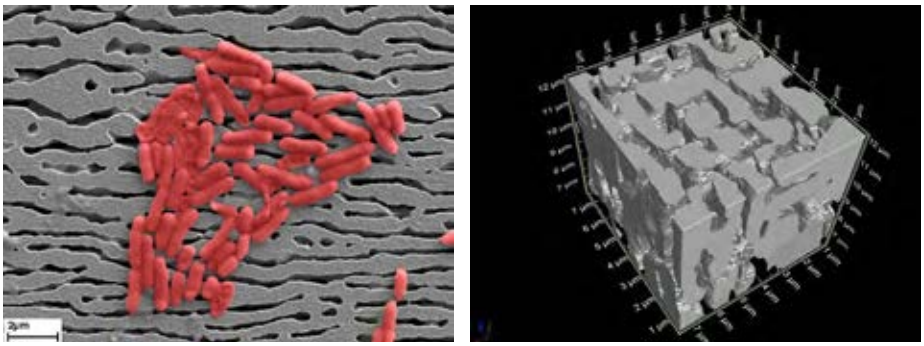
Contact
Technische Universität Braunschweig
Institute for Materials
Langer Kamp 8
38106 Braunschweig
Phone: +49 531 391-3068
j.roesler@tu-braunschweig.de
www.tu-braunschweig.de/ifw

Mission Statement

The focus of our research is on metallic materials. Our goal is to develop high temperature materials with unprecedented properties, investigate new materials using modern methods and understand failure and fracture of modern engineering materials.

Research

Nanoporous Superalloy Membranes and Porous Materials: Based on the well-known rafting process in superalloys we invented a technique to produce metallic membranes with extremely fine and homogenous porosity on the nanoscale. Current research focuses on manufacturing processes using single crystalline and polycrystalline superalloys, development of superalloys tailored for this application, understanding the mechanical behavior of these novel porous materials. Other porous metallic materials, such as porous aluminum, are investigated with respect to their microstructure-property relationship and tailored for functional applications such as noise attenuation.



Examples of nanoporous superalloy membranes. The ability to filtrate bacteria (here: pseudomonas) is shown on the left. The 3D-microstructure obtained by FIB-tomography of another membrane material is shown on the right.

High Temperature and High Performance Materials: Superalloys are developed for high temperature applications, e.g. turbine discs. Furthermore, we have invented Co-Re alloys for applications beyond the temperature capability of superalloys. Due to complete miscibility of Co and Re and a steadily increasing melting temperature with Re-addition, the character of these alloys can be tuned almost at will between that of conventional Co-alloys and high melting point refractory metals. Currently investigated alloys exhibit melting temperatures in excess of 1,500°C. Alloy development concepts are derived from in-depth studies of microstructure-property relationships. Furthermore, titanium alloys are investigated and developed, especially with a focus on biomedical applications.

Thermal Barrier Coatings: The micromechanics and failure mechanisms of thermal barrier coatings are studied with particular emphasis on the role of creep processes. Finite element simulation is used to analyze the stress state in the coating system and model crack-paths during thermo-mechanical loading. Furthermore, novel thermal barrier coating systems are developed for applications other than in gas turbines, e.g. rocket engines.

Publications

- T. Fiedler, J. Rösler, M. Bäker, Development of a CuNiCrAl Bond Coat for Thermal Barrier Coatings in Rocket Combustion Chambers, Journal of Thermal Spray Technology, 24, 1480 (2015).
- A. Landefeld, J. Rösler, Nanoforging – Innovation in three-dimensional processing and shaping of nanoscaled structures, J. Nanotechnol., 5, 1066 (2014).
- J. Rösler, O. Näth, Mechanical Behaviour of Nanoporous Superalloy Membranes, Acta Mater., 58, 1815 (2010).
- J. Rösler, D. Mukherji, T. Baranski, Co-Re-Based Alloys: A New Class of High Temperature Materials?, Adv. Eng. Mater., 9, 876 (2007).
- J. Rösler, H. Harders, M. Bäker, Mechanical Behaviour of Engineering Materials, Springer Verlag (2007).

Institute of Adaptronics and Functional Integration

Prof. Dr.-Ing. Michael Sinapius

- DFG Research Group 2021: "Acting principles of nano-scaled matrix additives for composite structures"

Researcher's Career

- Full Professor for Adaptive Systems, TU Braunschweig
- Member of the Directorate of the Institute of Composite Structures and Adaptive Systems, DLR
- Full Professor for Adaptive Lightweight Design, University of Magdeburg
- Deputy Director of the Institute of Composite Structures and Adaptive Systems, DLR
- Visiting Scientist, NASA Langley Research Center
- Research Scientist, Institute of Aeroelasticity, DLR
- Doctor of Engineering, RWTH Aachen
- Studies of Mechanical Engineering, University of Kassel

Funding

DFG, BMBF, EU, HGF, Industry

Contact

Technische Universität Braunschweig
Institute of Adaptronics and
Functional Integration
Langer Kamp 6
38106 Braunschweig
Phone: +49 531 391-2640
m.sinapius@tu-braunschweig.de
www.tu-braunschweig.de/iaf

Mission Statement

Our vision is a new school of lightweight construction through

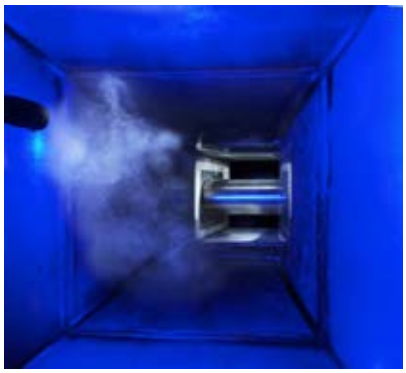
- structure compliant integration of functions from material through to component level
- adaptivity on environmental conditions and alternating requirements
- self-regulating production processes
- simultaneously securing robustness and fault tolerance.

Research

Adaptronics is an interdisciplinary science of engineering. This specific field deals with the research and development of adaptive components and constructions in mechanical engineering. Adaptronics includes an integration of new functions in carrying components through the combination of conventional construction materials with active material systems.

The aim of Adaptronics, also called smart structures technology, is active influence of the elasto-mechanical behavior of technical structures in mechanical engineering. Adaptronics solutions are characterized by special measures on function integration. This means they have at their disposal a structure compliant integration of sensory-actuator-like characteristics and/or components. Targets of Adaptronics are in particular:

- vibration reduction,
- noise reduction,
- shape control and
- structural health monitoring.



We are currently focusing our research on four fields:

Function integrated hybrid materials: DFG Research Group 2021: Operating principle of nanoscaled matrix additives for polymer composite structures; residual strength in Fibre-Metal-Laminates; Corrosion in CFRP-Steel-Laminates; durability for polymer composites under very high cycle loads.

Active machine elements: Controlled, adaptive tribological behavior between different structural surfaces; adaptive vibration suppression; adaptive foil bearings.

Adaptive components and structures: Adaptive flow control for high lift systems; integrated thermo-mechanical De-Icing; deployable ultralight-weight space structures; morphing structures; sound radiation and active structural acoustic control of structures with inhomogeneous damping.

Self-regulating manufacturing processes: Controlled pultrusion process with in-situ quality assurance; hybrid lamination process; production of composite structures in a serial-parallel process having self-regulating properties.

Publications

- Wiedemann, M., Sinapius, M. (Editors): Adaptive, Tolerant and Efficient Composite Structures. Research Topics in Aerospace. Springer. ISBN 978-3-642-29189-0) (2012)
- Kubicka, M., Mahrholz, T., Kühn, A., Wierach, P., Sinapius, M.: Magnetostrictive properties of epoxy resins modified with Terfenol-D particles for detection of internal stress in CFRP. Part 1: Materials and processes (2012) Journal of Materials Science, 47 (15), pp. 5752-5759., Part 2: Evaluation of stress detection, J. Material Science, 48:6578-6584
- Exner, W., Arlt, C., Mahrholz, T., Riedel, U., Sinapius, M. Nanoparticles with various surface modifications as functionalized cross-linking agents for composite resin materials (2012) Composites Science and Technology, 72 (10), pp. 1153-1159.
- Könnicke, D., Kühn, A., Mahrholz, T., Sinapius, M. Polymer nanocomposites based on epoxy resin and ATH as a new flame retardant for CFRP: Preparation and thermal characterization (2011) Journal of Materials Science, 46 (21), pp. 7046-7055.
- Algermissen, S., Keimer, R., Rose, M., Straubel, M., Sinapius, M., Monner, H.P. Smart-structures technology for parallel robots (2011) Journal of Intelligent and Robotic Systems: Theory and Applications, 63 (3-4), pp. 547-574.

Institute for Biochemical Engineering (ibvt)

Prof. Dr.-Ing. Antje C. Spiess

Researcher's Career

- Full Professor for Biochemical Engineering, TU Braunschweig
- Full Professor for Enzyme Process Technology, RWTH Aachen University
- Habilitation, Faculty of Mechanical Engineering, RWTH Aachen University
- Scientific Assistant at the Chair for Biochemical Engineering, RWTH Aachen University
- Ph.D. at Technical University Hamburg-Harburg, Department of Chemical Engineering
- Studies of Chemical Engineering, Technical University Hamburg-Harburg

Funding

DFG, NRW, MWK

Contact

Technische Universität Braunschweig
Institute for Biochemical Engineering (ibvt)
Rebenring 56
38106 Braunschweig
Phone: +49 531 391-55310
a.spiess@tu-braunschweig.de
www.ibvt.de

Mission Statement

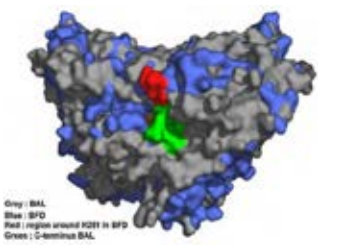
We apply and develop bioreactors, classical and systems biotechnological analytics, and modelling methods in a structured way using model-based experimental analysis in order to rationally develop tailored biocatalysts and sustainable integrated bioprocesses.

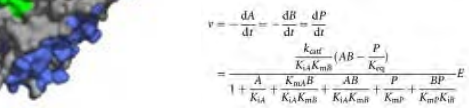
Research

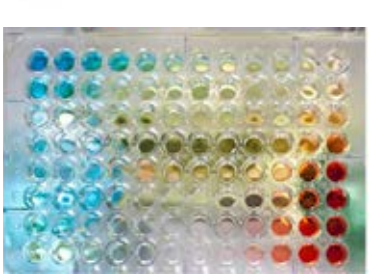
Analytics for bioprocesses: We apply, develop and validate analytics for the monitoring and control of bioprocesses, either spectrometric (photometry, CLSM, DLR) or chromatographic methods (GPC-MALLS, HPAED-PAD), in order to supply modelling with reliable quantitative data (e.g. Grosch et al. 2016). In particular, we have been successful in quantifying mass transport in enzyme immobilizates and in demonstrating that reaction and transport processes are orthogonal (e.g. Zavrel et al. 2010).

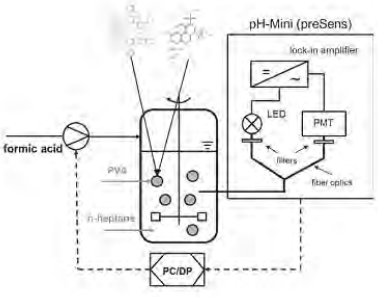
Model-based experimental analysis: We use a structured iterative approach to generation and validation of mathematical models for various kinds of bioprocesses, including advanced methods for analysis of identifiability, for experimental design (DOX and OED), as well as for parameter estimation (e.g. Zavrel et al. 2010). Mechanistic kinetic models attained through this rigorous approach can be applied both on a microscale to relate catalyst structure and function and on a macroscale to predict bioreactor performance (e.g. Begemann and Spiess 2015).

Bioreactor design and control: We develop new reactor concepts and control strategies for intensified bioprocesses, also using non-conventional, non-aqueous reaction media (see Engel et al. 2010). Besides reduced process times and simplified downstream-processing, new reaction trajectories can be further exploited (see Wiese et al. 2013).









Publications

- Grosch, J.-H., Sieben, M., Lattermann, C., Kauffmann, K., Büchs, J., & Spieß, A. C. (2016). Enzyme activity deviates due to spatial and temporal temperature profiles in commercial microtiter plate readers. Biotechnology Journal, 11(4), 519-529. http://doi.org/10.1002/biot.201500422
- Begemann, J., & Spiess, A. C. (2015). Dual lifetime referencing enables pH-control for oxidoreductions in hydrogel-stabilized biphasic reaction systems. Biotechnology Journal, 10(11), 1822-1829. http://doi.org/10.1002/biot.201500198
- Wiese, S., Spiess, A. C., & Richtering, W. (2013). Microgel-stabilized smart emulsions for biocatalysis. Angewandte Chemie - International Edition, 52(2), 576-579. http://doi.org/10.1002/anie.201206931
- Engel, P., Mladenov, R., Wulfhorst, H., Jäger, G., & Spiess, A. C. (2010). Point by point analysis: how ionic liquid affects the enzymatic hydrolysis of native and modified cellulose. Green Chemistry, 12(11), 1959-1966. http://doi.org/10.1039/cogc00135j
- Zavrel, M., Michalik, C., Schwendt, T., Schmidt, T., Ansorge-Schumacher, M., Janzen, C., ... Spiess, A. C. (2010). Systematic determination of intrinsic reaction parameters in enzyme immobilizates. Chemical Engineering Science, 65(8), 2491-2499. http://doi.org/10.1016/j.ces.2009.12.026

Institute of Space Systems

Prof. Dr.-Ing. Enrico Stoll

Researcher's Career

- Head of the Institute of Space Systems
- System Engineer at RapidEye / Blackbridge
- Lecturer at FU Berlin
- Visiting Researcher at University Putra Malaysia
- Postdoc at Massachusetts Institute of Technology, USA
- Dr.-Ing. at the Institute of Astronautics, TU München
- Studies in Mathematics at TU München and University of Hagen
- Studies in Aerospace Engineering at TU Dresden, MAI (Russia), and UNSW (Australia)

Funding

DLR, ESA, EU, industry

Contact

Technische Universität Braunschweig
Institute of Space Systems
Hermann-Blenk-Straße 23
38108 Braunschweig
Phone: +49 531 391 9960
e.stoll@tu-braunschweig.de
www.space-systems.eu

Mission Statement

We develop methods, technology, and approaches to ensure a sustainable use of space and the safety of space assets. For this purpose, we focus on the mitigation of risks associated with space debris by modelling the space debris environment and by investigating approaches to active debris removal.

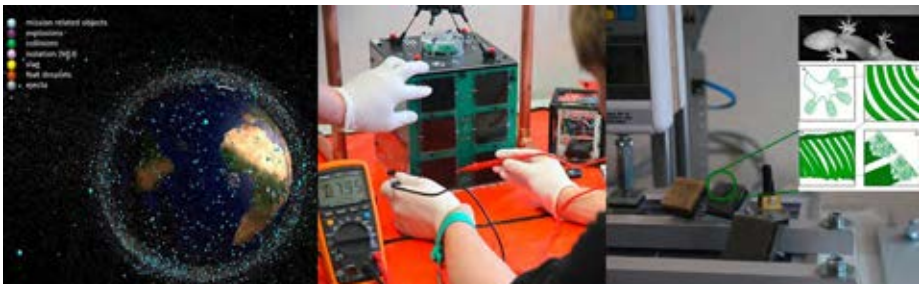
Research

Space Debris: The Institute of Space Systems develops and maintains the European reference model (MASTER) for the estimation of risks from high-velocity impacts with space-flight residua (so-called space debris) on satellites. The research supports the entire satellite life cycle by developing methods that

- support the mission design process with the selection of the orbit,
- support the satellite design process with knowledge of the direction of the space debris flux,
- support the operation of the satellite by providing methods for the calculation of collision probabilities and the optimization of avoidance maneuvers,
- consider the degradation of the satellite (flaking of paint, multi-layer insulation etc.) during operational life, which contributes to the space debris environment, and
- consider the re-entry of the satellite and the probabilities of trajectories that intersect populated land mass.

Satellite Operations: The satellite operations research at IRAS focusses on critical aspects of active debris removal (ADR) of high-risk objects. High-risk objects usually exhibit large masses and dimensions, such that the lifetime collision probability, which associated with the object (such as upper stages or large scientific satellites), is significant and the chance of creating new debris is high. Accordingly, methods are investigated to capture non-cooperative tumbling debris objects with masses of several tons.

Satellite Technology: Satellites involved in ADR missions are complex engineering solutions. The satellite technology research at IRAS therefore focuses on technology for precise orbit determination, next generation CubeSat components to enable cost effective ADR missions in the future, and biologically inspired docking mechanisms ("gecko material") that enable material independent and repeatable docking to non-cooperative targets. Further, mission reliability aspects are considered in order to decrease the probability of satellite component failures.



Publications

- E. Stoll, A. Brunn, K. Shahid, A. Horstmann, The Optimization of Memory Management in Earth Observation Constellations, Acta Astronautica, in press, Available online December 2015.
- E. Stoll, C. Trentlage, M.Becker, The use of biologically inspired gecko material for active debris removal of high priority objects, Deutscher Luft- und Raumfahrtkongress, Rostock, Germany, 2015.
- E. Stoll, S. Jaekel, J. Katz, A. Saenz-Otero, R. Varatharajoo, SPHERES interact-Human machine interaction aboard the International Space Station, Journal of Field Robotics, vol. 29, iss. 4, pp. 554-575, 2012.
- E. Stoll, J. Letschnik, M. Wilde, A. Saenz-Otero, R. Varatharajoo, J. Artigas, The future role of relay satellites for orbital telerobotics, Journal of Advances in Space Research, vol. 50, iss. 7, pp. 864-880, 2012.
- E. Stoll, A. Saenz-Otero, B. Tweddle, Multimodal Human Spacecraft Interaction in Remote Environments – A new concept for free flyer control, in Machine Learning and Systems Engineering, Springer, 2010.

Institute for Engineering Design

Prof. Dr.-Ing. Thomas Vietor

Researcher's Career

- Leader of the research area "Design and Simulation" in the Forschungscampus "Open Hybrid Lab Factory" OHLF e.V.
- Leader of the research area "Flexible Vehicle Concepts" at NFF
- Leader of the Institute for Engineering Design
- University (Full) Professor for Engineering Design at TU Braunschweig
- Leader of a vehicle concepts department and different positions in Vehicle Development in the automotive industry
- Dr.-Ing at the University of Siegen
- Research Assistant at the Institute of Mechanics and Control Engineering, University of Siegen
- Student of mechanical engineering at University of Siegen. Degree: Dipl.-Ing.

Funding
DFG, BMBF, BMWI, DAAD, EU,
Lower Saxony, industry

Contact
Technische Universität Braunschweig
Institute for Engineering Design
Langer Kamp 8
38106 Braunschweig
Phone: +49 531 391-66670
t.vietor@tu-braunschweig.de
www.tu-braunschweig.de/ik

Mission Statement

We develop approaches, methods and computer-aided tools ranging from elementary approaches to transferring methods into industry in order to support the process from an idea to a product. Knowledge of various technical systems as well as interdisciplinary cooperation in Automotive Research Centre Niedersachsen (NFF) and Aeronautics Research Centre Niedersachsen (NFL) as well as Battery LabFactory Braunschweig (BLB) and Open Hybrid LabFactory e.V. (OHLF e.V.) initiate innovative approaches.

Research

Design Methodology: Developing approaches for product planning and design including technical and organisational boundary conditions. Methods for requirements engineering, approaches for management of variants and complexity of products as well as tools for decision support and application of methods are core topics.

Vibro Acoustics: Design for Acoustics, Qualification in Acoustics, Computational Acoustics, and Higher Dimensional Acoustics are the core topics in this research discipline. Providing acoustic forecasting possibilities for the early phases of product development forms the connection to other research topics, as design methodology.

Machine Elements: Using multi-functional materials, solutions for adaptive machine elements are developed. Essential requirements are derived from the field of robotics and form the basis for developing adaptive joints and clutches for highly dynamic power transfer. Generative manufacturing techniques enable a quick realization of functional models for validation and first functional tests and in future for serial applications.

Computer-Aided Engineering: Tools and approaches for computer-aided product development are framed in this research area. Various development steps, such as selection of methods, knowledge management and visualization of correlations between requirements are supported. Developing approaches for structural and topological optimization of hybrid material parts is another focus in this area.

Vehicle Concepts: Development and evaluation of future automotive and railway vehicle concepts regarding different usage scenarios, this area contributes to creating future mobility. Combined with competences of the other research areas, methods and tools for the development of systems and parts and concepts in hybrid design are compiled regarding a holistic view of the vehicle on the road or trail.

Publications

- Vietor, T., Herrmann, C., Spengler, T. (2015): Synergetische Produktentwicklung. Unternehmensübergreifend erfolgreich zusammenarbeiten. Ergebnisse des Verbundprojekts SynProd. Shaker. Aachen. ISBN 978-3-8440-3437-0.
- Prüß, H., Vietor, T. (2015): Design for fiber-reinforced additive manufacturing. In: Journal of Mechanical Design. The American Society of Mechanical Engineers (ASME). doi: 10.1115/1.4030993.
- Ghaffarimejlej, V., Kleemann, S., Vietor, T. (2015): An approach for multi-objective optimization of hybrid material structure for mobility applications. 20th International Conference on Composite Materials. Copenhagen.
- Nehuis, F., Ibe, M., Stechert, C., Vietor, T., Rausch, A. (2013): Clustering Regional-Specific Requirements as a Methodology to Define the Modules of a Car Concept. In Chakrabarti, A. (Ed.): CIRP Design 2012. Sustainable Product Development. Springer London. ISBN 978-1-4471-4506-6.
- Stechert, C., Franke, H.-J., Vietor, T. (2010): Knowledge-Based Design Principles and Tools for Parallel Robots. In: Schütz, D., Wahl, F. M.: Robotic Systems. Springer. Berlin Heidelberg. ISBN 978-3-642-16784-3, pp 59-75.

- Automotive Research Centre Niedersachsen (NFF): www.tu-braunschweig.de/forschung/zentren/nff
- Aeronautics Research Centre Niedersachsen (NFL): www.tu-braunschweig.de/forschung/zentren/nfl

5

Electrical Engineering | Information Technology | Physics

Institute of Computer and Communication Engineering – Research Group Embedded System Design Automation

Prof. Dr.-Ing. Rolf Ernst

- Head of Institute of Computer and Communications Engineering (IDA)
- Coordinator of DFG Research Group FOR 1800 "Controlling Concurrent Change"
- DFG Liaison Officer TU Braunschweig
- Deputy Speaker Center tubs.CITY

Researcher's Career

- Full Professor at TU Braunschweig
- Member of Technical Staff at Bell Laboratories, Allentown, USA
- Ph.D. in Electrical Engineering (w. honors), Univ. Erlangen-Nürnberg (D. Seitzer)
- Diploma in Computer Science, Univ. Erlangen-Nürnberg

Funding

DFG, BMBF, BMWi, EU, industry (Europe, US, Japan)

Contact

Technische Universität Braunschweig
Institute of Computer and Communications Engineering
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 391-3730
r.ernst@tu-braunschweig.de
www.ida.ing.tu-bs.de

Mission Statement

Develop architectures and design methods for predictably, dynamically, flexibly networked multi-core embedded and cyber-physical systems, mainly targeting critical and mixed criticality applications in technology and society.

Research

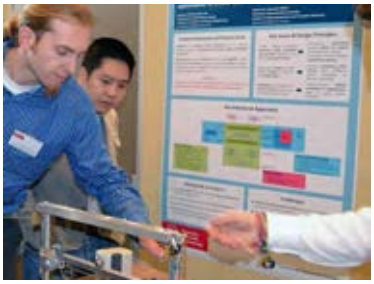
The research group is internationally known as a pioneer in embedded systems design automation. Starting in 1991 with early work on HW-SW co-design, research has extended to embedded system architectures, system analysis, and optimization covering both computation and communication. Emphasis is on architectures and design methods for predictably, dynamically and flexibly distributed and multicore systems. Work includes basic research into formal models, methods, and architectures, as well as challenging prototype designs in collaboration with academic partners and industry. Project groups are typically large consisting of 3 or more Post Docs, Ph.D. candidates, in addition to Bachelor's and Master's Degree students.

Rather than focusing on a single application domain, research addresses common problems and solutions for many applications ranging from automotive to avionics, from communication to energy and smart buildings. This approach has anticipated the current technical trend integrating different applications on the same increasingly open embedded systems network leading to new scientific challenges in cyber-physical systems and the Internet-of-Things.

Current main research objects include

- Real-time systems design and analysis using CPA (Compositional Performance Analysis) developed at IDA and used in automotive design worldwide (Spin-off Symtavision). Current focus: Automotive Networks and Multicore Run-time Environments
- CCC (Controlling Concurrent Change), a DFG Research Group investigating safe and secure methods for self-configuration and self-protection of critical embedded systems that change in the field. Main methods are automated model-based contracting, self-configuring hardware and software architectures, run time monitoring.
- IDAMC (Integrated Dependable Architecture for Many Cores), a manycore architecture with system level virtualization for mixed criticality applications
- System level virtualization in smart building and smart energy applications

FlexWAFE video accelerator



Self protecting distributed control demonstrator (CCC)

Publications

- L. Ecco, S. Saidi, A. Kostrzewa, R. Ernst. "Real-time DRAM Throughput Guarantees for Latency Sensitive Mixed QoS MpSoC. IEEE Int. Symp. Industrial Embedded Systems (SIES), June 2015, Best Paper Award
- M. Neukirchner, M. Negrean, R. Ernst T. Bone, "Response-Time Analysis of the FlexRay Dynamic Segment under Consideration of Slot-Multiplexing" in IEEE Int. Symp. Industrial Embedded Systems (SIES), June 2012, Best Paper Award
- S. Schliecker, M. Negrean, R. Ernst, "Response Time Analysis in Multicore ECUs with Shared Resources", IEEE Trans. on Industrial Informatics, vol. 5, No. 4, Nov. 2009.
- S. Schliecker, J. Rox, M. Negrean, K. Richter, M. Jersak, R. Ernst. System Level Performance Analysis for Real-Time Automotive Multi-Core and Network Architectures. IEEE Trans. on Computer Aided Design. Vol. 28 , No. 7, pp. 979-992, July 2009.
- M. Jersak, R. Henia und R. Ernst, "Context-Aware Performance Analysis for Efficient Embedded System Design" in Design Automation and Test in Europe – Most Influential Papers in 10 years of DATE, Springer 2008.

Institute for Communications Technology (IfN) – Department Signal Processing

Prof. Dr.-Ing. Tim Fingscheidt

- Head of Department Signal Processing

Researcher's Career

- 2014, IHK Technology Transfer Award
- Since 2011, Elected member of IEEE Speech and Language Processing Technical Committee
- Since 2006, Full Professor at Technische Universität Braunschweig
- 2005-2006, Competence field manager at Siemens Corporate Technology, Munich
- 2004, IEEE Senior member
- 2002, ITG Prize of VDE
- 1999-2005, R&D team leader at Siemens Communications, Mobile Phones, Munich
- 1999, Advancement Prize of the Mannesmann (now: Vodafone) Mobile Communications Foundation
- 1998-1999, Scientific Consultant at AT&T Labs (Shannon Labs), Florham Park, N.J., USA
- 1993-1998, Scientific Research Assistant at RWTH Aachen, PhD with distinction, Borchers medal
- 1987-1993, Student of Electrical Engineering at RWTH Aachen, Dipl.-Ing. with distinction, Springorum Prize

Funding
DFG, International Industry, Ministry of Economic Affairs

Contact
Technische Universität Braunschweig
Institute for Communications Technology (IfN)
Schleinitzstraße 22
38106 Braunschweig
Phone: +49 531 391-2485
t.fingscheidt@tu-braunschweig.de
www.ifn.ing.tu-bs.de/en/ifn/sp/

Mission Statement

Machine Learning and Signal Processing are core elements of our research towards speech and audio processing, transmission, automatic recognition, and instrumental performance assessment algorithms. Applications are production and quality monitoring, car handsfree systems, high-quality telephony, smartphones, hearing aids.

Research

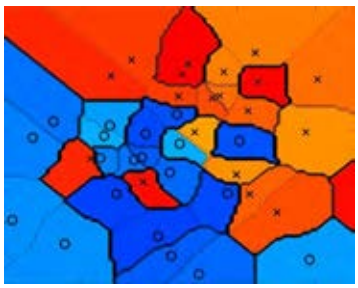
Speech Processing, Enhancement, and Transmisssion: Mobile speech communication is disturbed by background noise and acoustic echoes in the case of handsfree use. We perform research in a wide range of speech enhancement to allow high-quality speech and audio telecommunication covering noise reduction, acoustic echo cancellation (single- and multi-channel), artificial speech, bandwidth extension, ultra-low delay wireless audio transmission. We cooperate with smartphone and car handsfree speech technology solution suppliers, phone manufacturers, and teleconferencing voice service providers.

Information/Sensor Fusion in Automatic Speech Recognition: Fusion of information sources of different quality is a challenging problem in practice, particularly in sensor networks or multimodal signal processing. We perform both fundamental and applied research towards medium-level fusion approaches always showing better performance than using only the best single information, and better than the best early or late fusion system. Current work focuses on robust automatic speech recognition in a single or multi-channel, -modal, or -model setup.

Emotion Recognition and Social Signal Processing: Machine learning from speech and audio is able to provide not only a text transcript (automatic speech recognition), but also to convey information about who is talking, age and gender of the speaker, emotion and stress, language, etc. As application examples, our research supports the provision of feedback on team meetings, or car usage (number of people, men/women, ...).

Machine Learning in Production Technology and Quality Monitoring: Deep learning is at the heart of artificial intelligence today. We perform research and develop solutions, whereby recognition algorithms are designed almost purely data-driven by training of so-called deep neural networks with many hidden layers. Thanks to GPU support, our training algorithms run efficiently and allow fast development and prototyping.

Low-latency audio transmission for wireless microphones



Machine learning and clustering methods for many practical applications

High-quality speech communication for enterprise and automotive applications

Publications and Patents

- S. Receveur, R. Weiss, T. Fingscheidt, Turbo Automatic Speech Recognition, IEEE/ACM Transactions on Audio, Speech, and Language Processing, vol. 24, no. 5, pp. 846-862, May 2016
- M.-A. Jung, T. Fingscheidt, A Wideband Automotive Hands-Free System for Mobile HD Voice Services, in Smart Mobile In-Vehicle Systems, Next Generation Advancements, G. Schmidt et al., Ed., Springer, 2014, pp. 81-96.
- P. Bauer, J. Abel, T. Fingscheidt, HMM-Based Artificial Bandwidth Extension Supported by Neural Networks, IWAENC, Sep. 2014, pp. 1-5.
- A. Kolossa, B. Kopp, T. Fingscheidt, A Computational Analysis of the Neural Bases of Bayesian Inference, NeuroImage, vol. 106, pp. 222-237, Feb. 2015.
- P. Transfeld, S. Receveur, T. Fingscheidt, An Acoustic Event Detection Framework and Evaluation Metric for Surveillance in Cars, INTERSPEECH, Aug. 2015, pp. 2927-2931.
- 9 patents granted.

Institute for Electrical Machines – Traction and Drives (IMAB)

Prof. Dr.-Ing. Markus Henke

Researcher's Career

- Full Professor for Electrical Drives at TU Braunschweig
- Leader of the research area "Electromobility" at NFF
- Head of the Institute for Electrical Machines; Traction and Drives, TU Braunschweig
- Professor for Electrical Drives and Mechatronics at Ostfalia, Wolfsburg
- Head of the Electrical Drives Department at Volkswagen Group Research, Wolfsburg
- Dr.-Ing. at the University of Paderborn
- Research Assistant at the Institute of Power Electronics and Electrical Drives, University of Paderborn
- Study of electrical engineering, degree Dipl.-Ing. University of Paderborn

Funding

DFG, BMBF, BMWi, DBU, Lower Saxony, Industry

Contact

Technische Universität Braunschweig
Institute for Electrical Machines –
Traction and Drives (IMAB)
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 391-3914
m.henke@tu-braunschweig.de
www.tu-braunschweig.de/imab

Mission Statement

We work on new designs for electrical motors, linear actuators and power electronics to realize high performance drives with maximum energy efficiency. With a strong background in electromagnetic motor design, engineering design, power electronics and testing, prototype drive systems are realized, analyzed and enhanced.

Research

Innovative Electrical Machines for Automotive Applications: In cooperation with scientific and industrial partners (especially in NFF) we design, build and optimize electrical drives for automotive powertrains and for ancillary components. The main design targets are energy efficiency, power density and and noise reduction, which are pursued by implementing new electromagnetic materials, innovative machine topologies and optimized cooling systems.

Design and Control of High Speed Electrical Drives:
The main advantage of high speed drives is the possibility to reduce weight and size, especially in automotive applications.The technology is characterized by excitation with high mechanical frequencies, which effect the rotor dynamics and the design of mechanical structures and bearings.

Power Electronics for High Performance Motor Control: We work on operation of electrical drive systems with maximum energy efficiency. Here we use fast switching SiC and GaN semiconductors to reduce loss in power electronics and to enhance switching frequency and power density of converter systems.

Contactless Power Transfer: Contactless power transfer via inductive charging technology is an important feature of battery electric vehicles (busses and cars). We have been doing research for many years on the design of electromagnetic coupling and power conversion and have built up several types of charging systems in different power range.

Flywheel energy storage systems: In smart grids and in industrial applications flywheel systems are used to compensate energy fluctuations. Motor / Generator devices in combination with superconductive bearings support this technology. At IMAB we work on new innovative approaches to optimize these systems.

Design and Test of High Efficient Electrical Drives

Publications

- C. Bode, W.-R. Canders, M. Henke: "A new analytical approach to determine slotting based eddy current losses in permanent magnets of PMSM taking into account axial and circumferential segmentation", Int. Journal for Computation and Mathematics in Electrical and Electronic Engineering, 2015
- C. Bode, H. Schillingmann, M. Henke: "A Free-Piston PM Linear Generator in Vernier Topology using quasi-Halbach-Excitation", Int. Conf. on Electrical Machines ICEM 2014
- N. Domann, W.-R. Canders, M. Henke: "Design Process and Topology Comparison for a High Performance PM-Machine for Sustainable Traction Drive Technology" in Eighth Int. Conference and Exhibition on Ecological Vehicles and Renewable Energies (EVER), Monacco, 2013
- M. Cai, M. Henke, W.-R. Canders: "An Improved Method for Design of Symmetrical Multiphase Winding with Optimal Space Harmonics Spectrum", Int. Conf. on Electrical Machines and Systems, ICEMS 2014, Hangzhou
- N. Langmaack, G. Tareilus, M. Henke: "High Temperature and High CMR Gate Driver Circuit for Wide-Band-Gap Power Semiconductors", IEEE Int. Conf. on Power Electronics and Drive Systems, PEDS 2015

Institute of Geophysics and Extraterrestrial Physics

Prof. Dr. Andreas Hördt

Researcher's Career
- Full Professor of Applied Geophysics, TU Braunschweig.
- Temporary professor of Applied Geophysics, Institute of Geology, Universität Bonn.
- Assistant professor, Universität zu Köln.
- Postdoc, Universität zu Köln.
- Dr. rer nat., Universität zu Köln
- Dipl. geophysics, Universität zu Köln

Funding
DFG, MWK, EU, industry

Contact
Technische Universität Braunschweig
Institute of Geophysics and
Extraterrestrial Physics
Mendelssohnstraße 3
38106 Braunschweig
Phone: +49 531 391-5218
a.hoerdt@tu-braunschweig.de
www.igep.tu-bs.de

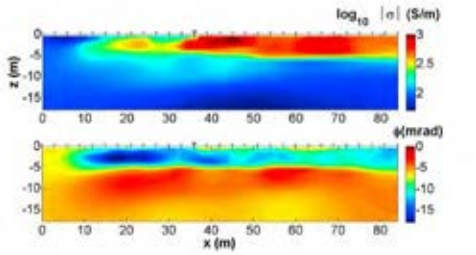
Mission Statement

We advance electrical and magnetic methods in the field of Applied Geophysics. Our aim is an improved investigation of the subsurface of the Earth, with a variety of applications in geosciences, such as groundwater research, exploration for resources, environmental sciences, permafrost and tectonics.

Research

Spectral induced polarization: measures the complex, frequency-dependent impedance of the subsurface. The aim is to estimate hydraulic parameters, important for many applications in groundwater research. We study method in the laboratory, at the field scale, and theoretically by developing models to understand the relationships between hydraulic and electric properties.

Spectral induced polarization measurements in the field



Electrical image of the subsurface

Capacitive resistivity: determines the electrical impedance of the subsurface without direct contact to the ground. In the frequency range between 100 Hz and 100 kHz, the electrical permittivity of water ice displays a characteristic frequency dependence. We exploit this information for terrestrial permafrost studies, and potentially during space missions for the investigation of small planetary bodies.

Three-component borehole magnetometry: We measure Earth's magnetic field in boreholes. Whereas conventional methods determine only the total field, we are able to measure all three components. This requires an extremely precise determination of the sensor orientation, for which we use fiber optic gyros and sophisticated software. From the data, we can determine the rock magnetization which is important for plate tectonics and ore exploration.

Publications and Patents

- Ehmann, S., A. Hördt, M. Leven, and C.Virgil, 2015. Paleomagnetic inclination and declination from three-component borehole magnetometer data – New insights from logging in the Louisville seamounts J. Geophys. Res. Solid Earth, 120, doi:10.1002/2014JB011531.
- Virgil, C., S. Ehmann, A. Hördt, M. Leven, and E. Steveling, 2015. Reorientation of three-component borehole magnetic data. Geophys.Prospect., 63, 225-242. doi:10.1111/1365-2478.12175
- Bairlein, K., Hördt, A., and Nordsiek, S., 2014. The influence of the sample preparation on induced polarization spectra of unconsolidated sediments. Near Surface Geophysics, 12,667-677, doi: 10.3997/1873-0604.2014023.
- Bücker, M., and Hördt, A., 2013b, Long and short narrow pore models for membrane polarization, Geophysics, 78, E299-E314.
- Bücker, M., and Hördt, A., 2013a. Analytical modelling of membrane polarization with explicit parameterization of pore radii and the electrical double layer, Geoph. J. Int., doi: 10.1093/gji/ggt136.

Institute of Communications Technology

Prof. Dr.-Ing. Thomas Kürner

Researcher's Career

- 2003-present, Full Professor for "Mobile Radio Systems", Technische Universität Braunschweig, Institut für Nachrichtentechnik
- 1999-2003, Team Manager "Radio Network Planning Support", E-Plus Mobilfunk GmbH & Co KG, Düsseldorf/Germany
- 1994-1999, Project Manager/Specialist "Radio Network Planning Tools", E-Plus Mobilfunk GmbH & Co KG, Düsseldorf/ Germany
- 1993-1994, Freelance Software Developer at L&S Hochfrequenztechnik GmbH, Lichtenau working on spectrum management systems
- 1991-1994, Research Assistant and doctoral candidate (Ph. D. received in 1993) at the Institut für Höchstfrequenztechnik und Elekronik of Universität Karlsruhe
- 1985-1990, Diploma in Electrical Engineering, Universität Karlsruhe

Funding

EU, BMBF, DFG, Industry

Contact

Technische Universität Braunschweig
Institute of Communications Technology
Schleinitzstraße 22
38092 Braunschweig
Phone: +49 531 391-2416
t.kuerner@tu-bs.de
www.ifn.ing.tu-bs.de/en/ifn/ms/kuerner/

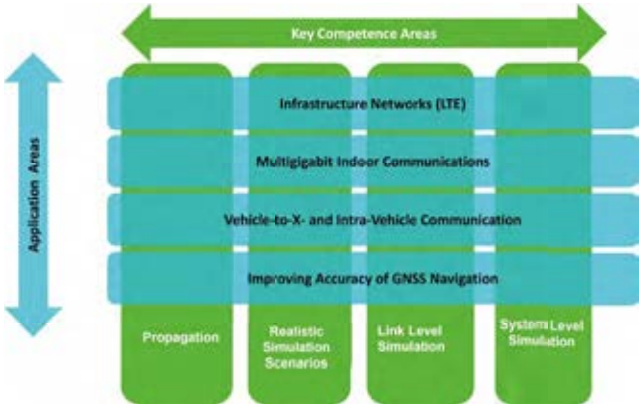
Mission Statement

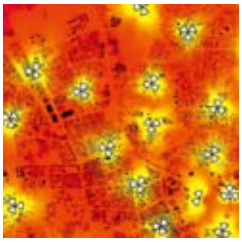
Deep understanding and knowledge of propagation and channel characteristics are the core of every wireless transmission system. We have key competences in these areas both in modeling and radio measurements, on top of which we build realistic simulators for mobile radio systems.

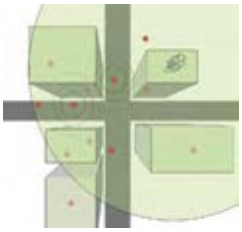
Research

Research of the Mobile Radio Systems group deals with radio transmission in all its facets. Our fields of research can be classified into a matrix of four fields of competence and application areas each. The fields of competence are **"Wave Propagation and Radio Channel Characterisation", "Link Level Simulation", "System Level Simulation"** and **"Generation of Realistic Reference Scenarios for the Simulation".**

The application areas are **"Methods and Algorithms for Planning and Optimisation of Infrastructure Networks", "Multi-Gigabit Indoor Communication", "Vehicle-to-X and Intra-Vehicle Communication"** and **"Improving Accuracy of GNSS Navigation".** The projects dealt with in our research on cognitive radio network management, future THz communications and wireless connectivity in automotive, for example, can be assigned to one or more of these application areas, and in each project research is carried out one or in a number of the stated fields of competence.







The group is internationally positioned – involved in international projects inside and outside Europe as well. Since 2010, Prof. Thomas Kürner has chaired the IEEE 802.15 THz Interest Group and since 2014 the IEEE 802.15 Task group 3d, in which the standardisation of future THz communication systems is fostered. Since 2012, he has been Chairman of the Working Group "Propagation" of the "European Association on Antennas and Propagation" (EurAAP). Since 2016 he has been a member of the EurAAP Board of Directors.

Publications

- T. Kürner, Y. Lostanlen: Propagation Models for Wireless Network Planning. in: de la Roche, G., Alayón-Glazunov, A., Allen, B. (Eds.) LTE-Advanced and Next Generation Wireless Networks: Channel Modeling and Propagation, Wiley, pp. 317-347, 2012.
- K.L. Chee, S.A. Torrico, T. Kürner: Radiowave Propagation Prediction in Vegetated Residential Environments. IEEE Transactions on Vehicular Technology, Vol. 62, No. 2, pp. 486-499, 2013.
- S. Priebe, T. Kürner: Stochastic Modeling of THz Indoor Radio Channels. IEEE Transactions on Wireless Communications, Vol. 12, No. 6, pp. 4445-4455, 2013.
- H.-J. Song, S. Priebe, T. Kürner: THz Wireless Communications in Song, H.-J. and Nagatsuma, T. (Eds.), 'Handbook of Terahertz Technologies: Devices and Applications'; pp. 495-526, CRC Press Book 2015
- B. Ai, Guan, M. Rupp, T. Kürner, X. Cheng, X.-F. Yin, Q. Wang, G.-Y. Ma, Y. Li, L. Xiong, J.-W. Ding: Future Railway Services Oriented Mobile Communication Network. Communications Magazine, IEEE, vol.53, no.10, pp. 78-85, October 2015

Institute for High Voltage Technology and Electrical Power Systems – elenia

Prof. Dr.-Ing. Michael Kurrat

- EFZN, management board member
- VDE Braunschweig, vice chair
- FNN steering committee LV/MV member
- ISDEIV (PISC) international steering committee member
- FSO international steering committee member

Researcher's Career

- Full-Professor and Director of the Institute for High Voltage Technology and Electrical Power Systems – elenia, TU Braunschweig
- Full Professor at TU Braunschweig, Head of high-voltage department, TU Braunschweig
- Moeller switchgear division, Krefeld, Head of gas-insulated switchgear development
- Dr.-Ing. at Universitaet Dortmund, Lehrstuhl für Hochspannungstechnik und Anlagen
- Study Electrical Engineering at Universitaet Dortmund

Funding
DFG, BMBF, BMWI, BMU, BMVBS, EURAMET

Contact
Technische Universität Braunschweig
Institute for High Voltage Technology and Electrical Power Systems – elenia
Schleinitzstraße 23
38106 Braunschweig
Phone: +49 531 391-7735
m.kurrat@tu-braunschweig.de
www.tu-braunschweig.de/elenia

Mission Statement

Our mission is to face the technological challenges for the power system of the 21st century.

Research

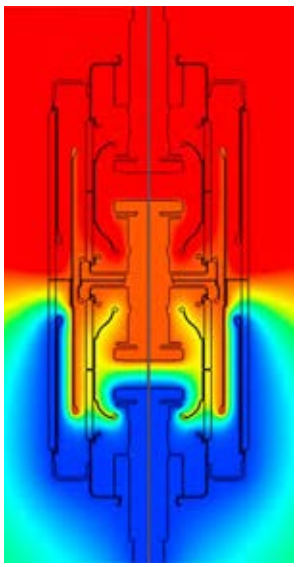
We address three strategic research sectors

- Advanced Components to enable sustainable power systems
- Smart Grids to find system solutions for power grids
- Electromobility to reinvent mobility

These focus areas of expertise represent platforms for professional knowledge exchange. Our expert knowledge and research infrastructure is bundled in six research groups.

- High Voltage Technology
- Electrical Power Systems
- Battery Technology
- Grid Integration
- Energy Management
- Market Integration.

Disciplinary and cooperative projects as well as industry funded projects constitute the framework of our research activities. elenia is a member of national and international working bodies in IEC, DKE, VDE, FNN, CIGRE, and a member of research centres in Lower Saxony for automotive (NFF), Battery Lab-Factory Braunschweig (BLB) and energy (EFZN). Scientific findings contribute directly to the educational curriculum such as new Master's Degree programs Electromobility or Sustainable Power Systems.



Publications and Patents

- O. Binder, J. Meisner, L. Schütze, M. Kurrat, HVDC Test Environment for Loss Measurements on Multilevel Converter Modules. IEEE International Workshop on Applied Measurements for Power Systems (AMPS), Aachen, 2015, S. 61-66.
- D. Boesche, E.-D. Wilkening, H. Köpf, M. Kurrat: Breaking Performance Investigation of Hybrid DC Circuit Breakers: An Experimental Approach The 61st IEEE Holm Conference on Electrical Contacts, HOLM 2015, San Diego, California USA, October 11-14, 2015
- CIGRE Technical Brochure 644, Common Characteristics and Emerging Test Techniques for High Temperature Superconducting Power Equipment, final report of WG D1.38, 2015
- CIGRE Technical Brochure 611, Feasibility Study for a DC Tracking & Erosion Test, final report of WG D1.27, 2015
- CIGRE Technical Brochure 533, HVDC Grid Feasibility Study, final report of WG B4.52, 2013

Institute of Control Engineering – Department Vehicle Electronics

Prof. Dr.-Ing. Markus Maurer

- Chair of Department Automotive Electronics Systems
- Member of the "round table automated driving" of the Federal Ministry of Transport and Digital Infrastructure;
- Member of the founding board of the "Niedersächsisches Forschungszentrum für Fahrzeugtechnik" (2008-2016);
- Founding member of the Uni-DAS e.V.

Researcher's Career

- Full Professor for Automotive Electronics Systems at TU Braunschweig
- Project manager and Head of the development department of "Driver Assistance Systems" at Audi
- Ph.D. at Universität der Bundeswehr München, E.D. Dickmanns.
- Studies in electrical engineering at TU München

Funding

DFG, BMWi, State Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute of Control Engineering
Hans-Sommer-Straße 66
38106 Braunschweig
Phone:: +49 531 391-3838
maurer@ifr.ing.tu-bs.de
www.ifr.ing.tu-bs.de

Mission Statement

Driver assistance systems and autonomous vehicles change the way we use our cars. In our research we focus on the enabling technology. Our mission is to research and develop concepts, methods, and algorithms for vehicle guidance systems including environment perception, decision making, vehicle control, and functional safety.

Research

Autonomous Driving / Driver Assistance Systems: Based on the DARPA Urban Challenge participation of TU Braunschweig in 2007, we have operated automated vehicles in our lead project Stadtpilot in public urban traffic since 2010, thus combining all our research activities to an overall system. Our research focuses on algorithms for environment perception, such as stationary and moving object detection and tracking, on decision making for driving decisions based on an environment model, and on trajectory generation and vehicle control.

Additionally, we study safe behavior of automated vehicles and functional safety for vehicle guidance systems. A third pillar of our research activities are simulation and test processes for the release of software for public traffic.

Vehicle Systems Engineering: In addition to the automated driving, vehicle systems engineering is another area of our research. With our research vehicle MOBILE, a self-built over-actuated full-by-wire electric vehicle, we are able to research and develop algorithms for failure detection and handling in electric and electronic vehicle systems. Our research combines vehicle dynamics control as well as hardware, software, and functional redundancies to new methods targeting at fail-safe and fault-tolerant operation of vehicles.

MOBILE features a unique actuator setup, which includes wheel individual electric motors, electric steering, and electromechanical brakes. In combination with autonomous vehicle technology, MOBILE allows us to deeply investigate vehicle architectures and vehicle systems.

Publications

- Maurer, M.; Gerdes, C.; Lenz, B.; Winner, H. (Eds.): Autonomous Driving – Technical, Legal and Social Aspects. Springer, 2016
- Matthaei, R.; Reschka, A.; Rieken, J.; Dierkes, F.; Ulbrich, S.; Winkle, T.; Maurer, M.: Autonomous Driving. In: Winner, H. et al.. (Eds.): Handbook of Driver Assistance Systems - Basic Information, Components and Systems for Active Safety and Comfort, Springer, 2016, pp. 1519-1556
- Reschka, A.; Maurer, M.: Conditions for a safe state of automated road vehicles. In: Zöllner, M. (Ed.): it - information technology, vol. 57, no. 4, , 2015, pp. 215-222
- Matthaei, R.; Maurer, M.: Autonomous Driving - A Top-Down-Approach. In: at – Automatisierungs-technik, vol. 63, no. 3, 2015, pp. 155-167
- Bengler, K.; Dietmayer, K.; Färber, B.; Maurer, M.; Stiller, C.; Winner, H.:Three Decades of Driver Assistance Systems - Review and Future Perspectives. In: IEEE Intelligent Transportation Systems Magazine, vol. 6, no. 4, 2014, pp. 6-22

Institute for Electron Devices and Circuits (BST)

Prof. Dr. Bernd Meinerzhagen

- Head of the Institute for Electron Devices and Circuits
- Dean (EE and Physics Dept.) (2011-2013)
- DFG-Fachkollegiat since 2012

Researcher's Career

- Diploma in Electrical Engineering, 1977, RWTH-Aachen
- Diploma in Mathematics, 1981, RWTH-Aachen
- Ph.D. in Electrical Engineering, 1985 RWTH-Aachen
- Member of Technical Staff, AT&T Bell Labs (Pa, USA), 1986-1987
- Oberingenieur, Inst. für Theoretische Elektrotechnik, RWTH-Aachen, 1988-1995
- Consultant for Motorola, Phoenix (Az, USA), 1994-2002
- Habilitation (Theor. Elektrotechnik), 1995, RWTH-Aachen
- Professor for Theory of Electrical Engineering, Univ. Bremen, 1995-2003
- Professor for Circuit Technology, TU Braunschweig, since 2003

Funding

DFG, BMBF, EU, SRC (USA), Industry

Contact

Technische Universität Braunschweig
Institute of Electron Devices and Circuits,
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 391-3169
b.meinerzhagen@tu-braunschweig.de
www.nst.ing.tu-bs.de/index.html

Mission Statement

Electron devices and analog circuits are indispensable building blocks (BB) of microelectronic systems. The BST incorporates the relevant knowledge about the modeling, design and characterization of theses BB into its undergraduate and graduate courses. The numerical simulation of advanced devices and the design of millimeter wave transceiver circuits are important research topics.

Research

Numerical Simulation of Semiconductor devices: The focus of this research is to provide numerical models which support the scaling of existing or the development of new semiconductor devices. Moreover, these models serve as a reference for the development of compact models which are the basis of circuit design. Depending on the device dimensions, models with different levels of complexity are needed for predicting the transport properties of a device as a function of its geometrical and material properties.

Semi-Classical and classical numerical device models: If the device band structure can be considered as known, and tunneling is not a dominant transport mechanism, the numerical solution of Poisson and Boltzmann-Transport equation is typically the method of choice, and quantum effects can be considered by well calibrated empirical models. For critical device dimensions larger than about 50 nm, ballistic transport is typically negligible and the mobility concept becomes valid so that simplified classical transport models like the drift diffusion equations can be used. For these two simulation domains Prof. Meinerzhagen and his coworkers have developed the numerical simulators ELWOMIS and GALENE III, respectively. Several semiconductor manufacturers have licensed these simulators for their development work. Today the research in these domains is mostly focused on the intelligent combination of both domains for the predictive simulation of noise or hot carrier effects, for example. A recent example is the predictive simulation of read disturbances in nanoscale flash memories by our group.

Simulation of transport in nanoscale MOS-transistors: For the transport in modern nanoscale field effect transistors (FETs) the bias dependent band structure needs to be considered. Additionally, the Schrödinger equation must be solved. Here our research is currently focused on the development of the first simulator for advanced p-channel FETs solving k•p-Schrödinger equation in confinement direction and Boltzmann-Transport equations within the resulting k•p-subbands in transport direction without applying the Monte-Carlo algorithm.

Design of Millimeter Wave tranceiver circuits: Since 2010 design and characterization of millimeter wave integrated circuits is a new research topic of our institute. The focus is currently on circuits for 24GHz and 77GHz radar sensor applications. First results include different versions of direct conversion receivers at 24 GHz fabricated in 130 nm CMOS.

Publications

- C. Jungemann, B. Neinhüs, C. D. Nguyen, A. J. Scholten, L. F. Tiemeijer, B. Meinerzhagen: "Numerical Modeling of RF Noise in Scaled MOS Devices" Solid-State Electron., Vol. 50, pp. 10-17, 2006.
- A. T. Pham, C. Jungemann, B. Meinerzhagen: "Deterministic multisubband device simulations for strained double gate PMOSFETs including magnetotransport" IEDM Tech. Dig., pp. 895-898, San Francisco, CA (USA), 2008.
- C. Jungemann, A. T. Pham, S. M. Hong, B. Meinerzhagen: "Deterministic solvers for the Boltzmann transport equation of 3D and quasi-2D electron and hole systems in SiGe devices" Solid-State Electronics, Vol. 84, pp. 112-119, 2013.
- A. Kuligk, C. Dong Nguyen, D.A. Löhr, V. Beyer, B. Meinerzhagen: "Accurate and Efficient Physical Simulation of Program Disturb in Scaled NAND Flash Memories" Proceedings of ULIS, pp. 157-160, University of Warwick (England), 2013.
- J. Dang, P. Sakalas, A. Noculak, M. Hinz, B. Meinerzhagen: "A K-band High Gain, Low Noise Figure LNA using 0.13 um Logic CMOS Technology" Proc. of the 10. EUMIC Conf. ,p. 120 , Paris (France), 2015

Institute for Theoretical Physics – Department of Numerical Plasma Simulations

Prof. Dr. Uwe Motschmann

- Chair, Department of Numerical Plasma Simulations

Researcher's Career

- Full Professor for Theoretical Physics, TU Braunschweig
- Guest Professor, German Aerospace Center (DLR), Institute of Planetary Research, Berlin
- Werner-Heisenberg-Stipend of DFG
- Postdoc, Imperial College, London
- Habilitation in Theoretical Physics, University of Potsdam
- PhD (Dr. sc. nat.), Academy of Sciences, Berlin
- Postdoc, Institute for Space Research, Berlin
- PhD (Dr. rer. nat.), University of Jena
- Study of Physics, University of Jena

Funding
DFG, HLRN, JSC

Contact
Technische Universität Braunschweig
Institute for Theoretical Physics
Department of Numerical Plasma Simulations
Mendelssohnstraße 3
38106 Braunschweig
Phone: +49 531 391-5181
u.motschmann@tu-braunschweig.de
www.tu-braunschweig.de/theophys/plasma

Mission Statement

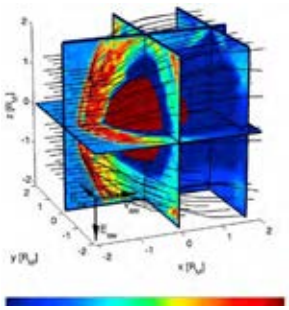
The space between the stars and planets is filled with a faint ionized gas, called space plasma. This material controls the interaction of astrophysical objects to a high degree. We develop and apply numerical models for the action and reaction of the bodies mediated by the space plasma. Our research supports the design of space missions and the interpretation of their results.

Research

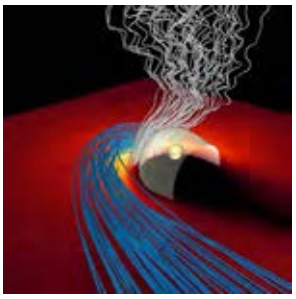
Loss of water on Mars: For the early Martian conditions an enhanced influence of the Sun's radiation flux to the Martian ionosphere is claimed. For a moderate Sun the water loss is equivalent to the depth of a global Martian ocean of about 2.6 m over the last 4.5 billion years. The induced Martian magnetic field strength was increased by up to about 2,000 nT. Our modeling with a very active Sun even results in a water loss of an equivalent global Martian ocean up to 205 m depth during 150 million years after the Sun reached the zero age mean sequence. Thus Mars is very dry today as observed by the Mars-Express mission.

Plasma environment of comet 67P/Churyumov-Gerasimenko: The Rosetta mission with its long term flight in formation and the landing on the surface revolutionized our knowledge of comets. Our simulated plasma environment predicted the Rosetta observations of the magnetic field, particle density and flow structures with high accuracy. A new type of quasi-coherent, large-amplitude magnetic field oscillation which dominates the immediate plasma environment of the nucleus was identified and interpreted.

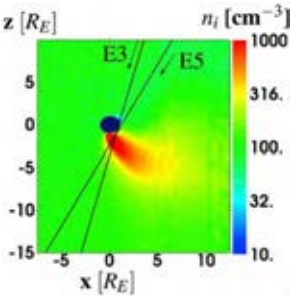
Geysers on Saturn's icy moon Enceladus: An extended plume of water vapor and ice grains at the south pole of Saturn's icy moon Enceladus was the fascinating discovery of the Cassini mission. Our investigation of the mutual feedback between the ice grains and Saturn's plasma environment explains the sophisticated twist of the magnetic field and the filamentary ion density structure observed by the Cassini plasma instruments.



Mars



Comet



Enceladus

Publications

- A. Bößwetter,, H. Lammer, Y. Kulikov, U. Motschmann, S. Simon, Non-thermal water loss of the early Mars: 3D multi-ion hybrid simulations, Planet. Space Sci., 58, 2031–2043, 2010.
- J. Mueller, S. Simon, U. Motschmann, J. Schuele, K.-H. Glassmeier, G. J. Pringle, A.I.K.E.F. Adaptive Hybrid Model for Space Plasma Simulations, Computer Physics Communications, 182, 946-966, doi:10.1016/j.cpc.2010.12.033, 2011.
- Y. Narita, K.-H. Glassmeier, U. Motschmann, M. Wilczek, Doppler shift and broadening in sloar wind turbulence, Earth Planets Space, 65, e5-e8, doi:10.5047/eps.2012.12.002, 2013.
- H. Kriegel, S. Simon, P. Meier, U. Motschmann, J. Saur, A. Wennmacher, D.F. Strobel, M.K. Dougherty, Ion densities and magnetic signatures of dust pick-up at Enceladus, J Geophys Res, 119, 2740-2774, doi:10.1002/2013JA019440, 2014.
- H. Comisel, U. Motschmann, J. Buechner, Y. Narita, Y. Nariyuki, Ion-Scale Turbulence in the Inner Heliosphere: Radial Dependence, Astrophysical Journal, 812:175 (6pp), doi:10.1088/0004-637X/812/2/175, 2015.

Institute of Mathematical Physics

Prof. Dr. Patrik Recher

Researcher's Career
- Full professor for Theoretical Physics at the TU Braunschweig
- Emmy Noether group leader (DFG) at the Universität Würzburg
- Postdoc at the Universiteit Leiden and TU Delft
- Postdoc at Stanford University and University of Tokyo
- PhD in Theoretical Physics at the Universität Basel
- Diploma in Theoretical Physics at the Universität Basel

Funding
DFG, EU, Lower-Saxony

Contact
Technische Universität Braunschweig
Institute for Mathematical Physics
Mendelssohnstraße 3
38106 Braunschweig
Phone: +49 531 391-5200
p.recher@tu-braunschweig.de
www.tu-braunschweig.de/eitp/aktuell/kurzportraits/recher/index.html

Mission Statement

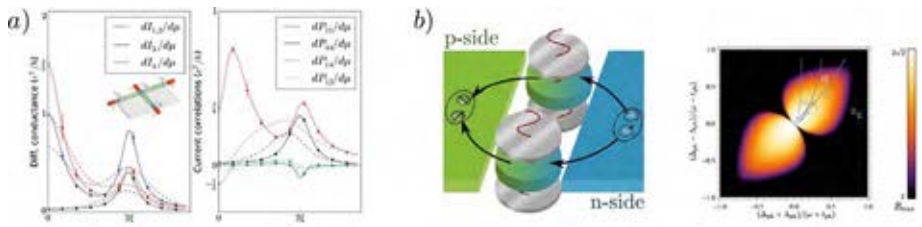
The theory of quantum transport in condensed matter systems is at the heart of a profound understanding of charge, spin and energy transport at the nano- and mesoscale. We work towards predictions of new transport means for information and computing in new materials and devices.

Research

Creation and detection of spin-entangled electrons: The notion of entanglement, non-classical correlations between distant particles, is one of the most elusive but useful predictions of quantum theory. We work theoretically towards the creation and detection of mobile and pairwise spin-entangled electrons at superconductor-normal hybrid structures which combine metals and semiconductors at low temperatures. We use the theory of coherent electron transport in non-equilibrium in combination with effective low-energy quantum models.

Probing new phases of matter by quantum transport: In recent years new materials that mimic the dynamics of massless relativistic particles were brought into focus of modern condensed matter research. The hallmark of these materials are so called topologically protected surface states which host quasiparticle excitations with fascinating properties, e.g. anyons with non-abelian statistics or spin-momentum locked Dirac-states exhibiting Berry phase effects. We investigate how electron transport can probe and manipulate such excitations. In addition we are also interested in designing new material hybrid structures that would host such surface states.

Quantum Metrology: The physics of measurement and a precise definition of standards is a key issue in metrology. We work within the graduate school „NanoMet" on questions of quantized transport phenomena that could be used for metrological applications. Further, we consider the conversion of entangled electronic degrees of freedom to polarization-entangled photons, e.g. in superconducting light-emitting diodes, and investigate the quantification and stability of these entangled electrons- and photon pairs.



a) Transport properties (conductance and noise) of a topological T-junction (inset) as a function of voltage μ (taken from L. Weithofer et al., Phys. Rev. B 90, 205416 (2014))
b) emission of photon pairs in a superconducting p-n junction with two quantum dots embedded in photonic cavities, the Bell parameter B_{max} measures the fidelity of the entanglement of the photon pairs (taken from A. Schroer and P. Recher, Phys. Rev. B 92, 044514 (2015))

Publications

- S. Park, P. Recher, Detecting the Exchange Phase of Majorana Bound States in a Corbino Geometry Topological Josephson Junction, Phys. Rev. Lett. 115, 246403 (2015).
- A. Schroer, P. Recher, Detection of Nonlocal Spin Entanglement by Light Emission from a Superconducting p-n Junction, Phys. Rev. B 92, 044514 (2015).
- L. Weithofer, P. Recher, T.L. Schmidt, Electron transport in multiterminal networks of Majorana bound states, Phys. Rev. B 90, 205416 (2014).
- A. Schroer,...,P. Recher, Detection of spin entanglement via spin-charge separation in crossed Tomonaga-Luttinger liquids, Phys. Rev. Lett. 113, 266401 (2014).
- J. Schelter, B. Trauzettel, P. Recher, How to Distinguish between Specular and Retroconfigurations for Andreev Reflection in Graphene Rings, Phys. Rev. Lett. 108, 106603 (2012).

Institute for Communications Technology (IfN) – Department System Theory and Technology of the Electronic Media

Prof. Dr.-Ing. Ulrich Reimers

- Vice President Strategic Development and Technology Transfer TU Braunschweig.
- Managing Director of IfN.
- Chairman of the Technical Module of the international consortium DVB Project (1992 – 2012).

Researcher's Career

- Full Professor for Communications Technology at TU Braunschweig
- Director of Engineering Norddeutscher Rundfunk (NDR)
- Honorary Professor Universitaet Kassel
- Broadcast Television Systems GmbH (BTS): Director Product Division Studio Equipment
- Dr.-Ing. Technische Universitaet Braunschweig

Funding
EU, Industry, Lower Saxony, BMVi, BMWI

Contact
Technische Universität Braunschweig
Institut fuer Nachrichtetentechnik
Schleinitzstraße 22
38106 Braunschweig
Phone: +49 531 391-2480
u.reimers@tu-braunschweig.de
www.ifn.ing.tu-bs.de

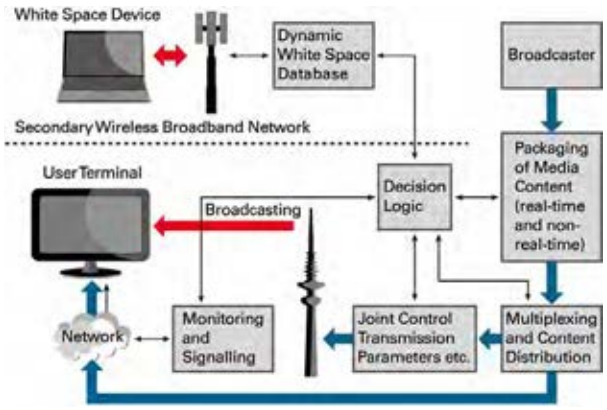
Mission Statement

Research and development related to the distribution of media and data over a variety of networks. Contributions to the definition of global standards such as those for Digital Television (DVB-x, ATSC 3.0). Invention of systems providing the co-operative use of frequency spectrum by broadband and broadcast spectrum.

Research

Broadcast systems: Since 1993 the world of broadcast has changed significantly. In Europe, systems developed by the international consortium DVB (Digital Video Broadcast) have replaced analogue TV over cable, satellite and terrestrial networks. We have contributed and in fact are currently contributing to the development of such systems through our research, through inventions and by field trials.

Dynamic Broadcast: With the advent of broadband Internet it has become possible to distribute content dynamically over broadcast and broadband networks. Our invention Dynamic Broadcast which we first showed live at IFA Berlin 2012 revolutionizes broadcast by turning each component in the distribution chain into a dynamic system. One result is a much reduced use of the valuable frequency spectrum which can now be allocated dynamically to a variety of networks instead of being permanently used for broadcast only.



Tower Overlay over LTE-A+ (TOoL+): The growth of data traffic in mobile data networks is governed by video being consumed on Smartphones and Tablet PCs. Predictions indicate that in 2019 72% of the mobile data traffic world-wide will be video. Cellular mobile networks will be overloaded by such data – especially during popular sports and similar events. With TOoL+ we have invented a solution which allows the distribution of video to Smartphones and handhelds via a network overlaying the cellular mobile networks. TOoL+ is currently being field tested in European countries.

Awards: We received a significant number of national and international awards in recognition of our work – among others "The Masaru Ibuka Consumer Electronics Award" of the Institute of Electrical and Electronic Engineers (IEEE), the J. J. Thomson Medal of the Institution of Electrical Engineers (IEE), or the placement in the hall of fame of the International Electrotechnical Commission (IEC).

Publications

- Slimani, M., Reimers, U., Robert, J., Schlegel, P. et al.: Results of the DVB-T2 Field Trial in Germany. IEEE Transactions on Broadcasting, Vol. 61 (2015), No. 2, p. 177-194
- Juretzek, F., Reimers, U., Point-To-MultiPoint Overlay (P2MP) for LTE Advanced using DVB-T2 Future Extentension Frames. Proceedings of the 2013 IEEE Broadcast Symposium, San Diego, USA, electronic, 6 pages, October 2013
- Neumann, P., Reimers, U.: Live and time-shifted content delivery for dynamic broadcast: terminal aspects. IEEE Transactions on Consumer Electronics, Vol. 58 (2012), No. 1, p. 53-59
- Reimers, U.: DVB - The Family of International Standards for Digital Video Broadcasting. Proceedings of the IEEE, Vol. 94, No.1, January 2006, pp. 173 to 182
- Reimers, U. (ed.): DVB – The Family of International Standards for Digital Video Broadcasting. Springer-Verlag, Berlin Heidelberg New York (2nd ed., 2004), ISBN 3-540-43545-X Numerous patents

Institute for Electrical Measurements and Foundations of Electrical Engineering

Prof. Dr. Meinhard Schilling

- Head of the Institute for Electrical Measurements and Foundations of Electrical Engineering since 2001
- Speaker of the Braunschweig International Graduate School of Metrology since 2007
- Speaker of the RTG 1952/1 since 2014
- Dean of studies (EE) 2010 – 2012
- Member of Braunschweigische Wissenschaftliche Gesellschaft since 2015
- Founding partner of 3 spin-off companies Magnicon GmbH, Capical GmbH, Fabmaker GmbH

Researcher's Career

- Universität Hamburg, Diploma in Physics, 1989
- Universität Hamburg, Ph.D. (Dr.rer.nat) in Physics, 1992
- Universität Hamburg, Habilitation, (Experimentalphysik), 1998
- Universität Hamburg, Scientific Assistant, 1989-1998
- Universität Hamburg, Privatdozent, 1998-2001
- TU Braunschweig, Full Professor (Electrical Engineering), since 2001

Funding

DFG (SFB508, SFB578, GrK1952/1, SPP1681), BMBF, BMWi, BMZ, Humboldt-Foundation, MWK Niedersachsen, EU Projects

Contact

Technische Universität Braunschweig
Institute for Electrical Measurements and Foundations of Electrical Engineering
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 391-3866
m.schilling@tu-braunschweig.de
http://www.emg.tu-bs.de

Mission Statement

The research topics cover the manufacturing of novel sensors from metals and metal oxide ceramic materials and their integration into sensor systems by analog electronics operated by microcontroller systems. Main application areas are electromagnetic sensor systems, biomedical diagnostic instruments and ultrahigh frequency measurements. The institute hosts the Braunschweig International Graduate School of Metrology and the DFG RTG 1952/1 "Metrology of Complex Nanosystems" and is founding member of the Laboratory of Emerging Nanometrology LENA.

Research

In the cleanroom facility of the institute ultrasensitive SQUID-Sensors and Josephson junctions from high-temperature superconductors are manufactured. From magnetic materials AMR, GMI and Fluxgate sensors are built and patterned by UV-lithography and electron beam lithography. The characterization is accomplished by electron microscopy (SEM, TEM, EDX) and by scanning force microscopy, as well as by x-ray diffraction. The sensor characterization is done by electrical transport and noise measurements in a shielded environment, especially in the magnetically shielded room Vakuumschmelze AK3b at the institute.

These preparation methods are complemented by high-resolution additive manufacturing of thermoplastic material, ceramics and metal structures. For commercialization we support our spin-off company Fabmaker GmbH, Braunschweig.

For biomedical diagnosis electrical measurements on the human body surface, we developed with research partners novel instruments for heart diagnosis and for brain-computer-interfaces based on capacitive electrodes. With these electrodes the signal can be measured without direct electrical contact to the skin. The new ECG systems are approved as medical devices and are sold by our spin-off company Capical GmbH, Braunschweig.

The investigation of magnetic nanoparticles as markers in immunoassays is the main topic of many projects. Magnetic iron-oxide nanoparticles are biocompatible and are approved for use in human body as contrast agent. We investigate the preparation of nanoparticles, their stabilization and functionalization and employ them in diagnostic systems such as magnetic particle imaging.

With our terahertz microscope we investigate ultrafast electronic circuits with operating frequencies up to above 1 THz. This instrument can measure and visualize the spatial radiation distribution above a microwave circuit with 100 nm resolution.

Publications

- Heim E, Ludwig F, Schilling M, 2009, Binding assays with streptavidin-functionalized superparamagnetic nanoparticles and biotinylated analytes using fluxgate magnetorelaxometry, J. Magn. Magn. Mater. 321:1628
- Ludwig F, Guillaume A, Schilling M, Frickel N, Schmidt A M. 2010. Determination of core and hydrodynamic size distributions of $CoFe_2O_4$ nanoparticle suspensions using ac susceptibility measurements. J. Appl. Phys. 108:033918
- Dieckhoff J, Schilling M, Ludwig F. 2011. Fluxgate based detection of magnetic nanoparticle dynamics in a rotating magnetic field. Appl. Phys. Lett. 99:112501
- I Yoshida T, Enpuku K, Dieckhoff J, Schilling M, Ludwig F, 2012, Magnetic fluid dynamics in a rotating magnetic field, J. Appl. Phys. 111: 053901
- Ludwig F, Wawrzik T, Yoshida T, Gehrke N, Briel A, Eberbeck D, Schilling M, 2012, Optimization of magnetic nanoparticles for magnetic particle imaging, IEEE Trans. Magn. 48:3780

Institute of High Frequency Technology – AG Terahertz-Systems Technology

Prof. Dr. Thomas Schneider

Researcher's Career

- Full Professor for Terahertz-Systemtechnik, TU-Braunschweig
- Full Professor for High-Frequency Technology, HfT-Leipzig
- Head of the Institute for High Frequency Technology, Leipzig
- Guest Professor, Ecole Polytechnique Federal de Lausanne (EPFL), Switzerland
- Guest Scientist, Heinrich Hertz Institute, Berlin,
- Guest Scientist Telekom-Laboratories, Berlin
- Ph.D. in Physics TU-Cottbus
- Development engineer AEG-Postautomation, Berlin
- Diploma Degree in Electrical Engineering, Humboldt Universität zu Berlin

Funding

DFG, VW-Stiftung

Contact

Technische Universität Braunschweig
Institut für Hochfrequenztechnik,
AG Terahertz-Systemtechnik
Schleinitzstraße 22
38106 Braunschweig
Phone: +49 531 391-2003
thomas.schneider@ihf.tu-bs.de
www.tu-braunschweig.de/ihf/forschungsprofil/abteilungen/terahertz

Mission Statement

The data rates in all communication pipes such as the Internet, data centers, or even between the cores of a super-computer, are increasing drastically. To keep pace with these increasing data rates, new
approaches are required. Thus, the aim of our research is to find new methods of data communications and signal processing.

Research

Ultra-high Bitrate Communications: The maximum possible symbol rate can be transmitted in a channel if each sub-channel has a rectangular bandwidth. This requires sinc-shaped symbols in the time domain. However, such a shape is just a theoretical construct. We have found ways to circumvent this physical problem through the generation of periodical symbols. With these symbols we can transmit sub-channels directly adjacent to each other without any guard-band between them. For wireless communications, like WiFi or the cellphone networks, usually carrier frequencies below 10 GHz are used. However, this drastically limits the transmittable data rates. Thus, another very important field of our research is to find methods to transmit ultra-high data rates with carrier frequencies in the mm- and THz-range of the electromagnetic spectrum as well as the generation of these frequencies.

Optical Signal Processing: For ultra-high data rates the electrical signal processing comes to its limits. Thus, we investigate ways to make the complete signal processing all-optically. This includes optical sampling, optical storage and optical spectrum analysis.

Integrated Optics: "... with cutting-edge supercomputers, the trick is to keep them from melting." (Nature 492, 174, 2012). A solution for these rising temperatures and corresponding energy consumption in modern electronics can be to use photons instead of electrons for the signal processing. However, this requires small-footprint, integrated solutions. Thus, we are working on Silicon-on-Insulator based optical chips for all-optical signal processing, optical transmitters and receivers.

Distributed Fiber Sensing: Another important field of our research is distributed Brillouin fiber sensing. These sensors can measure the temperature and strain over distances of 30-50 km with a resolution of 1 m. Thus, they can be seen as thousands of sensors in just one fiber and can be used to monitor pipelines, railway tracks, motorways, buildings etc.. Our aim is to enhance the sensitivity and resolution of these sensors.

Terahertz Technology group, back: Hassanain Al-Tiey, Julia Böker, Thomas Schneider, Stefan Preußler (f.l.t.r.), front: Cheng Feng, Lucky Agrawal, Gilda Raoof-Mehrpoor, Denis Albrecht, Mohammadali Dorokstar Siani.

Publications

- T. Schneider, C. Brès, L. Thévenaz, M. A. Soto, A. Karladani, M. Mehdi, A. Shoaie, A. Vedadi, System and method for producing optical sinc-shaped pulses, US-Patent: US-Patent: 20150323781
- M. A. Soto, M. Alem, M. A. Shoaie, A. Vedadi, C.-S. Brès, L. Thévenaz, T. Schneider, "Optical sinc-shaped Nyquist pulses of exceptional quality, Nature Comm. 4:2898 doi: 10.1038/ncomms3898 (2013).
- S. Preussler, T. Schneider, "Stimulated Brillouin scattering gain bandwidth reduction and applications in microwave photonics and optical signal processing," Opt. Eng. 0001;55(3):031110. doi:10.1117/1.OE.55.3.031110 (2016).
- S. Preussler, T. Schneider, "Attometer resolution spectral analysis based on polarization pulling assisted Brillouin scattering merged with heterodyne detection," Opt. Express 23, 26879-26887 (2015).
- H. Al-Taiy, N. Wenzel, S. Preußler, J. Klinger, and T. Schneider, "Ultra-narrow linewidth, stable and tunable laser source for optical communication systems and spectroscopy," Opt. Lett. 39, 5826-5829 (2014).

Institute of High Frequency Technology – Microwave Engineering Lab

Prof. Dr.-Ing. Jörg Schöbel

Researcher's Career

- TU Braunschweig: University Professor for Microwave Engineering
- Part-time side activities: Shareholding managing director of a university spin-off (SF Microwave GmbH) and consulting for the European Commission (expert evaluator)
- Bosch Corporate Research and Advance Engineering: R&D engineer and project leader in automotive radar systems research and RF-MEMS
- Dr.-Ing. at TU Braunschweig
- TU Braunschweig: Research Associate in the field of organic electronics & electronic properties of layer interfaces
- AT&T Bell Laboratories, Holmdel, USA: Visiting Scientist in the field of Silicon oxidation technologies
- Study of Electrical Engineering (microelectronics, microwave technology and optical communications) at TU Braunschweig

Funding

Industry and public funding with a focus on SMEs

Contact

Technische Universität Braunschweig
Institute of High Frequency Technology – Microwave Engineering Lab
Schleinitzstraße 22
38106 Braunschweig
Phone: +49 531 391 2002
j.schoebel@tu-braunschweig.de
www.tu-bs.de/ihf

Mission Statement

Our work comprises state of the art research on conception, design, analytical modeling and numerical simulation covering high-frequency components through to entire microwave systems. Applications comprise radar and sensing, communications, and materials characterization and processing. We put a strong focus on the application of scientific results in terms of prototyping and demonstration.

Research

IHF's microwave engineering lab focuses on research and advanced development in the following fields:

Radar and ground penetrating radar, microwave imaging, and signal processing: We investigate microwave radar and imaging systems for diverse applications with special focus on ground penetrating radar. Industrial applications range from civil engineering (localization of cables and supply lines in the ground) to agriculture (mechanical harvesting of asparagus) and aviation (collision warning for ultralight aircraft). In this context we design and realize radar system prototypes based on different concepts and implement signal processing for functional demonstration.

Microwave circuits and antennas for applications in communications, sensing, and security systems: Our experience in antenna design comprises broadband antennas as well as planar patch arrays and beamforming with Rotman lenses in a range from MHz to millimeter waves. We design and realize microwave circuits for radar, communication, sensing and security applications, such as detection and localization of radio emission and ultrafast tunable and ultrawideband microwave signal generation. We have a full range of equipment for prototyping as well as for microwave and antenna measurements up to 170 GHz. Commercial software is employed for circuit design and for 3D electromagnetic simulation of antennas and passive structures.

Analytical and numerical modeling, development and application of mode-matching algorithms for 3D electromagnetic simulation and filter design: We are engaged in analytical and numerical modeling of microwave systems, components and signal processing concepts. The mode-matching framework developed in our group enables extremely fast and accurate simulation and optimization of microwave structures and outperforms most commercial solvers.

Microwave material characterization and processing, microwave plasma technology: We investigate energy-efficient microwave heating and melting processes focusing on raw silicon processing and microwave plasma generation for surface and thin-film processing. Accurate material characterization techniques allow to precise prediction of materials' behaviour in innovative microwave processes.

Millimeter-wave and Terahertz technology for communications and sensing: Much experience has been gained in the design and realization of RF front ends, as well as planar antennas and arrays with beam forming devices, using low-cost RF technology, micro-technology and MMICs, e.g. for 60 GHz communication.

Publications

- C. Monka, J. Schoebel, Eigenmodes of partially filled coaxial waveguides, 2016 German Microwave Conference (GeMiC), Bochum, March 14-16, 2016.
- D. Seyfried, J. Schoebel, Ground Penetrating Radar for Asparagus Detection, Journal of Applied Geophysics, Volume 126, March 2016, Pages 191-197.
- S. Brueckner, D. Seyfried, J. Schoebel, Locating utility pipes using m-sequence ground penetrating radar, 2015 German Microwave Conference (GeMiC), Pages: 351-354.
- P. Herrero and J. Schoebel, 60 GHz radio front end demonstrator with Quality of Service, Electron. Lett. 46, No. 14, July 2010.
- J. Schoebel, P. Herrero, Planar Antenna Technology for mm-Wave Automotive Radar, Sensing, and Communications; in: Radar Technology, ed. Guy Kouemou, Intech, Croatia, December 2009, pp. 297-318, http://www.intechopen.com/books/radar-technology

Institute of Control Engineering

Prof. Dr.-Ing. Walter Schumacher

Researcher's Career

- Conference SPS/IPC/Drives, Chair of the Drives Part
- Member of the International Steering Committee of PEMC
- Member of the Executive Committee and International Steering Committee of European Conference on Power Electronics and Applications
- Leader of the Institute of Control Engineering
- University (Full) Professor for Control Engineering at Technische Universität Braunschweig
- Division Manager Systems Engineering at Institut für Angewandte Mikroelektonik GmbH, Braunschweig
- Dr.-Ing. at Technische Universität Braunschweig
- Study of Electrical Engineering at Technische Universität Braunschweig

Funding

DFG, BMBF, BMWi, Lower Saxony, industry

Contact

Technische Universität Braunschweig
Institute of Control Engineering
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 391-3837
w.schumacher@tu-braunschweig.de
www.ifr.ing.tu-bs.de

Mission Statement

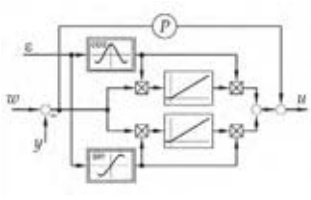
Dynamic and closed-loop systems are present in almost every technical system. Based on fundamental research on control theory methods, our group focuses on improving control of electrical drives and electrical energy distribution in cooperation with partners in industry and research.

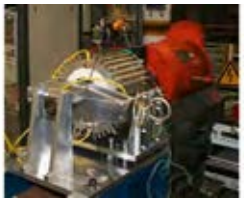
Research

Control methods: Control performance is directly linked to the knowledge of a system's structure and its parameters. Therefore, model-based control methods are one focus of our research. Further fields of research are resonant and multi-resonant control schemes (harmonic control) providing disturbance rejection for a selectable fundamental frequency as well as its harmonics. Third, we are using bit streams of delta sigma converters, long time known in the field of audio applications, without digital low pass filtering as inputs of control algorithms by employing a bit stream algebra. This results in high dynamics comparable to analog designs and the parameter stability of digital approaches while shifting the sampling frequency to formerly unachievable values.

Electrical drives: During the 1970s, field-oriented current control for induction machines was developed at our institute, and our research still continues in this area. More recently, we have developed enhanced models of synchronous machines and special drives like transverse flux machines with regard to magnetic saturation and harmonics in model parameters. Thus, we were able to enhance the quality of encoderless control approaches and the precision of torque control. In other research projects, we have used FPGA technology to enhance position and speed acquisition as well as control performance through reduced sampling times in the current control. The application of delta sigma control using bit stream algebra has lead to further improvements in performance.

Power systems: The increasing amount of renewable energy sources present in electrical power grids requires thorough scientific investigation. Our work concentrates on the modeling and stability analysis of current and future power grids consisting of decentralized sources like PV-parks and wind farms as well as classical energy producers. We have been able to enhance control designs by developing models of interconnected power plants with reduced complexity that provide a better insight into grid dynamics.





Publications

- Schumacher, W., Homann, M. (2015): Electronic power converter and computer program. WO2015/193439A1
- Schumacher, W., Homann, M. (2014): Stromrichter und Computerprogramm. DE102014108667A1
- Klöck, J., Schumacher, W. (2015): Phase current harmonics in transverse flux machines: A state space representation. 17th Europ. Conf. on Power Electronics an Applications (EPE-ECCE)
- Martens, O., Klöck, J., Schumacher, W. (2015): Evaluation of Multi-Axis Control Systems, Int. Exhib. and Conf. for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management (PCIM)
- Klöck, J., Schumacher, W. (2014): Harmonic current control for transverse flux machines. Int. Exhib. and Conf. for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management (PCIM)
- Calabria, M., Schumacher, W. (2014): Stability optimization for distributed generation of load-following energy. Int. Energy Conference (ENERGYCON)
- Calabria, M., Schumacher, W. (2014): Modeling power inverter interactions in a low voltage grid. 15th Workshop on Control and Modeling for Power Electronics (COMPEL)

Institute for Condensed Matter Physics

Prof. Dr. Stefan Süllow

Researcher's Career
- Supernumerary professor at TU Braunschweig
- Scientific Assistant and junior professor at TU Braunschweig
- Postdoc at University of Michigan, Ann Arbor, USA, and MPI-CPfS, Dresden
- Ph.D. at Leiden University, Kamerlingh Onnes Laboratory, Netherlands
- Study of Physics at TU Braunschweig

Funding
DFG, DAAD, JSPS, ESF

Contact
Technische Universität Braunschweig
Institute for Condensed Matter Physics
Mendelssohnstraße 3
38106 Braunschweig
Phone.: +49 531 391-5116
s.suellow@tu-braunschweig.de
www.ipkm.tu-bs.de

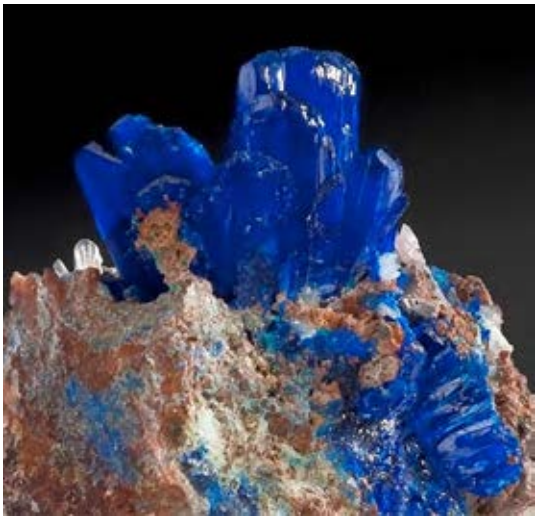
Mission Statement

In solid-state materials, new and exotic phenomena emerge as a result of strong electronic interactions, and which form the basis for future applications of such materials. It is our aim to better understand these phenomena and the underlying quantum mechanical concepts.

Research

Fundamental Condesed Matter Physics: The main research focus lies on studies of the electronic and magnetic properties of new solid state materials. In this field, emergent phenomena – viz., new ground state phases resulting from cross correlation between electronic, structural and spin degrees of freedom – challenge our understanding of the physics of condensed matter. Typical examples for such emergent phenomena are novel superconducting states or exotic field induced phases with a character resembling so-called Bose-Einstein-condensates.

In this context, we study the physical properties of new materials by a multitude of different experimental techniques, ranging from essential laboratory tools like electrical resistivity or magnetization to advanced microscopic probes offered at large scale facilities such as neutron scattering or muon spin relaxation. These experiments are carried out under extreme environments, such as low temperatures down into the milliKelvin range, or high magnetic fields a million times larger than the earth magnetic field. In close collaboration with theory, the results of these studies are used to further develop the modelling of new and modern materials. This way, in particular insight is obtained into the role of quantum mechanical effects controlling material properties.



Publications

- B. Willenberg, M. Schäpers, A.U.B. Wolter, S.-L. Drechsler, M. Reehuis, J.-U. Hoffmann, B. Büchner, A. Studer, K.C. Rule, B. Ouladdiaf, S. Süllow, S. Nishimoto: Complex field induced states in Linarite $PbCuSO_4(OH)_2$ with a variety of high-order exotic SDWp states - Phys. Rev. Lett. 116 (2016) 047202
- D. Rauch, M. Kraken, F.J. Litterst, S. Süllow, H. Luetkens, M. Brando, T. Förster, J. Sichelschmidt, A. Neubauer, C. Pfleiderer, W.J. Duncan, F.M. Grosche: Spectroscopic study of the metallic magnetism in single-crystalline $Nb_{1-x}Fe_{2+y}$ - Phys. Rev. B 91 (2015) 174404
- B. Willenberg, H. Ryll, K. Kiefer, D.A. Tennant, F. Groitl, K. Rolfs, P. Manuel, D. Khalyavin, K.C. Rule, A.U.B. Wolter, S. Süllow: Luttinger-Liquid Behavior in the Alternating Spin-Chain System Copper Nitrate - Phys. Rev. B 91 (2015) 060407(R)
- B. Willenberg, M. Schäpers, K.C. Rule, S. Süllow, M. Reehuis, H. Ryll, B. Klemke, K. Kiefer, W. Schottenhamel, B. Büchner, B. Ouladdiaf, M. Uhlarz, R. Beyer, J. Wosnitza, A.U.B. Wolter: Magnetic Frustration in a Quantum Spin Chain: The Case of Linarite $PbCuSO_4(OH)_2$ - Phys. Rev. Lett. 108 (2012) 117202
- K.C. Rule, A.U.B. Wolter, S. Süllow, D.A. Tennant, A. Brühl, S. Köhler, B. Wolf, M. Lang, J. Schreuer: Nature of the spin dynamics and 1/3 magnetization plateau in azurite - Phys. Rev. Lett. 100 (2008) 117202

Department of Electrical Engineering, Information Technology, Physics

Prof. Dr. Andrey Surzhykov

Researcher's Career

- Full Professor for Theoretical Atomic Physics at Braunschweig University of Technology
- Head of the Institute "Fundamental Physics for Metrology" at National Metrology Institute (PTB)
- Helmholtz Young Investigators Group Leader at University of Heidelberg
- Guest Researcher at École normale supérieure, Paris
- Postdoc at Max Planck Institute for Nuclear Physics, Heidelberg
- Dr. rer. nat. at the University of Kassel
- Study of Physics, Lomonosov Moscow State University

Funding

BMBF, DFG, HGF

Contact

Technische Universität Braunschweig
Institute for Theoretical Physics
Bundesallee 100
38116 Braunschweig
Phone: +49 531 592-8100
a.surzhykov@tu-braunschweig.de
www.ptb.de/fpm

Mission Statement

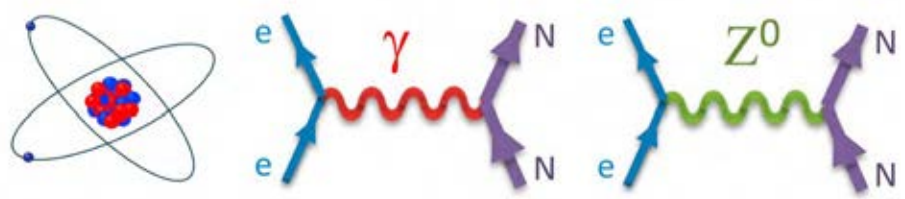
Development of novel theoretical approaches to study electronic structure and collision dynamics of neutral atoms and positively charged ions. Knowledge about the properties of these atomic systems is in high demand for probing fundamental symmetries in nature, realizing high-precision atomic clocks, or even searching for a "new physics".

Research

High-precision atomic structure calculations: We develop and implement methods aiming at accurate predictions of atomic energy levels, lifetimes and transition probabilities. Based on the multi-configuration Dirac-Fock and configuration-interaction approaches, these methods provide theoretical data for the analysis and guidance of modern experiments with trapped atoms and ions.

Theoretical analysis of photon–matter interactions: Here, emphasis is placed not only on basic reactions, such as photo-absorption and -ionization or atomic bremsstrahlung, but also to non-linear processes. For example, detailed studies of the multi-photon transitions in neutral atoms and few electron ions were recently performed.

Investigations of atomic parity-violation phenomena: Based on the relativistic many-body calculations, we have proposed a number of scenarios to observe the parity mixing of atomic states as caused by the Z^0-boson exchange between nucleus and electrons as well as by the nuclear anapole moment.



Development of non–perturbative approaches for time-dependent Dirac problems: This work promises to have a profound impact not only for the accurate description of fundamental processes, accompanying atomic and ionic collisions, but also for the design of new ab-initio methods in quantum chemistry.

Studies of interactions of vortex light beams: In recent years we have paid special attention to the twisted (vortex) light beams that carry a non–zero projection of the orbital angular momentum onto their propagation direction. Such studies are of special importance in the field of quantum computing, where twisted photons lead to an improvement in the (orbital) momentum transfer between quantum systems.

Publications

- Fritzsche, S., Surzhykov, A. & Volotka, A. (2015) Relativistically prolonged lifetime of the $2s2p\,^3P_0$ level of zero nuclear-spin beryllium-like ions. New J. Phys., 17:103009. doi:10.1088/1367-2630/17/10/103009.
- Surzhykov, A., Yerokhin, V.A, Stöhlker, Th. & Fritzsche, S. (2015) Rayleigh x-ray scattering from many-electron atoms and ions. J. Phys. B: At. Mol. Opt. Phys., 48: 144015. doi:10.1088/0953-4075/48/14/144015.
- Artemyev, A.N. & Surzhykov A. (2015) Quantum electrodynamical corrections to energy levels of diatomic quasimolecules. Phys. Rev. Lett., 114:243004. doi:10.1103/PhysRevLett.114.243004.
- Yerokhin, V.A, Surzhykov, A. & Fritzsche, S. (2014) Relativistic configuration-interaction calculation of Kα transition energies in berylliumlike iron. Phys. Rev. A, 90:022509. doi:10.1103/PhysRevA.90.022509
- Scholz-Marggraf, H.M., Fritzsche, S., Serbo, V.G., Afanasev, A. & Surzhykov, A. (2014) Absorption of twisted light by hydrogenlike atoms. Phys. Rev. A, 90:013425. doi:10.1103/PhysRevA.90.013425

Institute of Semiconductor Technology – Hybrid Nanostructures and Time-Resolved Nanooptics

Prof. Dr. Tobias Voss

Researcher's Career

- Professor at the Institute of Semiconductor Technology, TU Braunschweig
- Substitute Professorship "Nanotechnology" at the Institute of Microsystems Engineering IMTEK, University of Freiburg
- Business Development Manager at the Fraunhofer Heinrich Hertz Institute, Fiber-optical sensor systems, Goslar
- Senior Research Assistant at the Institute of Solid State Physics, University of Bremen
- Postdoc at the School of Engineering and Applied Science, Harvard University, USA
- Dr. rer. nat. at the Institute of Solid State Physics, University of Bremen
- Diploma degree in physics at Clausthal University of Technology, Clausthal-Zellerfeld
- Visiting researcher at JILA/University of Colorado at Boulder, USA

Funding

DFG, BMWi, BMU

Contact

Technische Universität Braunschweig
Institute of Semiconductor Technology
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 319-3774/3821
tobias.voss@tu-braunschweig.de
www.tu-braunschweig.de/iht

Mission Statement

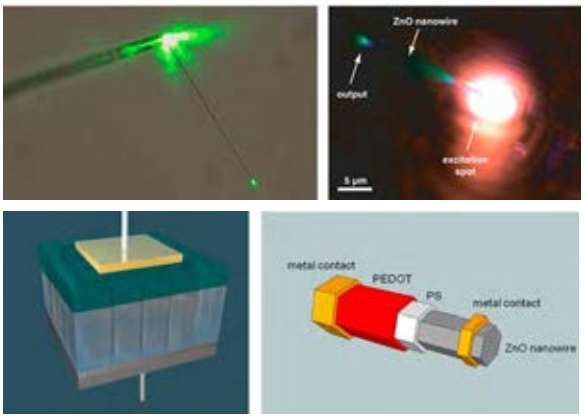
We develop hybrid nanomaterials for optoelectronic and sensing applications and analyze the relevant electron- and energy-transfer processes at the hybrid interfaces with the focus on time-resolved optical spectroscopy methods

Research

Chemical vapor deposition of polymer layers: The design and fabrication of organic-inorganic hybrid devices have attracted considerable attention in basic research and for applications because they offer the possibility to combine the stability and tunable electronic properties of inorganic semiconductors with the large functionality and selectivity of organic chemistry. In semiconductor technology, gas-phase deposition techniques are often favorable for achieving controlled interfaces. We develop and study chemical vapor deposition (CVD) techniques for different kinds of polymers that allow us to achieve a conformal coating of porous or 3D-nanostructured substrates with ultrathin polymer layers.

Fluorescent carbon nanoparticles and colloidal quantum dots: Strongly luminescent and environmentally friendly Carbon nanodots (C-Dots) with diameters below 10 nm offer a great potential for optimized color conversion in LED displays and selective gas detection in sensing devices. Low toxicity, biocompatibility, excellent chemical and photo stability, cheap large-scale fabrication schemes and tunable photoluminescence emission are among their outstanding properties. Our research focuses on functionalization schemes in which C-Dot with optimized photo-stability and tailored absorption and emission spectra are combined with inorganic semiconductor nanostructures in optoelectronic or sensing devices.

Nanooptical investigations of semiconducting and hybrid materials with picosecond time-resolution: We employ various optical spectroscopy techniques (with the focus on picosecond time-resolved laser spectroscopy) to study the dynamics of electronic excitation in optoelectronic devices. The detailed analysis of relaxation, recombination, and trapping processes allows us to develop strategies for improving the device performance, efficiency, and stability.



Publications

- Functional ZnO/polymer core-shell nanowires fabricated by oxidative chemical vapour deposition (oCVD) J.-P. Richters, A. Dev, C. Ronning, J. Gutowski, and T. Voss; Journal of Physics D: Applied Physics 47, 394004 (2014).
- Intense intrashell luminescence of Eu-doped single ZnO nanowires at room temperature by implantation created Eu-Oi complexes; S. Geburt, M. Lorke, A. da Rosa, T. Frauenheim, R. Röder, T. Voss, U. Kaiser, W. Heimbrodt, and C. Ronning; Nano Letters 14, 4523 (2014).
- Oxygen-controlled photoconductivity in ZnO nanowires functionalized with colloidal CdSe quantum dots; D. Hou, A. Dev, K. Frank, A. Rosenauer, and T. Voss; Journal of Physical Chemistry C 116, 19604 (2012).
- Scalable fabrication of nanowire photonic and electronic circuits using spin-on glass; M. A. Zimmler, D. Stichtenoth, C. Ronning, W. Yi, V. Narayanamurti, T. Voss, and F. Capasso; Nano Letters 8, 1695 (2008).
- High-order waveguide modes in ZnO nanowires; T. Voss, G. T. Svacha, S. Müller, C. Ronning, D. Konjhodzic, F. Marlow, and E. Mazur; Nano Letters 7, 3675 (2007).

Institute of Semiconductor Technology – Semiconductor- and Nanotechnology

Prof. Dr. Andreas Waag

Researcher's Career

- Head of epitaxy competence center ec2, Braunschweig.
- Coordinator of TUBS/LUH research alliance on Quantum- and Nanometrology
- Member of International Graduate School on Nanometrology, Braunschweig
- Speaker of Advisory Board "Advanced UV for Life" (BMBF)

- Full Professor for Semiconductor Technology at Braunschweig University of Technology
- Associate Professor at the department of semiconductor physics, Ulm University
- Visiting Assistant Professor at Purdue University, West Lafayette, USA
- Gaede Award of the German Vacuum Society 1996
- PhD at the University of Würzburg
- Study of phyics, University of Würzburg

Funding

EU, DFG, BMBF, Industry, VW Foundation

Contact

Technische Universität Braunschweig
Institute of Semiconductor Technology
Hans-Sommer-Straße 66
38106 Braunschweig
Phone: +49 531 391-3773
a.waag@tu-baunschweig.de
www.tu-braunschweig.de/iht .../ec2 .../mib/lena

Mission Statement

Our mission is to carry semiconductor nanostructures from basic research towards novel device applications. With a strong background in GaN, oxide and silicon technology, novel devices in the field of nanophotonics, solid state lighting, power electronics and sensing are developed, including novel methods for nanometrology.

Research

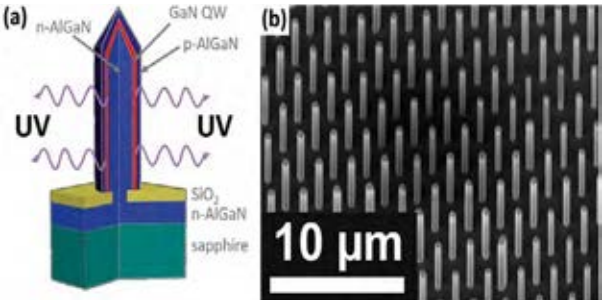
Semiconductor Epitaxy: Based on the epitaxy competence center ec2, the institute operates a research foundry for GaN, having excellent access to state of the art GaN MOCVD technology, as well as exploring novel growth techniques. Epitaxial growth programs also include oxides and other optoelectronic and electronic materials of interest.

Semiconductor Technology: With a strong focus on 3D semiconductor nanostructures, suitable processing technologies like nanoimprint for nanopatterning or ICP etching for full device capability are developed.

Photonics and Solid State Lighting: 3D nanorod based GaN will serve as the basis for future 3D nanoLEDs with superior properties. Due to its substantial expertise in semiconductor epitaxy, the institute is a world leading place for 3D GaN technology.

Nanometrology and Sensing: The institute is part of the Laboratory for Emerging Nanometrology LENA, a center for nano- and quantum metrology in close collaboration with the Physikalisch-Technische Bundesanstalt PTB Braunschweig, in which novel methods for 3D nanometrology are developed.

Novel Device Concepts: The activities also cover novel device concepts like nanoscale device technology including packaging. Presently, device related work aims at nanoLEDs, nanoFETs and nanoSensors.



Publications

- S.F.Li, A.Waag, GaN based nanorods for solid state lighting, J.Appl.Phys, 111(071101)2012.
- Wang, X., A.Waag et al, Growth kinetics and mass transport mechanisms of GaN columns by selective area MOVPE, (2014) Journal of Applied Physics, 115 (16), 163104.
- M.W.G. Hoffmann, A.Waag et al, Highly selective SAM-nanowire hybrid NO2 sensor: Insight into charge transfer dynamics and alignment of frontier molecular orbitals, (2014) Advanced Functional Materials, 24 (5), pp. 595-602.
- A.Waag et. al., The nanorod approach: GaN NanoLEDs for solid state lighting, (2011) Phys. Stat Solidi (c) Current Topics in Sol. State Physics, 8 (7-8), pp. 2296
- W.Bergbauer, A.Waag et al, Continuous-flux MOVPE growth of position-controlled N-face GaN nanorods, Nanotechnology 21(2010)305201.

6

Humanities and Educational Sciences

English and American Studies

Prof. Dr. Carmen Becker

Researcher's Career

- Full Professor Foreign Language Pedagogy, TU Braunschweig
- Associate Professor Foreign Language Pedagogy, TU Braunschweig
- Associate Professor Foreign Language Pedagogy, Leibniz Universität Hannover
- Dr. Phil., Leibniz Universität Hannover
- Research Assistant, Leibniz Universität Hannover
- Lecturer for Foreign Language Pedagogy and Applied Linguistics, Leuphana Universität Lüneburg
- Member of NiLS, Lower Saxony State Institute for Teacher Education and School Development
- Teacher at primary and secondary schools in Cuxhaven, Sülze and Celle
- Teacher Training, Second State Examination, Oldenburg
- Study of English and General Science Sachunterricht, Kassel/Monmouth (OR), First State Examination

Funding
MWK

Contact
Technische Universität Braunschweig
English and American Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8725
c.becker@tu-braunschweig.de
www.tu-braunschweig.de/anglistik/seminar/esud/mitarbeiter/becker

Mission Statement

The aim is to identify factors that facilitate language acquisition/learning in instructional settings and to design evidence-based state-of-the-art methods, approaches and materials for language learning and teaching, for the purpose of impacting the English curriculum and English language teaching practice.

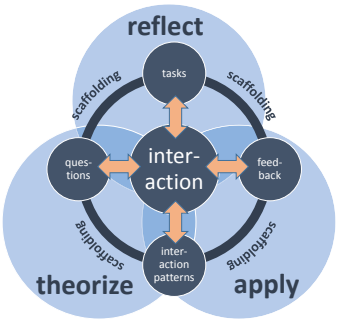
Research

Portfolio implementation and assessment: The implementation of the European Language Portfolio (ELP) has given rise to the recognition and attribution of a vast potential owing to the capacity of the ELP to change the learning culture in the foreign language classroom and to improve language learning. The quantitative empirical study examines the efficiency of the implementation of the portfolio, as well as its potential for modification in the wider institutional context of schools in Lower Saxony.

CLIL by interaction: Content and Language Integrated Learning (CLIL) is an established approach to support multilingualism by teaching various school subjects in an additional European language.
We develop and examine a variety of CLIL scenarios, supporting content learning, language learning and skill development with the key focus on interaction and developing CLIL teacher training courses in cooperation with the Lower Saxony Ministry of Education.

Inclusive foreign language pedagogy / Zertifikat Inklusiv Englisch Lehren und Lernen (ZiEL): The Convention of the United Nations for the rights of persons with disabilities grants all individuals access to an inclusive primary and secondary education with others in the communities in which they live. At the same time the European policy Mother Tongue +2 requires all European citizens to learn and speak two additional languages. We examine the implementation of the UN Convention in the foreign language classroom identifying teaching conditions and teacher competences for successful inclusive foreign language learning.

Creative speaking and improvisation: In the foreign language classroom at primary as well as lower secondary level opportunities for creative language use are generally scarce. We develop and examine improvisation activities as a possible means to create opportunities for creative speaking in language lessons with young learners.



Publications

- Becker, C.; Blell, G. & Rössler, A. (Eds.) (2016). Web 2.0 und komplexe Kompetenzaufgaben im Fremdsprachenunterricht. Frankfurt: Peter Lang.
- Becker, C.; Blell, C. & Kupetz, R. (2016 -). Series Fremdsprachendidaktik inhalts- und lernerorientiert / Foreign Language Pedagogy - content- and learner-oriented. Frankfurt am Main: Peter Lang.
- Becker, C. & Roos, J. (2016). "Der Film The Gruffalo im Englischunterricht der Grundschule – Lernszenarien gestalten und Lernpotenziale erschließen." In: Fremdsprachen Lehren und Lernen 45.1, pp. 34-44.
- Becker, C. & Roos, J. (2016). "An approach to creative speaking activities in the young learner's classroom." In: Education Inquiry Vol. 7, No. 1, pp. 1-18.
- Becker, C. (2015). "Von der Selbsteinschätzung zur Selbstregulation. Fördern und Fordern im Englischunterricht." In: Die Grundschulzeitschrift 285/286, pp. 78-82.

Georg Eckert Institute for International Textbook Research – Member of the Leibniz Association (GEI)

Prof. Dr. Eckhardt Fuchs

- Director of the Georg Eckert Institute
- Chair for History of Education/ Comparative Education at the Technical University Braunschweig

Researcher's Career

- Research director and deputy director of the Georg Eckert Institute
- Assistant professor at the University of Mannheim
- Research fellow at the Historical Commission in Berlin, the John F. Kennedy Institute of the Freie Universität of Berlin, the German Historical Institute in Washington and the Max Planck Institute for the History of Science in Berlin
- Studies and PhD at the University of Leipzig

Funding

Public

Contact

Georg-Eckert-Institut – Leibniz-Institut für internationale Schulbuchforschung
Celler Straße 3
38114 Braunschweig
Phone: +49 531 590-99 100
info@gei.de
www.tu-braunschweig.de/allg-paed/personal/fuchs/index.html

Mission Statement

Researchers at the GEI analyze textbooks and other teaching materials from diverse geographical regions and time periods in their respective contexts from the perspective of a range of academic disciplines. They make recommendations to policymakers and educational practitioners on how textbooks might be used to transcend difficulties in communication and understanding within or between societies. The research infrastructure of the GEI enables research into textbooks and allows us to support international partners working towards similar aims.

Research

The GEI conducts applied, multidisciplinary research into textbooks and educational media, informed primarily by history and cultural studies. It also provides advisory services to national and international education policymakers, practitioners and organisations, and acts as a coordinator and mediator in international issues and projects around textbooks. Research, knowledge transfer and research infrastructure services are all closely interconnected at the GEI; as a non-university institution both carrying out and facilitating research into textbooks and educational media, the institute is an internationally recognised centre of excellence in the field.

Prof. Dr. Eckhardt Fuchs combines research on the history of education and comparative education with textbook research. Based on a cooperation agreement he is a full professor at the Technical University and director of the GEI. His research interests include the global history of modern education, international education policies, and curriculum and textbook development. He focuses on the history and politics of transnational organizations involved in the field of education by emphasizing in particular their dependence on national and regional development processes. His approach is theory-based and comparative, transcending the bounds of national history and examining the interaction between international diffusion and interpenetration processes and regional appropriation processes. Furthermore, he has investigated the function of teaching and learning materials for secondary schools by international comparison as well as the impact of curricular reforms resulting from global developments on teaching practices especially in the field of history. He also has been writing extensively on the history and current status of textbook research and is editor of several educational journals.

Prof. Fuchs has been an advisor for international organizations such as UNESCO and OSCE and is involved in projects on textbook revisions in many parts of the world. He has been awarded scholarships by a variety of organizations and foundations and served as a visiting professor in Sydney, Umeå, Tokyo, and Seoul.

Villa Bülow – Georg Eckert Institute

Publications

- France, Corine; Faure, Romain; Fuchs, Eckhardt (Hg.) (2015): Bildung in Deutschland nach 1945. Transnationale Perspektiven. Frankfurt/Main.
- Fuchs, Eckhardt; Carrier, Peter; Messinger, Torben (2015): The International Status of Education about the Holocaust. A Global Mapping of Textbooks and Curricula. Paris: UNESCO.
- Bagchi, Barnita; Fuchs, Eckhardt; Rousmaniere, Kate (Hg.) (2014): Connecting Histories of Education: Transactions, Transculturalism and Transnationalism. New York: Berghahn Books.
- Fuchs, Eckhardt; Niehaus, Inga; Stoletzki, Almut (2014): Das Schulbuch in der Forschung. Analysen und Empfehlungen für die Bildungspraxis. Göttingen: V&R unipress (Eckert. Expertise 4).
- Fuchs, Eckhardt; Otto, Marcus (Hg.) (2013): Postcolonial Memory Politics in Educational Media. In: Journal of Educational Media, Memory and Society (JEMMS) 5 (1). Oxford, New York: Berghahn Books.

Institute for Educational Science – Department of Further Education/ Media Center of Excellence in Lower Saxon Higher Education

Prof. Dr. Stefanie Hartz

- Full Professor for Further Education
- Head of Center of Excellence in Lower Saxon Higher Education

Researcher's Career

- Full Professor for Further Education, TU Braunschweig, Institute for Educational Science
- Head of Center of Excellence in Lower Saxon Higher Education, TU Braunschweig
- Postdoctoral Researcher at Eberhard Karls University Tübingen
- Scientific Assistant at the German Institute for Adult Education – Leibniz Center for Lifelong Learning (DIE)
- Dr. phil., Ruhr-University Bochum
- Scientific Assistant at Ruhr-University Bochum
- Master's Study Program of Educational Science, Saarland University, Trier University

Funding

Federal Ministry of Education and Research (BMBF), Ministry of Sciences & Culture for Lower Saxony, private industry

Contact

Technische Universität Braunschweig
Institute for Educational Science
Dept. of Further Education and Media
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8816
s.hartz@tu-braunschweig.de
https://www.tu-braunschweig.de/wbm

Mission Statement

We are dedicated to the assessment and enhancement of lifelong learning processes of individuals and organizations by engaging in applied and basic research using a broad spectrum of quantitative and qualitative research methods.

Research

Our research on learning processes of individuals focuses on the following areas:

- analyzing the teaching competencies of academic teachers,
- examining key factors of influence on the learning processes of academic teachers participating in university teachers' training programs,
- analyzing the development of pedagogical/educational knowledge conveyed in academic teachers' training programs,
- evaluating the conditions of theoretical knowledge transfer in teacher-learner interaction.

In the context of organizational education, we explore learning processes in, by and between organizations. In this respect we analyze

- why and how organizations incorporate the principles of (quality) management models into their existing organizational lines of reasoning and action,
- how organizations acquire and assimilate management models,
- how organizations evolve instigated management models to the level of teacher-learner-interaction, and
- how or whether they ensure that management systems have an impact on the learner.

We realize applied and basic research implementing a complex combination of qualitative and quantitative research methods (surveys, case studies, expert interviews, group discussions, analysis of documents, videography etc.) with different measuring times. The data analyses are based on explorative, descriptive and multivariate procedures.

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Publications

- Hartz, Stefanie, & Marx, Sabine (Hrsg.) (2016). Leitkonzepte der Hochschuldidaktik. Theorie – Praxis – Empirie. Bielefeld: wbv
- Beuße, Mareike, Hartz, Stefanie, & Piep, Jasmin (2016). Die Förderung der Selbstwirksamkeitserwartung durch hochschuldidaktische Qualifizierung. In Stefanie Hartz, & Sabine Marx (Hrsg.), Leitkonzepte der Hochschuldidaktik. Theorie – Praxis – Empirie (pp. 42-50). Bielefeld: wbv
- Hartz, Stefanie (under review). Qualitätsmanagement und -entwicklung als Gegenstand der Organisationspädagogik. In Michael Göhlich, Andreas Schröer, & Susanne M. Weber (Eds.), Handbuch Organisationspädagogik. Wiesbaden: Springer
- Hartz, Stefanie (2015). Aneignung. In Jörg Dinkelaker, & Aiga von Hippel (Hrsg.), Erwachsenenbildung in Grundbegriffen (pp. 42-48). Stuttgart: Kohlhammer Verlag
- Hartz, Stefanie (2015). Wirksamkeitszuschreibungen von Weiterbildungseinrichtungen zur Lernerorientierten Qualitätstestierung. Zeitschrift für Erziehungswissenschaft, 18(2), pp. 303-325, DOI 10.1007/s11618-015-0620-z

Institute of Mathematics Education and Elementary Mathematics

Prof. Dr. Frank Heinrich

Researcher's Career
- Full Professor of Mathematics Education, TU Braunschweig
- Academic Council/Senior Lecturer, University of Bamberg
- Dr. phil. and Habilitation (Dr. habil.), University of Jena
- Scientific Assistant/Research Assistant, University of Jena
- Teacher of Mathematics and Physics

Funding
MWK, Stifterverband für die Deutsche Wissenschaft and Volkswagen AG

Contact
Technische Universität Braunschweig
Institute of Mathematics Education and Elementary Mathematics
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8851/-52
f.heinrich@tu-braunschweig.de
www.tu-braunschweig.de/idm

Mission Statement

"All Life is Problem Solving" (Karl Popper) – Finding and solving mathematical problems belongs to the self-concept for all those who are concerned with mathematics. Accordingly, it is of particular importance for teaching and learning mathematics to take this aspect into due consideration.

Research

From the perspective of mathematics education, it is of great interest how mathematical problem solving can succeed, what relevant learning contents are and how corresponding competences can be acquired. Against this background we assume that suggestions for measures promoting mathematical problem solving competences can be won through empirical research and analyses of problem solving processes and from problem solving lessons in school.

Empirical studies of problem solving processes: We investigate
- what pupils do if they cannot continue the chosen pathway for their solution process,
- what kind of mistakes/difficulties occur during pupils' solution processes and how they deal with them,
- how pupils start their solution process.

Empirical studies of problem solving lessons: Here the focus primarily lies on the behaviour of the teacher. The following questions are of particular interest:
- What is done during lessons if a chosen method for tackling the problem turns out to be unrewarding?
- What kind of mistakes/difficulties occur during the problem solving process and how are they dealt with?
- How is the work on mathematical problems started?
- Is a review process carried out after the actual problem solving process (meaning a reflective observation and an outlook)? If so, how is it designed?

Furthermore, the development, testing and evaluation of learning offerings for problem oriented mathematic lessons are taken into consideration.

Across the river
On an expedition through the jungle, Professor Fluctus wants to cross a raging river. As there is no bridge, he must use the stepping stones in the water that are fortunately lined up in a row from one riverbank to the other. When crossing the river, Professor Fluctus can either hop from one stepping stone to the next, or skip the next and hop directly to the stepping stone after that. Let us assume that there are five stones in the water. How many different (alternative) ways are there for the Professor to get to the other side? (Fritzlar 2005)

Publications

- Heinrich, F. (2004): Strategische Flexibilität beim Lösen mathematischer Probleme – Theoretische Analysen und empirische Erkundungen über das Wechseln von Lösungsanläufen [Stategic flexibility in mathematical problem solving – theoretical analyses and empirical studies about switching between different approaches to a problem]. Hamburg: Dr. Kovac.
- Heinrich, F. & Fritzlar, T.; Ed. (2010): Kompetenzen mathematisch begabter Grundschulkinder erkunden und fördern [Studying and supporting the skills of mathematically talented primary school children]. Offenburg: Mildenberger.
- Heinrich, F., Bruder, R. & Bauer, Ch. (2015): Problemlösen lernen [Learning how to solve problems]. In: R. Bruder et. al.: Handbuch der Mathematikdidaktik. Berlin, Heidelberg: Springer Spektrum.
- Heinrich, F., Jerke, A. & Schuck, L.-D. (2015): Lernangebote für problemorientierten Mathematikunterricht in der Grundschule [Learning offerings for problem-oriented mathematic lessons in primary schools]. Offenburg: Mildenberger.
- Heinrich, F. & Fritzlar, T.: River crossing with Fibonacci. In: Hodnik Cadez et. al. (Ed.): Partial Ideas for Problem Solving in the Mathematics Classroom - Experiences from Different Countries. Münster: WTM, in preparation.

English Seminar and American Studies

Prof. Dr. Rüdiger Heinze

Researcher's Career
- Full Professor for American Literary and Cultural Studies, TU Braunschweig
- Associate Professor for American Literary and Cultural Studies, TU Braunschweig
- Assistant Professor for American Literary and Cultural Studies, Freiburg University
- Dr. Phil., TU Braunschweig
- Study of American Literature and Culture, Linguistics, History, and Comparative Literature, Braunschweig/Austin (TX)/ Bloomington (IN)

Funding
MWK, Andrea von Braun, DAAD, Fulbright, FRIAS

Contact
Technische Universität Braunschweig
English Seminar and American Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8712
r.heinze@tu-braunschweig.de
www.tu-braunschweig.de/anglistik/seminar/

Mission Statement

Conceptualizing and delineating how literary and cultural texts represent and project who and what we (as a person or community) are and who we can or want to be.

Research

- A transdifferent and comparative literary and cultural history and theory of children of immigrants in the USA.
- A history and theory of difference and repetition in filmic adaptation and remaking.
- Transmedial storytelling: how do storyworlds and entire fictional universes change when they move across media?
- 'Unnatural' narratives and narratology: how do and can we make sense of narratives (in fiction, film, comics, etc.) that break with a specific set of experiential real-world parameters such as natural laws, logic, causality, etc.?

Source:
Mike Deodato Jr., Denis Calero
"Heroes" (New York: Marvel, 2001)

Publications

- Heinze, R. & Kraemer, L. (2015). Remakes & Remaking: Concepts – Media – Practices. Bielefeld: transcript.
- Heinze, R. & Mueller, K. (2010-). Reihe Kultur- und Naturwissenschaften im Dialog. Muenster: LIT.
- Alber, J. & Heinze, R. (2011). Unnatural Narratives, Unnatural Narratology. Berlin: Walter de Gruyter.
- Heinze, R. (2014). The Eagle Never Lands: Weltraum und Weltraumfahrt in der US-Amerikanischen Kultur. In: Germanistisch-Romanistische Monatszeitschrift 64:2: 225-239.
- Heinze, R. (2013). Strange Perspectives = Strange (Narrative?) Identities? In: Rethinking Narrative Identity. Persona and Perspective. Hrsg. Claudia Holler und Martin Klepper. New York: John Benjamins Publishing Company. 117-127.

Institute of Educational Psychology

Prof. Dr. Elke Heise

Researcher's Career

- Full Professor for Educational Psychology, TU Braunschweig
- Full Professor for Educational Psychology, Dortmund University
- Postdoctoral Lecture Qualification (Habilitation), Göttingen University
- Young Scientist Award of the German Psychological Society (DGPs), 1992
- Dr. rer. nat., Göttingen University
- Study of Psychology (Diploma), Göttingen University

Funding

DFG, BMBF, APS

Contact

Technische Universität Braunschweig
Institute of Educational Psychology
Bienroder Weg 82
38106 Braunschweig
Phone: +49 531 391-94049
el.heise@tu-braunschweig.de
www.tu-braunschweig.de/ipp/team/heise

Mission Statement

Our empirical research focuses on processes of learning and teaching within the educational system, including the role of diversity and diversity management.

Research

Student satisfaction: Based on the person-environment-fit model, we examine how much of the variance in students' satisfaction and success at the university can be explained by the fit between abilities and demands on the one hand and needs and supplies on the other. Our empirical findings show that different aspects of student satisfaction (contents, conditions, coping with study-related stress) can be predicted by different aspects of person-environment-fit.

Diversity and diversity management: With increasing diversity of university students, diversity management (DiM) is required in the context of university education. We analyze if students' diversity and their perception of DiM can predict student satisfaction and students' organizational commitment to their university. In a study with first-year students we were able to show that DiM-fit regarding students' cognitive and motivational skills is a significant predictor of both satisfaction with the conditions of studying and satisfaction with one's coping with study-related stress. At present we are interested in the potential change of relevant DiM-factors with more advanced students. Our results can be applied to the development of a DiM-system within university education.

Action regulation: In experimental research we aim to identify under which circumstances task performance is impaired by goal conflicts. Current problem-solving behavior may be hampered, if the learner's attention is distracted by additional information which, although unrelated to the current task, is related to a competing goal. We also explore the role that task difficulty plays in maintaining the current goal in the face of difficulties and protecting it against competing goals.

Publications

- Heise, E., Böhme, E. & Körner, S. B. (2010). Montessori-orientierter und traditioneller Grundschulunterricht: Ein Vergleich der Entwicklung von Rechtschreibung, Rechnen, Intelligenz und Kreativität. Psychologie in Erziehung und Unterricht, 57, 273-289.
- Heise, E. & Thies, B. (2015). Die Bedeutung von Diversität und Diversitätsmanagement für die Studienzufriedenheit. Zeitschrift für Pädagogische Psychologie, 29, 31-39.
- Heise, E. & Zaepernick-Rothe, U. (2012). Zufriedenheit von Lehrenden an deutschen Universitäten mit ihrer Lehrtätigkeit. In F. G. Becker, G. Krücken & E. Wild (Hrsg.), Gute Lehre in der Hochschule – Wirkungen von Anreizen, Kontextbedingungen und Reformen (S. 115-135). Bielefeld: W. Bertelsmann.
- Scheiter, K., Gerjets, P. & Heise, E. (2014). Distraction during learning with hypermedia: Difficult tasks help to keep task goals on track. Frontiers in Psychology, 5. doi: 10.3389/fpsyg.2014.00268
- Thies, B. & Heise, E. (2014). (MOOC-gestützte) Online-Einheiten als Mittel der Binnendifferenzierung in heterogenen Lehrveranstaltungen: Ein Pilotprojekt. In M. Krämer, U. Weger & M. Zupanic (Hrsg.), Psychologiedidaktik und Evaluation X (pp. 153-160). Aachen: Shaker.

Institute of Sport Science and Movement Pedagogy

Prof. Dr. Prof. h.c.
Reiner Hildebrandt-Stramann

Researcher's Career

- Since 2000 Full Professor for Sport Science and Pedagogical Movement, TU Braunschweig
- Full Professor for Sport Science, University of Lüneburg and Vechta
- Honorary professorship of the Federal University of Bahia/Salvador,Brazil
- Guest-Professor at the Universitis of Bahia-Salvador, Recife, Rio Grande de Norte, Brazil
- Guest-Professor at the University of Santa Maria, Brazil
- Scientific Assistant at the University of Kassel and Braunschweig, Department of Sport Science
- Ph.D. at the University of Kassel, Department of Sport Science
- Studies of Sport Science an Science of Politic, University at Kassel

Funding
DVS, DAAD, BMBF

Contact
Technische Universität Braunschweig
Institut für Sportwissenschaft und Bewegungspädagogik
Pockelstraße 11
38106 Braunschweig
Phone: +49 531 391 3417
R.Hildebrandt-Stramann@tu-braunschweig.de
www.tu-braunschweig.de/sport

Mission Statement

The institute offers a two subject-Bachelor's and Master's Degree program in "Sport science and movement pedagogy".

The focus of teaching and research rests on movement pedagogical ideas and concepts.
The aim of the departments courses is the student professionalization, enhancing their competency of didactical transforming movement, games and sport into educational application situations.

Research

Movement, games and P.E. in all-day schools: The nationwide introduction of all-day schools in Germany can be considered as one of the most important educational reform-projects of the German educational system in the last twenty years.

In their research the department's team working on movement pedagogy are making use of qualitative research methods to examine the importance of movement, games and sport in all-day schools.

The research is focused on the four fields of action which typically determine quality all-day schools: a balanced rhythm of the school day, exercise and lessons or rather exercise and learning, school as a space for physical activities and its design, providing physical activities and cooperations with partners from outside.

Another focal point of the movement oriented all-day school research is the intercultural comparison with Spain, Portugal and Brazil.

Reflecting educational application situations didactically: The department examines Physical Education Lessons and educational application situations by looking at different movement fields such as, for example, athletics (running, jumping, throwing), gymnastics, other movement arts and ball games. The team is looking at the ways topics for movement pedagogy can be constituted, how they can be staged and what results they can produce. The review method as a qualitative research method is used for interpretive analysis of movement pedagogy.

Movement and language: The project "movement and language" has been established to prove that movement actions can also be considered as language actions. The media for this research are so called "motion workshops" which are put to the test in cooperation with primary schools. Research methods are standardized language tests and motor system examinations.

Movement oriented development cooperation with Brazil: In cooperation with the DAAD (German Academic Exchange Service) the department is concerned with the development of a movement oriented curriculum and its evaluation for the P.E. teacher education at Brazilian universities. Another project deals with the research of the importance of movement in every day life in Brazil. A third project is looking at the importance of the Brazilian culture of human motion in the environment of Brazilian children and young people as well as in educational application situations in Brazilian schools.

Publications

- Hildebrandt-Stramann, R., Beckmann, H., Faustino, A., Probst, A. & Wichmann, K. (2014). Bewegung, Spiel und Sport in der Ganztagsschule – ein interkultureller Vergleich zwischen Deutschland und Portugal. Baltmannsweiler: Schneider.
- Hildebrandt-Stramann, R. (2014). Raumtheorien und bewegungsbezogene Schulentwicklung. In A. Rütten, S. Nagel & R. Kähler (Hrsg.), Handbuch Sportentwicklungsplanung (pp. 85-98). Schorndorf: Hofmann.
- Hildebrandt-Stramann, R. (2015). Ganztagsgrundschulen in Bewegung – Bewegung in die Ganztagsgrundschule. Praxis der Psychomotorik (3), 139-144.
- Hildebrandt-Stramann, R. & Zulke Taffarel, C. (2015). Saber treinar a si mesmo: Porque e como devemos ensinar treinamento nas aulas de Educação Física? Ágora 17 (3), 266-283.
- Hildebrandt-Stramann, R., Beckmann, H., Bores, N., Martinez, L., Probst, A. & Wichmann, K. (2016). Bewegte Ganztagsgrundschulen in Deutschland und Spanien – ein interkultureller Vergleich. Baltmannsweiler: Schneider.

English and American Studies

Prof. Dr. Holger Hopp

Researcher's Career

- Full Professor for English Linguistics, TU Braunschweig
- Full Professor for Multilingualism, University of Mannheim
- Visiting Researcher, Pennsylvania State University
- Assistant Professor for English Linguistics, University of Mannheim
- Ph.D in Linguistics, University of Groningen, (NL)
- MA in Linguistics and English Language, University of Durham (UK)
- Studies at the Universities of Gießen, Göttingen, East Anglia, Berlin (FU)

Funding
BMBF, DAAD

Contact
Technische Universität Braunschweig
English and American Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8700
h.hopp@tu-braunschweig.de
www.tu-braunschweig.de/anglistik/seminar/linguistik

Mission Statement

Our group investigates how languages interact in the multilingual mind and how speakers navigate different languages and linguistic repertoires. We study how children and adults acquire and learn English as a first, second or third language and how they produce and understand language in real time.

Research

Multilingual Language Processing: Building on formal grammatical theories, we investigate linguistic and cognitive aspects of multilingualism. Our projects focus on second language (L2) and L3 acquisition and processing of English at interfaces of grammar and cognition. In eye-tracking and reaction-time experiments, we examine how bilingual and L2 learners acquire and process grammatical knowledge in and across different domains of language (e.g. morphology, lexicon, syntax, semantics).

Linguistic and Cognitive Aspects of Multilingualism: In a joint project with the University of Mannheim, we examine whether early multilingualism provides general (cognitive) benefits in English language acquisition in primary school and/or whether specific language structures and features of the first and second languages transfer into English (MEG-SkoRE: Sprachliche und kognitive Ressourcen der Mehrsprachigkeit im Englischerwerb in der Grundschule, BMBF 01JM1401, 11/2014-10/2017).

Language Contact and Language Attrition: In comparative perspective, we study how cross-linguistic influence from a dominant second language can lead to erosion of the native language in different populations and how development in first language attrition compares to second language acquisition.

Language Processing and Language Learning: Several projects explore how instruction and teaching can change the implicit processing of grammatical knowledge in child and adult L2 learners.

English as a Second Language versus English as a Third Language: In psycholinguistic experiments, we study how the acquisition of English as a second language (L2) compares to the acquisition of English as an L3 in children and adults in order to find out whether the L1 or the L2 affect further languages in differential ways.

Publications

- Hopp, H. (2016). "Learning (not) to predict: Grammatical gender processing in adult L2 acquisition". Second Language Research, doi:10.1177/0267658315624960
- Hopp, H. (2016). "The timing of lexical and syntactic processes in L2 sentence comprehension." Applied Psycholinguistics, doi:10.1017/S0142716415000569
- Hopp, H. (2016). "Cross-linguistic lexical and syntactic co-activation in L2 sentence processing." Linguistic Approaches to Bilingualism, doi:10.1075/lab.14027.hop
- Hopp, H. & León,M. (2016). "Structural and inherent case in the non-native processing of Spanish: Constraints on inflectional variability." Second Language Research, 32(1), 75-108.
- Hopp, H. & Putnam, M.T. (2015). "Syntactic restructuring in heritage grammars: Word order variation in Moundridge Schweitzer German." Linguistic Approaches to Bilingualism, 5(2), 180-214.

Institute of Philosophy

Prof. Dr. Nicole C. Karafyllis

Researcher's Career

- Full Professor of Philosophy, TU Braunschweig
- Full Professor of Philosophy, United Arab Emirates University (UAEU), Abu Dhabi (UAE)
- Visiting Professor for Cultural Philosophy of Science, Vienna University (Austria)
- Habilitation in Philosophy at Stuttgart University
- Post-Doc at Goethe University Frankfurt am Main
- Franzke-Award for Technology and Responsibility, TU Berlin
- PhD (doctorate) at the International Centre for Ethics in the Sciences and Humanities, Tübingen University
- Research projects on technology assessment of renewable resources at the Center for Small-scale Technologies and Local Development (Ain-Shams University, Cairo) in Egypt and at the German Wuppertal-Institut für Klima, Umwelt, Energie
- Parallel studies of Biology (Dipl.-Biol.) and Philosophy at the universities in Erlangen-Nuremberg, Stirling (UK) and Tübingen

Funding
BMBF, DAAD, BBAW, VDI, State Lower Saxony

Contact
Technische Universität Braunschweig
Institute of Philosophy
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8616
n.karafyllis@tu-braunschweig.de
www.tu-bs.de/philosophie

Mission Statement

Philosophy of Science and Technology, analyzing problems occurring at the interface of Biology, Biotechnology and Engineering. This embraces STS, Anthropology, Phenomenology, Applied Ethics (Environmental, Agricultural and Engineering Ethics, Bioethics), Intercultural Philosophy and the History of Philosophy.

Research

Theory of biofacts: biofacts are intermediary entities between artefacts and natural living beings. They grow, but not by themselves. In the light of biotechnologies and synthetic biology, how can we still differentiate between nature and technology? Is the Aristotelian concept of growth (physis) still a useful candidate to make a difference? This research includes the investigation of modern seed banks, its knowledge orders and theories of living collections, melting into a project funded by the BMBF and entitled "The language of biofacts: semantics and materiality of high-tech plants" (together with TUM and LMU).

Plants and agriculture as utopy: in the modern age, plants emerge as a Academic Exchange Service symbol for both the non-technical and non-animal (anthropology/ontology). On the contrary, the plant is a flexible object for modern laboratory methods in biotech: cloning, vaccination and transplantation derived from agricultural technics. It is analyzed how different concepts of the plant and its cultivation interact with modern and premodern concepts of technology, and how plant-metaphors help articulating modes of mediality and potentiality which otherwise would be hidden in a technical worldview.

Intercultural concepts of "technics" and "technology": Technology is not universal. Research focus is on how different cultures have conceptualized technics, how they regarded technology as encroaching on nature, how the relation of technology and progress, and of high-tech and low-tech is modeled, and how the present dialogues on global ethics of technology and educational issues in the STEM-field could profit from cultural insights.

The philosopher's (auto)biography: Narrating one's life is a difficult task, particularly if it is one's own life – and the life of a philosopher. This research area unites the idea of "life" in a 1st-person-perspective and philosophy of history, asking the question how philosophers can be material objects of biographical narration and, at the same time, scholars of a discipline that used to strictly separate life from thought.

Publications

- Renn, O., Karafyllis, N. C., Hohlt, A., Taube, D. [Ed.] (2015): International Science and Technology Education: Exploring Culture, Economy and Social Perceptions. London: Routledge.
- Karafyllis, N. C. (2015): Willy Moog (1888-1935): Ein Philosophenleben. Freiburg: Alber
- Karafyllis, N. C. (2013). Putzen als Passion. Ein philosophischer Universalreiniger für klare Verhältnisse. Berlin: Kulturverlag Kadmos (2nd ed. 2015)
- Karafyllis, N.C. and G. Ulshöfer [Ed.] (2008): Sexualized Brains. Scientific Modeling of Emotional Intelligence from a Cultural Perspective. Cambridge, Mass.: MIT Press
- Zittel, C., Nanni, R., Engel, G. and Karafyllis, N.C. [Ed.] (2008): Philosophies of Technology. Francis Bacon and his Contemporaries. 2 Volumes. Leiden/Boston: Brill

Historical Institute

Prof. Dr. Christian Kehrt

Researcher's Career

- Full Professor of History of Science and Technology TU Braunschweig
- Assistant Professor Helmut-Schmidt-University of the Armed Forces Hamburg
- Fellow at the Rachel Carson Center for Environment and Society Munich
- Assistant Professor at the Research Institute for the History of Science and Technology Deutsches Museum Munich.
- PhD at the interdisciplinary post-graduate college "Technology and Society" at the University of Technology Darmstadt
- Study of History and Philosophy University of Tübingen and Stony Brook, NY.

Funding
DFG, VWStiftung

Contact
Technische Universität Braunschweig
Historisches Seminar
Schleinitzstraße 13
38106 Braunschweig
Phone: +49 531 391-3080
c.kehrt@tu-braunschweig.de
www.historisches-seminar-braunschweig.de/index.php?id=1677

Mission Statement

The objective is a broad historical understanding of modern technological cultures, in which science, technology and society are inseparably intertwined. I share the Science and Technology Studies approach of interdisciplinary work as well as a focus on contemporary problems and constellations.

Research

1. Aviation: The technological experiences of military pilots
In order to examine pilots experiences of flight, physiological, psychological and technical aspects were investigated with the help of an integral approach from cultural history. Active control and male commanding of technology as well as calm, athletic prowess and desire for adventure characterized the civilian and military pilots' habitus in the First and Second World War.

2. Nanotechnology: Instruments, Images and Visions in the Practice of Nanotechnology
The nanotechnology protagonists from Munich were located in a differentiated research and innovation landscape. The nanoscience networks CeNS and NIM were founded in order to be able to react more quickly and flexibly to transdisciplinary research trends within the institutional constraints of universities. The example of nanotechnology offers an insight into how research at universities answers to external demands – from the political, public and economic spheres – for more "applicability" and "transparency" in order to continue to experiment freely with molecules and electrons.

3. The Polar Regions in Environmental Perspective
The polar regions were, in addition to outer space and the deep sea, one of the central areas of conflict and laboratories of the Cold War. During this period, knowledge of ice, snow, wind and weather, oceans and higher levels of the atmosphere increased markedly. This knowledge that was constituted during the Cold War was an essential prerequisite to the perception of global climate and environmental problems.

Publications

- Kehrt, C. (2016), Mit Molekülen spielen. Wissenskulturen der Nanotechnologie zwischen Politik und Medien. Bielefeld.
- Kehrt, C.; Heßler, M. (Hg.) (2014), Die Hamburger Sturmflut 1962. Risikobewusstsein und Katastrophenschutz aus umwelt-, technik- und zeithistorischer Perspektive, Göttingen.
- Kehrt, C, Torma, F. (2014), Einführung: Lebensraum Meer. Globales Umweltwissen und Ressourcenfragen in den 1960er und 1970er Jahren. In: Geschichte und Gesellschaft 40, 313-322.
- Christian Kehrt, Peter Schüßler, Marc-Denis Weitze (Hg.) (2011), Neue Technologien in der Gesellschaft. Akteure, Erwartungen, Kontroversen und Konjunkturen, Bielefeld 2011.
- Kehrt, Christian. "The Wegener Diaries: Scientific Expeditions Into the Eternal Ice." Digital exhibition, Environment & Society Portal (Rachel Carson Center for Environment and Society, 2013). http://www.environmentandsociety.org/exhibitions/wegener-diaries

Institute of Educational Science

Prof. Dr. Katja Koch

Researcher's Career
- Full Professor for School Education, TU Braunschweig
- Liaison professor Friedrich-Ebert-Stiftung
- Postdoc, Georg-August-University Göttingen
- Dr. phil. Philipps-University Marburg
- Study of History, German language and literature, Education Philipps-University Marburg

Funding
BMBF, BMFSFJ, Mercator, NLQ

Contact
Technische Universität Braunschweig
Institute of Educational Science
Bienroder Weg 97
38106 Braunschweig
Phone: 49 531 391-8839
katkoch@tu-bs.de
https://www.tu-braunschweig.de/schulpaedagogik/mitarbeiter/koch

Mission Statement

Command of the instruction language is the most important predictor for success in school. In the context of my research, my team and I seek to discover how educational institutions are managing to foster, better than heretofore, the language acquisition process of children who have a different original language.

Research

The research activities in my field of work relate to the following other fields:

Basic research in second language acquisition:
I am interested in what educational facilities can do to support children of kindergarten or primary school age who, for example, have a different original language. In the process I am searching for kindergartens and schools that are rather successful at this. One of the most important findings from our programme is the fact that collective meals have proven to be a very good venue for fostering/developing language acquisition in children.

Evaluation of educational-policy measures in the field of German as a Second Language:
What receive the most time and effort in my working field are research activities that evaluate educational-policy measures for language promotion. Thus we were able to show, for example, for the implementation of on-going language training, that the process runs the same in almost all schools, and that well-trained and motivated teaching staff in the schools are able to further the pupils' development.

Development of a training programme regarding language teaching strategies:
In order to do justice to our complex research topic of second language acquisition for children, we work together with colleagues from other research disciplines and universities. For example, we are designing together with colleagues from the Developmental Psychology Department a teachers' training programme that combines language learning with the conveyance of concrete knowledge and emotional knowledge.

Development and implementation of innovative teaching-learning formats:
So that prospective teaching staff learn how they can properly react to the challenges of an increasingly heterogeneous student body, we are developing innovative teaching-learning formats such as an interdisciplinary blended-learning unit regarding migration and language promotion. And together with eight other universities in Lower Saxony, we are designing university-didactic materials regarding language development and language education.

Publications

- Koch, K. (2016): Schulartenspezifische Aspekte der Sprache in der Bildung. In: Kilian J.; Brouër, B.; Lüttenberg, D. (Hrsg.): Handbuch Sprache in der Bildung. De Gruyter Mouton: Berlin. pp. 362-379
- Hormann, O.; Krüger, M.; Hofmann,B.; Jüttner, A-J. & Koch, K: (2015): Von Strukturen und Prozessen zu Strukturen in Prozessen. In: Cloos, P. ; Koch, K. ; Mähler, C. (Hrsg.). Entwicklung und Förderung in der frühen Kindheit. Interdisziplinäre Perspektiven. Weinheim: Beltz Juventa; pp. 160-177
- Schulz, S.; Koch, K. (2014): Projekt „Netzwerk für Deutsch als Zweit- und Bildungssprache, Mehrsprachigkeit und Interkulturelle Kompetenz in Niedersachsen (DaZNet)". Niedersächsisches Landesinstitut für schulische Qualitätsentwicklung (NLQ).
- Koch, K. (2014): Kinder mit einer anderen Herkunftssprache im Übergang in die Grundschule. In: Liegmann, A, Mammes, I. ,Racherbäumer, K. (Hrsg.): Facetten von Übergängen im Bildungssystem. Nationale und internationale Ergebnisse empirischer Forschung. Wiesbaden, pp. 23-34
- Koch, K. (2012): Zweitspracherwerb am Übergang vom Elementar- in den Primarbereich. Herbert Utz Verlag, München

English and American Studies – Didactics of English Language Teaching

Prof. Dr. Angelika Kubanek

Researcher's Career

- First and Second State Exam for Teachers (Bavaria) : English/German for secondary schools,
- school teacher for 5 years
- Diploma (Univ.) in Adult Education
- Ph.D.: The representation of the Third World in English as a Foreign Language Textbooks used in Germany.
- Habilitation (Katholische Universität Eichstätt): Child oriented early foreign language teaching: from history to the present day (1997)
- Visiting professor in Turkey, visiting professor University of Koblenz-Landau,
- full professor in Braunschweig since 2001
- lectures, expert and teacher trainer in German and various international contexts

Funding
EU, ministries of education, other educational institutions, DFJW,

Contact
Technische Universität Braunschweig
English and American Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8726
a.kubanek@tu-braunschweig.de

Mission Statement

I. Foreign language didactics is education for peace, and learners can, via their competences in English and other languages, contribute to conflict solving and the appreciation of the diversity of cultures. II. Foreign language didactics have much to give to, and share with related didactic areas such as museum pedagogy, public understanding of science, the Easy Language movement.

Research

Orpheus Project: Didactic videos in accessible English with sustainability researchers and other experts, for teenagers and laymen

The project is situated within Environmental Humanities and within Foreign Language Didactics. It uses a narrative approach and has the following aims: to support science appreciation, to create teaching material for the English classroom, to investigate comprehension strategies of teenagers, teachers, teacher training students, to investigate the appropriateness of various explanation formats, to support visibility of sustainability research and expertise.

Exploring intercultural processes within a foreign language teaching context

This topic has been investigated in various constellations, most often in a young learner context: e.g. the emergence of European awareness and sense of place of older children learning English, French, Czech or Polish (2002), cultural differences affecting the quality of language programs in kindergarten and primary school in the neighboring Saar territory, (2008), or how pre-service students present their own stays abroad to early learners of English in (primary) school settings. Recently, a bi-national (French-German) qualitative study co-authored by AK with German and French educators and teacher trainers investigated how the different cultural and educational backgrounds affect the reception of new bi-cultural learning material for children, and what needs to be considered as regards child development when planning such material.

Publications

- The main pedagogical principles underlying the teaching of very young learners.Published research, good practice and main principles. Brussels: European Commission 2006. Authors: Peter Edelenbos, Richard Johnstone, Angelika Kubanek (EAC 89/04, Lot 1)
- "Teacher assessment: the concept of 'diagnostic competence'." Language Testing, 21(2004), 3, 259-283. (with Peter Edelenbos)
- Chapter 5: Researching intercultural learning of young foreign language learners - comprehending learning processes in the context of the German-French kidsbox. [Article is in German]. In: Die deutsch-französische Kinderkiste – Sprache und Kultur des Anderen in Kindergarten und école maternelle. G. Brougère, A.Kubanek, D. Macaire, J. Putsche. Berlin/Paris: Deutsch-Französisches Jugendwerk 2015, pp. 201-251.
- Orpheus-Project videos (2014ff): (e.g. Douglas firs, forest care, stress tests with food crops, recycling electronic waste, the meaning of wild & wilderness). They can be accessed via the following link:
- https://opac.lbs-braunschweig.gbv.de/DB=1/CLK?IKT=8063&TRM=Orpheus+Project+-+public+understanding+of+science

Institute of Science Education – Department of Biology and Biology Education

Prof. Dr. Maike Looß

- Head of Department of Biology and Biology Education

Researcher's Career

- Full Professor for Biology and Biology Education, TU Braunschweig
- Scientific assistant for Biology and Biology Education (habil.), University of Flensburg
- Research associate and PhD (Dr. rer. nat.), University of Bremen
- Teacher-trainee for secondary education
- Study of Biology and Art Education, University of Bremen

Funding

BMBF, MWK Lower Saxony

Contact

Technische Universität Braunschweig
Institute of Science Education,
Department of Biology and Biology Education
Bienroder Weg 82
38106 Braunschweig
Phone: +49 531 391-94091
m.looss@tu-braunschweig.de
www.ifdn.tu-bs.de/didaktikbio/

Mission Statement

Our mission is to enhance professionalization of prospective biology teachers. Our research focuses on several topics of biology education and teacher training. It includes development and evaluation of modern approaches and concepts for learning and teaching biology, diagnostic and experimentation skills.

Research

Diagnostic Competency: Diagnostic competency is a key skill of teacher professionalization. It is an essential condition to give a professional and adequate opinion on the learning behavior of students and requirements of tasks and promotion. The project's aim is to train prospective science teachers' diagnostic competencies relating to domain specific learning processes. By means of video-vignettes the diagnostic skills in identifying students' skills of problem solving were promoted. The progression of prospective science teachers competencies were analyzed regarding subject didactics, teaching methodology, diagnostic skills, research methods and "nature of science".

Competency development in teacher training: This project asks specifically about the matching between acquired teaching skills in the first phase of teacher training at the university and the second phase at teacher training college and school.

Epistemological beliefs: To impart science process skills in school lessons, epistemological beliefs matter. In cooperation with University of Erzincan, Turkey, we analyze the epistemological beliefs of German and Turkish prospective teachers in status and progression.

Benefits of teaching-learning laboratories: In a research supported teaching-project, we analyze the outcomes of an early implemented conjunction of theoretical and practical qualification skills in undergraduate studies using the extension of a learning laboratory to a teaching-learning-laboratory.

Value of living animals in school lessons (Dr. Konstantin Klingenberg; member of working-group): This research focuses on learning outcomes as well as interaction, immediate and long-term effects of animals as original objects in biological school lessons. According to the self-determination theory especially intrinsic motivation was investigated as a mediate factor.

Publications

- Tasci, G./Looss, M./Yurdugül, H./Hilfert-Rüppell, D./Sülün, A./Hinrichs, D./Aydogdu, S./Klingenberg, K./Tas, F. S.: Adaption of scale "Working like Scientists" (WLS). A Turkish-language version: validation and reliability. In: Participatory Educational Research (PER), Vol.3 (1), 2016, pp.54-66; http://dx.doi.org/10.17275/per.16.03.3.1
- Hilfert-Rüppell, D./Looss, M.: Fach(seminar)leiter im Interview: Welche Basis braucht die zweite Phase? In: Hammann, M./Mayer, J.(Hrsg.): Lehr- und Lernforschung in der Biologiedidaktik 6. Studienverlag, Innsbruck 2015, S. 155-172
- Hilfert-Rüppell, D./Eghtessad, A./Looss, M./Höner, K.: Empirische Studien zum Professionalisierungsprozess in den naturwissenschaftlichen Fächern der Lehramtsstudiengänge. In: Lehrerbildung auf dem Prüfstand, Landau 2012 – (2), 157-179
- Looss, M./Buck-Dobrick, T.: Qualität der Lehrerausbildung – Die Sicht von Lehramtsanwärtern auf das Studium des Faches Biologie. In: SEMINAR – Lehrerbildung und Schule, 16. Jg., Heft 2/2010, 123-140
- Looss, M.: Lernstrategien, Lernorientierungen, Lern(er)typen. In: Krüger, D./Vogt, H. (Hrsg.): Theorien in der biologiedidaktischen Forschung. Ein Handbuch für Lehramtsstudenten und Doktoranden. Heidelberg 2007, 141-152
- Editorship: Höner, K./Looss, M./Müller, R. (Hrsg.): Naturwissenschaften vermitteln. Braunschweiger Beiträge zu Lehrerbildung und Fachdidaktik. Münster 2004-2016

Institute of Didactics of the Natural Sciences

Prof. Dr. Rainer Müller

- Leader of Department of Physics and Physics Education Research

Researcher's Career

- 1990: Universität Konstanz, Diploma in Physics
- 1994: Universität Konstanz, Ph. D. (Dr. rer. nat)
- 1995-1997: Postdoc Ludwig-Maximilians-Universität München (Theoretical Physics)
- 1997-2002: Scientic Assistant, Ludwig-Maximilians-Universität München (Physics Education Research)
- since 2002: Full Professor, Technische Universität Braunschweig (Physics Education Research)

Contact

Technische Universität Braunschweig
Institut für Fachdidaktik der Naturwissenschaften (IFdN)
Bienroder Weg 82
38106 Braunschweig
Phone: +49 531 391-94130
rainer.mueller@tu-braunschweig.de

Mission Statement

My aim is to improve the quality of physics teaching in school and university by developing and testing new and innovative approaches based on empirical research. My research is focused on two fields: (1) Quantum physics, especially the conceptual issues, (2) Physics in daily life and in technical applications.

Research

My research addresses the interplay between physics content, learning theories and results from Physics Education Research. It is founded on empirical research in school and university.

Teaching and Learning of Quantum Physics: My research on the teaching and learning of quantum physics has proceeded since 1995. It is centered around the developed a research-based modern course on quantum mechanics (MILQ) in which the conceptual issues of quantum mechanics are taught at an introductory level. In the MILQ project, virtual laboratories (computer simulations of the double slit experiment and the Mach-Zehnder interferometer) are used to let the students discover from the very beginning how quantum phenomena deviate from our classical everyday experience.

The MILQ project has been empirically tested. The results of the evaluation show that the majority of the students acquired appropriate quantum mechanical conceptions, and that many of the common misconceptions encountered in traditional instruction have been avoided.
A comprehensive internet learning platform on the basics of quantum mechanics has been developed (milq-physik.de). It has been continuously developed since 2000. Presently, it consists of a few hundred pages with manuscripts, simulations, and applets. It is visited by several thousand users each month.

Physics in everyday life and in technical applications: Psychological theories of learning indicate that learning is easier and more interesting if the material is presented in a meaningful context. Thus, a focus of my research is to develop learning materials that present physics topics in everyday contexts or in technical applications that are perceived by students as relevant and interesting. Besides numerous articles in national and international journals, I have authored the physics textbooks "Klassische Mechanik – vom Weitsprung zum Marsflug" (de Gruyter, 2009) and "Thermodynamik – vom Tautropfen zum Solarkraftwerk" (de Gruyter, 2013). In these books, a context-oriented approach is followed for teaching mechanics and thermodynamics.

Publications

- R. Müller (2013): Thermodynamik – vom Weitsprung zum Marsflug. Berlin: de Gruyter (2. Auflage 2016).
- R. Müller (2009): Klassische Mechanik – vom Weitsprung zum Marsflug. Berlin: de Gruyter (3. Auflage 2015).
- T. Henning, R. Müller, A. Strahl (2014): Kontextorientierte Aufgaben in der Hochschuldidaktik – Evaluation von Aufgaben und Untersuchung semesterbegleitender Veranstaltungen aus Sicht der Physikdidaktik. In: GFD (Hrsg.): Lernaufgaben entwickeln, bearbeiten und überprüfen – Ergebnisse der fachdidaktischen Forschung.
- R. Müller (2012): A semiquantitative treatment of surface charges in DC circuits. In: Am. J. Phys. 80, 782.
- R. Müller (2014): The Boltzmann factor: a simplified derivation. In: Eur. J. Phys. 35 055002.

Institute of German Studies

Prof. Dr. Martin Neef

Researcher's Career

- Dean of the Faculty of Humanities and Educational Sciences
- Full Professor for German Linguistics, TU Braunschweig
- Assistant Professor for German Linguistics, University of Cologne
- Researcher, SFB 'Theory of the Lexicon', University of Cologne and University of Düsseldorf
- PhD and Habilitation, University of Cologne
- Study of German Studies, General Linguistics, and Pedagogics, University of Cologne

Funding

DFG, BMBF, DAAD, Thyssen-Stiftung

Contact

Technische Universität Braunschweig
Institute of German Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8635
martin.neef@tu-braunschweig.de
www.tu-braunschweig.de/germanistik

Mission Statement

Language can be studied under a wide range of perspectives. Regarding the language system as an abstract object, which is the defining criterion for the newly developing paradigm of Linguistic Realism, allows solving inherent contradictions of the dominant paradigm of Cognitive Linguistics that takes language as a mental object.

Research

Grammatical Categories: Common knowledge tells us that grammatical categories stem from semantic categories. In school grammar, for example, the category of plural is defined as 'denoting more than one entity'. This is evidently wrong as the plural can also be used to denote exactly one entity (*1,0 Torten*) or nothing (*null Torten*). We reconstruct grammatical categories as formal categories and arrive at a clearer understanding of categories that are central for school teaching, like parts of speech, grammatical functions, number, and gender.

Grapholinguistics: The usual approach to the analysis of written language is to take phonemes as the starting point and relate them to orthographic forms. In the Modular Approach to Grapholinguistics, two distinct components are distinguished: Graphematics reconstructs the way sequences of letters relate to phonological representations, while Systematic Orthography asks how words from specific levels of the vocabulary have to be spelled. In this way, it is possible to give a proper analysis to the distinct spellings of words with the same phonological representation like *Wal* and *Wahl*.

Autonomous Declarative Phonology: Theories of phonology predominantly take the concrete sound signal as basic and arrive at phonological categories via proper abstraction from this base. This is a questionable approach given that phonological categories should be regarded as unaffected from such articulatory circumstances like whispering, singing, or speaking with full mouth. Thus, they cannot be conceived as rooted in phonetics. In Autonomous Declarative Phonology, phonology as the system of elements of a language system that have the potential to distinguish meaning is conceived as principally autonomous from phonetics.

Word Design: This approach to morphology takes morphological categories as basic instead of morphemes. In a declarative way, diverse categories from inflection and lexeme-formation are modeled, taking grammatical variation into account.

Publications

- Neef, M. (general editor) (2008-2015): Written Language and Literacy, Issues 11.2-18.1. Amsterdam: Benjamins.
- Appelt, A., Balestra, M. & Neef, M. (2015): Orthographic constraints on the spelling of German a-sounds. In: Written Language and Literacy 18.1: 153-174.
- Neef, M. (2015a): The status of so-called linking elements in German: arguments in favor of a non-functional analysis. In: Word Structure 8.1: 29-52.
- Neef, M. (2015b): Synthetic compounds in German. In: Word-formation: an international handbook of the languages of Europe. Eds. P.O. Müller, I. Ohnheiser, S. Olsen & F. Rainer. Berlin: de Gruyter, 581-592.
- Neef, M. (2015c): Writing systems as modular objects: proposals for theory design in grapholinguistics. Open Linguistics 2015; 1: 708-721.
- Neef, M. (2014a): Das nächste Paradigma: Realistische Linguistik. In: Muttersprache 124: 105-120.
- Neef, M. (2014b): Satzgliedfunktionen im Deutschen: eine realistische Weiterentwicklung. In: Zeitschrift für germanistische Linguistik 42.3: 420-455.

Evangelical Theology and Pedagogy of Religion

Prof. Dr. Gottfried Orth

Researcher's Career

- Professor for Evangelical Theology and Pedagogy of Religion - TU Braunschweig
- Member of Team ORCA-Institute for Conflict Management and Training
- University docent for Pedagogy of Religion - RWTH Aachen
- Apl. Professor - Evangelical Theology Johann Wolfgang Goethe University Frankfurt
- Habilitation in Practical Theology - Institute fur Theology Johann Wolfgang Goethe University Frankfurt
- Doctorate in Dr. phil. Institute for Theology Johann Wolfgang Goethe University Frankfurt
- Theological Speaker (EKD and DEAE)
- Community and school Pastor

Funding

BMUB, EKHN, Evang.-Luth. Landeskirche in Braunschweig

Contact

Technische Universität Braunschweig
Seminar für Evangelische Theologie und Religionspädagogik
Bienroder Weg 97
38106 Braunschweig
Phone: +49-531-391-8890
g.orth@tu-braunschweig.de
www.tu-braunschweig.de/theologie

Mission Statement

Evangelical Theology conducts research and teaches confessional theology within the History of Christianity on the horizon of contemporary culture(s) in a globalised world. It reveals itself here to be obligated, in particular, to a non-violent and liberation-seeking practice of Christians, churches and congregations in an ecumenical perspective.

Research

Systematic Theology considers itself to be language teachings of faith (dogmatics) and behavioural teachings of Christians, churches and Christian groups on the ecumenical horizon (ethics). Dogmatics reflects the theological traditions in the face of present-day perceptions of the truth. Ethics reflects historical and present-day courses of action particularly involving issues of justice, peace and the Integrity of Creation.

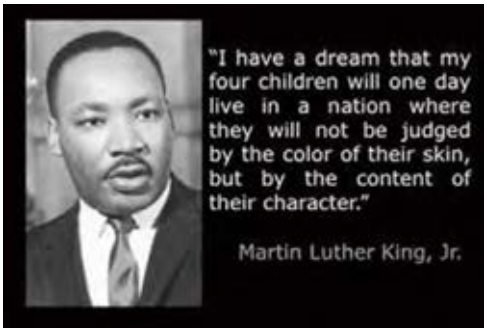
Emphasis for research and teachings in Braunschweig are topics involving Peace Ethics and Peace Theology, and here in particular Christian and non-Christian traditions of non-violence.

This begs the question, on the one hand, of how non-violence can become a central criterion of dogmatic contemplation and discourse – in light of a history of Christianity rich in experience with violence and prospects for peace.

On the other hand, there is a plethora of both ethical questions in the context of increasing non-violent conflict possibilities and movements as well as economic, state-sponsored and terroristic violence.

Particular emphasis is placed on non-violent communication (GFK). Thou shalt love thy neighbour as thyself – how am I supposed to do that? Judge not, that ye be not judged – how can I do that?

These were two key questions posed by Marshall Rosenberg (1934-2015), as he was developing non-violent communication in the context of the North American civil rights movement of the 1960s. One of his main communicative, political and spiritual issues was respectful dealings with oneself and other human beings. For this purpose, Rosenberg developed a communication model that enjoyed increasing significance in, not least, in the context of institutions such as schools, churches and hospitals. This communication model can also be applied hermeneutically, so that a new appreciation of biblical texts and the history of Christianity becomes possible.



Publications

- Gewaltfreie Kommunikation in der Schulseelsorge. In: Empathische Zeit. Ausgabe 2/15. S. 44-45.
- Dem bewohnten Erdkreis Schalom. In: H. Rupp, S. Schwarz (Hrsg.), Lebensweg, religiöse Erziehung und Bildung. Religionspädagogik als Autobiographie. Band 6. Würzburg 2015. S. 277-295.
- Gewaltfreie Kommunikation in Kirchen und Gemeinden. Die Nächsten lieben wie sich selbst. Paderborn 2016.
- Gewaltfreie Kommunikation. Die Sprache des Friedens sprechen in einer konfliktreichen Welt. In: Deutsches Pfarrerblatt. 116. Jg. 1/2016. S. 11-15.
- Eine Sprache des Lebens – Gewaltfreie Kommunikation auch in Kirchen und Gemeinden. In: P&S. Magazin für Psychotherapie und Seelsorge. Februar 2016. S. 34-37.

Institute of German Studies

Prof. Dr. Jan Röhnert

Researcher's Career

- Junior / Associate Professor TU Braunschweig since 2011
- Habilitation TU Braunschweig 2014
- Lecturer German Academic Exchange Office (DAAD) at Sofia University / Bulgaria 2008–2010
- Assistant Professor at Friedrich Schiller University Jena 2002–2008
- Ph.D. Friedrich Schiller University Jena 2007
- M.A. Friedrich Schiller University Jena 2002
- Lecturer Pedagogic Exchange Office (PAD) at Toulon /France 1999/2000
- Study of German and Comparative Literature, French and Romance Studies, Pedagogics and Intercultural Studies (DaF) at Friedrich Schiller University Jena and Genoa University/Italy

Funding
DAAD, S. Fischer Stiftung, BMW, Volkswagenstiftung

Contact
Technische Universität Braunschweig
Institut für Germanistik
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8646
j.roehnert@tu-bs.de
www.tu-braunschweig.de/germanistik/abt/lit/prof/roehnert/index.html

Mission Statement

Understanding recent German literary history and how it deals with scientific, technical, cultural and political change from early Romanticism (Goethe) via Modernism (e.g. Gottfried Benn) und Post-Modernism (e.g. Elfriede Jelinek) up to the global context of the present day (e.g. Peter Handke).

Research

- German and Comparative Poetry, Poetics, Theory of Poetry 1800–2000
- Contemporary and Intercultural Poetics and Literature – considering the many languages contributing to German letters from Goethe's "Weltliteratur" up to the globalized world
- Interrelations between Science, Technology and Literature – examining a 'scientific turn' in German in recent letters (e.g. Hans Magnus Enzensberger's vast interest in science and technology)
- Landscape and Literature: The transformation of a landscape (or a cityscape) into writing; e.g. how to 'write' the countryside or the autobahn
- Mobility and Literature: how writing perceives and transforms mobility, acceleration and speed
- Media, especially Film and Cinema, and their interaction with Literature, especially Poetry: How did/do poets conceive the cinema
- Non-fictional writing, cross-boundaries between fictional and factual writing, especially in autobiographical narratives; war and autobiographical writing
- Creative Writing, Criticism

Publications

- Di Rosa, V. / Röhnert, J. (2016; eds.): "Im Hier und Jetzt". Konstellationen der Gegenwart in der deutschsprachigen Literatur seit 2000. Köln/Weimar/Wien: Böhlau.
- Röhnert, J. (2016; ed.): Wulf Kirsten – Poesie der Landschaft. Munich: Lyrik Kabinett.
- Röhnert, J. (2015; ed.): Technische Beschleunigung – ästhetische Verlangsamung? Inszenierung von Mobilität in Literatur, Film, Kunst und Musik. Köln/Weimar/Wien: Böhlau.
- Röhnert, J. (2015; ed.): Die Metaphorik der Autobahn. Literatur, Film, Kunst, Architektur. Köln/Weimar/Wien: Böhlau.
- Röhnert, J. (2014): Selbstbehauptung. Autobiographisches Schreiben vom Krieg bei Goethe, Heine, Fontane, Benn, Jünger, Handke. Frankfurt/M.: Klostermann.
- Röhnert, J. (2007): Springende Gedanken und flackernde Bilder. Lyrik im Zeitalter der Kinematographie. Göttingen: Wallstein.

Institute of Philosophy

Prof. Dr. Hans-Christoph Schmidt am Busch

Researcher's Career

- Professor of Philosophy, TU Braunschweig
- Fellow of the Alexander von Humboldt Foundation, Northwestern University, Georgetown University and Columbia University
- Habilitation, philosophy, Goethe University Frankfurt
- Ph.D., University of Münster
- Studied Philosophy, Sociology, Political Science and Economics in Frankfurt, Montpellier, Münster and Hagen

Funding

DFG, Humboldt Foundation, Böckler Foundation

Contact

Technische Universität Braunschweig
Institute of Philosophy
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8627
h.schmidtambusch@tu-bs.de
www.tu-braunschweig.de/philosophie

Mission Statement

Braunschweig's Institute of Philosophy focuses on high-quality discussion and research into both classical philosophical problems and contemporary issues within our complex modern world. We believe that the systematic explorations of philosophical research should be informed by historical knowledge.

Research

Hans-Christoph Schmidt am Busch specializes in social and political philosophy, the history of modern philosophy, and the history of economic thought. Current research topics and questions include:

Recognition: What is recognition? Are there different types of recognition? Do relations of recognition have a specific ethical quality to them? How might these relations be institutionally secured?

Work: In what ways does work contribute to a good life? How should we understand 'work' within the context of this question? Does the contemporary working world offer work that is appropriate? What would justice in the working world amount to?

Rights: What are private property rights? To which objects can such rights apply? How might they be justified? How should Frankfurt School social philosophers deal with private property rights?

Critical Theory: What are the philosophical origins of contemporary critical theory? What perspective does this tradition of thought bring to bear on issues? How can we adequately ground a critical social theory in the contemporary world? Which phenomena would such a theory be used to explain?

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Publications

- La "reconnaissance" comme principe de la Théorie critique, Lyon: ENS Éditions, 2015. (A German version has appeared from de Gruyter.)
- "Personal Freedom without Private Property?" In: International Critical Thought, 5, 4, 2015, 473-485.
- "'The Egg of Columbus'? How Fourier's Social Theory Exerted a Significant (and Problematic) Influence on the Formation of Marx's Anthropology and Social Critique," in: British Journal for the History of Philosophy, 21, 6, 2013, 1154-1174.
- "Cameralism as 'Political Metaphysics': Human Nature, the State, and Natural Law in the Thought of Johann Heinrich Gottlob von Justi," in: The European Journal of the History of Economic Thought, 16, 3, 2009, 409-430.
- "Personal Respect, Private Property, and Market Economy," in: Ethical Theory and Moral Practice, 11, 5, 2008, 573-586.

Institute of German Studies

Prof. Dr. Renate Stauf

Researcher's Career

- Full Professor for Modern German Literary Studies at the Technische Universität Braunschweig
- Assistant Professor for Modern German Literary Studies at the Technische Universität Berlin; Institute of German Philology, General & Comparative Literary Studies
- Academic research associate in Modern German Literary Studies at the University of Gießen
- Dr. Phil., University of Gießen, Institute of Modern German Literature
- Study of German Philology, History and Educational Psychology at the University of Gießen

Funding

Thyssen, German Academic Exchange Service (DAAD)

Contact

Technische Universität Braunschweig
Institute of German Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8657
r.stauf@tu-braunschweig.de
www.tu-braunschweig.de/germanistik/abt/lit/prof/stauf/index.html

Mission Statement

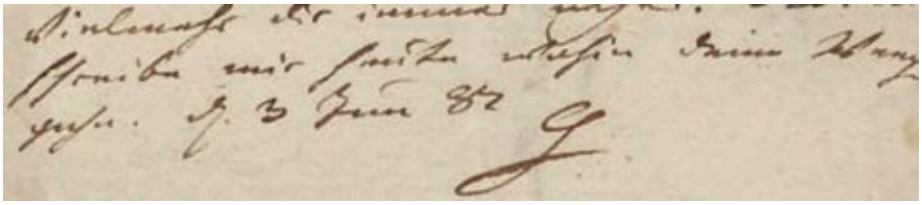
Research into the intricate relationship between writing and living, writing as an aesthetic cultural practice and the close interweaving of modes of writing and existence in the respective genre and media-specific intensification.

Research

Writing processes in the interspace – historic and medial signatures in the love-letter culture

The genuine human ability to write becomes visible as an aesthetic and cultural practice in new and current writing research and cannot be accurately understood with the traditional differentiation between life and works, reality and fiction, subject and object. To be able to gain new insights into the neglected aesthetics in non-fictional texts, such as letters, diaries, autobiographies, essays, travel reports, notebooks, etc., requires a scientifically sound expansion of aesthetics and a repositioning of the literary term.

The project builds upon the research collaboration on the subject of writing processes in the interspace: on the aesthetics of non-fictional texts which has existed between the universities of Braunschweig, Hildesheim and Graz since 2014. Its aim is to develop description modes which provide a differentiated outline of the writing process in the interspace of non-fictional texts and can explain them. A particular emphasis is on the culturally and historically reflected types of expression of emotionality and (gender-marked) subjectivity. The focus of the project as a whole incorporates the results gained from conferences, workshops and publications of three individual projects and is divided into the subject areas of Writing Gestures, Writing Scenes and Writing Movements in the Love-Letter Culture (Renate Stauf, Braunschweig), Writing Practices – Etho-Poetics – Gender (Toni Tholen, Hildesheim), Poetics of Movement (Susanne Knaller, Graz). Further expansion of the research group collaboration at an international level is planned.



Publications

- R. Stauf, A. Simonis & J. Paulus (Ed.) (2008): Der Liebesbrief. Schriftkultur und Medienwechsel vom 18. Jahrhundert bis zur Gegenwart. Berlin, New York. Ibid: R. Stauf: "Erklär mir, Liebe". Kunst des Liebens und der Liebessprache im Briefwechsel Ingeborg Bachmanns mit Hans Werner Henze, 401-423.
- K. Kellermann, J. Paulus & R. Stauf (2012): Liebesrede, Liebesbrief. In: Historisches Wörterbuch der Rhetorik. Ed. Gert Ueding. Band 10: Nachträge A-Z. Berlin, 574-584.
- R. Stauf & J. Paulus (Ed.) (2013): SchreibLust. Der Liebesbrief im 18. Und 19. Jahrhundert. Berlin, Boston. Ibid: R. Stauf: "[...] rette Dich, setze mich aus ans Ufer". Aporien der romantischen Liebe im Briefwechsel zwischen Karoline von Günderrode und Friedrich Creuzer. 165-186.
- R.Stauf (2016/17): "Ich gehe immer und immer an den äussersten Rändern." Stefan Georges Briefkommunikation. In: George Jahrbuch 11. Ed. W. Braungart & U. Oelmann. Berlin, Boston (forthcoming)
- A. Hübener, J. Paulus & R. Stauf (2016/17): Liebesbrief/Erotischer Brief. In: Handbuch Brief. Ed. J. Schuster & J. Strobel. Berlin, Boston (forthcoming).

Institute of German Studies

Prof. Dr. Matthias Steinbach

Researcher's Career

- Study of History, Physical Education, Pedagogy, Philosophy and Art history – Universities of Jena, study visits in Paris, Rome, Sevilla and Metz
- PhD at the Historical Institute of the University of Jena
- Assistant Professor at the University of Jena
- Assistant Professor at the University of Frankfurt/Main
- Full Professor History and History Didactics, TU Braunschweig

Funding

DFG; Stifung Braunschweigischer Kulturbesitz; Fritz-Thyssen-Stiftung

Contact

Technische Universität Braunschweig
Historisches Seminar, Geschichte und Geschichtsdidaktik
Bienroder Weg 97
38106 Braunschweig
Phone: +49 531 391-8611
m.steinbach@tu-braunschweig.de

Mission Statement

The objectives are a broad understanding and documentation of ego-documents, the representation and examination of border regions and the study of History Didactics as well as the history of historiography. Hereby, I share the approach of interdisciplinary work.

Research

Geteilte Erinnerungen – Divided memories: The project aims at catching and collecting sources and reports about living beyond and next to the inner German border. Special focus is placed on the border area between Lower Saxony and Saxony-Anhalt, especially the so called Braunschweiger Land between Wolfsburg and Bad Harzburg. Despite the fact that the German Reunion has already taken place this area is still of much importance since borders are simply facts. Hence, relevance to the aftermath of the German Division is still given.

Alexander Carteliieri's diaries: This critically commented edition of Alexander Cartellieri's diaries provides input into the history of Historiography from the period of the German Empire until the time of the German Division. Cartellieri's diaries provide a direct insight into the methods of a historian with strong national roots and enlighten the areas of conflict between autonomy and the determination of scientific and political action throughout different political carinations.

Relief of Clemens von Delbrück: The relief of Clemens von Delbrück, which is stored at the library of the University of Jena, is an essential portfolio for investigating the history of the German Empire as well as the early years of the Weimar Republic. This project aims at the recording, sorting and digitalization of Delbrück's relief.

Nietzsche in the GDR – sites and discourses: Friedrich Nietzsche afterlife in Germany, i.e. the GDR, was always political. Almost all German Nietzsche places: Röcken, Naumburg, Schulpforte, Leipzig, Tautenburg, Jena and Weimar, lay in their territory. In the official versions less so than Nietzsche's texts, its mere name and some tags were preferably used against the ideological opponent. At the same time this difficult thinker was seen as anachronistic, maladjusted, lonely and remained as such a possible metaphor for political confusion and subversion. Nietzsche existed in very different political and cultural contexts, and his legacy reveals itself not only in files and books.

Publications

- Wie der gordische Knoten gelöst wurde. Anekdoten der Weltgeschichte historisch erklärt (Hrsg.), Stuttgart 2011.
- Alexander Cartellieri. Tagebücher eines deutschen Historikers. Vom Kaiserreich bis in die Zweistaatlichkeit (1899-1953) (=Deutsche Geschichtsquellen des 19. und 20. Jahrhunderts. Band 69) (als Herausgeber gemeinsam mit U. Dathe), München 2014.
- Der Fall Hodler. Krieg um ein Gemälde 1914-1919 (=Reihe ZeitgeschichteN. Band 13), Berlin 2014
- Mobilmachung 1914. Ein literarisches Echolot, Stuttgart 2014.
- Erinnerung sichtbar machen Braunschweiger Vorträge zur Teilung und Wiedervereinigung Deutschland 2009/2010 (=Braunschweiger Beiträge zur Kulturgeschichte. Band 5) (als Herausgeber gemeinsam mit M. Ploenus), Frankfurt a.M. 2016.

Institute of Educational Psychology

Prof. Dr. Barbara Thies

- Head of Braunschweig Training and Counselling Programme (TrauBe, Braunschweiger Trainings- und Beratungsmodell)

Researcher's Career

- Full Professor of Educational Psychology, TU Braunschweig
- Full Professor of Social Work (main emphasis: psychology), Hochschule (University of Applied Sciences) Emden-Leer
- Postdoctoral lecture qualification (habilitation), University Vechta (Venia Legendi: psychology / educational psychology)
- Dr. phil., University Vechta
- Studies of Psychology, Ruhr-University Bochum, (main emphasis: educational psychology, clinical psychology and developmental psychology, final degree: diploma)

Funding

VolkswagenStiftung (Niedersächsisches Vorab), BMBF

Contact

Technische Universität Braunschweig
Institute of Educational Psychology
Bienroder Weg 82
38106 Braunschweig
Phone: +49 531 391-94002
Barbara.thies@tu-braunschweig.de
www.tu-braunschweig.de/ipp/team/thies/index.html

Mission Statement

Obtaining a deeper understanding of intra- und interpersonal processes to develop procedures for establishing high-quality-relationships and optimal conditions for learning, education, and society

Research

Social Perception and Interaction (especially teacher-student-relationships): The quality of the relationships between students and their teachers is the basis for achievement and satisfaction. Therefore, our research focuses on factors endangering this relationship (e.g. missing competences and knowledge on diverse classrooms, stereotypes and prejudices). We develop and evaluate trainings to support (future) teachers to provide classroom settings which serve learning and education. Current projects are investigating classroom management competences.

Diversity and Diversity Management in Education: Diversity research in Germany mainly focuses on "objective" socio-demographic features such as gender and ethnicity. We adopt a more subjective perspective and question the relevance of diversity features in different educational settings on students' satisfaction and well-being. Moreover, we critically look at the perceived diversity management of (university) teachers and its effects on diverse students.

Trust (interpersonal, organizational and systemic) and Protest Research: As members of an interdisciplinary research project ("Eskalationsforschung Niedersachsen") we are interested in the effect of trust and trust breaching along large building and infrastructure processes. We aim to clarify effective measures to deescalate conflicts by inventing trust building processes. Current projects also focus on relationships in the educational field. Recently, we integrate different concepts of trust to establish habitual trust as a stressor as well as a resource in educational settings.

Publications

- Bandelow, N. & Thies, B. (2014). Gerechtigkeitsempfindungen bei Großprojekten als Ursache von Konflikteskalationen? Vertrauen und Legitimität als moderierende Faktoren illustriert am Beispiel der Konflikte um die Erweiterung des Frankfurter Flughafens. Politische Psychologie, 4 (Journal of Political Psychology), 24-37.
- Heise, E. & Thies, B. (2015). Die Bedeutung von Diversität und Diversitätsmanagement für die Studienzufriedenheit. Zeitschrift für Pädagogische Psychologie, 29, 31-39.
- Misamer, M. & Thies, B. (2014). Machtverhältnisse im Unterricht: Eine Analyse des Spannungsfeldes von Macht, Gerechtigkeit und Vertrauen. Politische Psychologie, 4 (Journal of Political Psychology), 51-61.
- Thies, B. (2008). Historische Entwicklung der Lehrer-Schüler-Interaktionsforschung. In M. Schweer (Hrsg.), Lehrer-Schüler-Interaktion. Inhaltsfelder, Forschungsperspektiven und methodische Zugänge (S. 77-100). Wiesbaden: VS.
- Thies, B. (2014). Beziehungsgestaltung in der Schulklasse: Steigerung der Interaktionsqualität durch Vertrauen und Classroom Management. In J. Fetzer & C. Tillack, (Hrsg.), Beziehungen in Schule und Unterricht (Schriftenreihe "Theorie und Praxis der Schulpädagogik", S. 188-209). Immenhausen: Prolog.

Institute of German Studies

Prof. Dr. Regina Toepfer

- Head of the Scientific Network "Humanistic translation of ancient texts"

Researcher's Career
- Full professor of medieval German studies, TU Braunschweig
- Heisenberg Fellow (DFG), HU Berlin
- Visiting professor at the Collaborative Research Centre 933, "Material Text Cultures", Heidelberg University
- Guest professor of medieval German literature, Goethe University Frankfurt, HU Berlin and Heidelberg University
- Habilitation and venia legendi, Goethe University
- Visiting scholar, Tromsø University and Bern University
- Research associate, Goethe University Frankfurt
- Dr. phil., Göttingen University
- Graduate student, International Max Planck Research School "History and Transformation of Cultural and Political Values in Medieval and Modern Europe", Göttingen University and Basel University
- Studies in German philology, theology and Ancient Greek, Marburg University

Funding
DFG, Thyssen, Foundation of Lower Saxony, Local foundations

Contact
Technische Universität Braunschweig
Institute of German Studies
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8650
r.toepfer@tu-braunschweig.de
www.tu-braunschweig.de/germanistik/abt/spr/prof/toepfer

Mission Statement

Our purpose is to research and teach the language, literature and culture of the German Middle Ages from 800 to 1600. We help gain access to cultural heritage and contribute to expanding current scholarly discourses on language, literature and culture to include as historical perspective.

Research

Humanistic translation of ancient texts and early modern poetics in Germany (1450–1620): Early modernity saw a fundamental change in the history of reception: antique works were rediscovered, published and annotated; many classical authors were translated into the vernacular for the first time. This major transfer of literature had a positive impact on the development of the German language and literature. Twenty scholars from Germany, Austria and Switzerland are jointly investigating the relationship between translations of antique works and early modern poetry. The scholarly network is based at the TU Braunschweig and funded by the DFG.

Childlessness in the Middle Ages: Childlessness is a highly topical phenomenon, but not historically new. In my book project I am examining how infertility was dealt with in the Middle Ages from the theological, medical, canonical, marriage-didactic and poetic perspectives. By addressing the historical discursivization of childlessness and its literary staging in the Middle Ages, the study will provide a historical basis for current discussion.

Repertory of printed German plays during the Reformation: Dramas constitute the most multifaceted text genre of the early modern period. They contain information relevant to all literary-historical and cultural studies disciplines. By systematically indexing all printed German plays of the sixteenth century, the repertory will yield a fundamental reference. The Herzog August Bibliothek in Wolfenbüttel offers the best resource for this project.

The ambivalences of the religious drama: At an international conference we will examine what features distinguish the mass medium of the Middle Ages. Are religious plays closer to modern theatre performances or to church rituals? The chief focus will be on the relationships between devotion and entertainment, humour and holiness. The project brings together scholarship, cultural work and schools. Its contents will be made available to the public.

Publications

- Toepfer, R.; Antike Historiographie im deutschen Südwesten. Das Übersetzungswerk Hieronymus Boners. In: Pirckheimer Jahrbuch 29 (2015), S. 37-60.
- Toepfer, R.; Der Eheteufel auf der 'Hochzeit zu Cana'. Paul Rebhuns dramatisierte Geschlechterordnung. In: Literaturwissenschaftliches Jahrbuch 56 (2015), S. 137-159.
- Toepfer, R.; G. Radke-Uhlmann (Ed.): Tragik vor der Moderne. Literaturwissenschaftliche Analyse. Heidelberg 2015.
- Toepfer, R.; Vom Liebesverbot zum Leseverbot. Die deutsche Rezeption von Pyramus und Thisbe in Mittelalter und Früher Neuzeit. In: Jahrbuch für Internationale Germanistik / Reihe A 120 (2015), S. 211-234.
- Toepfer, R.; Die Frauen von Bechelaren. Stand, Herkunft und Geschlecht im Nibelungenlied sowie in Thea von Harbous Nibelungenbuch und in Fritz Langs Film Die Nibelungen. In: N. Bedeković et. al. (Ed.): Durchkreuzte Helden. Das Nibelungenlied und Fritz Langs Film *Die Nibelungen* im Licht der Intersektionalitätsforschung. Bielefeld 2014, S. 211-238.

English and American Studies

Prof. Dr. Eckart Voigts

- 2013- Full Professor of English Literature and Head of Literary and Cultural Studies
- 2014-2016, Head of the Institute of English and American Studies

Researcher's Career

- 2013-, Professor of English Literature, TU Braunschweig.
- 2010, Leverhulme Visiting Professor, University of Leeds
- 2006-2013, Professor, University of Siegen
- 1997, 2002, 2004, 2005, 2006, Visiting Professor, UW Madison, UW Milwaukee, Vienna, Frankfurt, Chemnitz
- 1991-2005, Assistant and Associate Professor, University of Giessen
- 2003, 1994, Post-doctoral dissertation, Dissertation, Giessen University
- PL (with J. Malkin), "Hyphenated Cultures: Contemporary British-Jewish Theatre" (VW Stiftung), Association of Adaptation Studies (Trustee), Centre for Adaptations (Honorary Fellow)
- Editorial boards: Adaptation, OUP; Adaptation in Performance and Film, Intellect; Transmedia, Amsterdam UP, et al.
- Member of graduate program "Kulturen der Partizipation" (Oldenburg University)
- 2010-16, President of CDE (German Society for Theatre and Drama in English)

Funding

VW-Stiftung Niedersächsisches Vorab, DFG, DAAD, DAAD-AHRC PPP, Leverhulme Trust

Contact

Technische Universität Braunschweig
Anglistik und Amerikanistik,
Abt. Literatur- und Kulturwissenschaften
Bienroder Weg 80
38106 Braunschweig
Phone: +49 531 391-8710 / 12
e.voigts@tu-braunschweig.de
www.tu-braunschweig.de/anglistik

Mission Statement

We provide orientation in an ever more complex world of media and signs. One of the branches within the 'Institut für Anglistik und Amerikanistik', the Literary and Cultural Studies unit specializes in transdisciplinary research on the 'Anglosphere' that merges literary and cultural studies with media studies.

Research

Adaptation and intermediality: Texts have never been stable, but the digital world has intensified this liquid textuality and provided sites of endless textual variation. We consider the ways in which new intertextual forms engendered by emerging technologies, mashups, remixes, reboots, samplings, remodelings and transformations operate under changing media protocols.

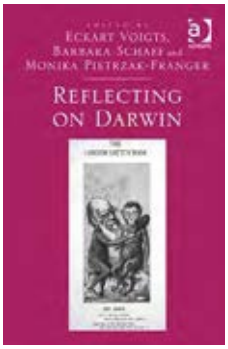
We explore the political and aesthetic dimensions of **cultural participation** and the participatory texts of convergence culture, the forms and functions, premises and conditions, as well as the individual and collective actors of participation, focusing on viewer engagements with, and appropriations of, transmedia franchises, and Internet memes (co-operation with PhD-program Cultures of Participation, Oldenburg).

Current **dystopian and utopian narratives** have replaced the classic dystopian and apocalyptic imagination in the 20th century (Orwell, Huxley) with narratives of a future societal crisis, responding to the urgent global challenges at the beginning of the 21st century. The project takes a transmedial and comparative look not only at remarkably popular dystopian, post-apocalyptic but also utopian narratives that are engaging globalization, terrorism, climate change, new technologies, etc. in almost all genres and media: literature, film, television, graphic narratives, visual arts, computer games et al.

Contemporary theatre and drama: We live in a performative culture both inside and outside of the confines of the theatre. As a consequence, this research focus specializes in contemporary British theatre and drama. The research program "Hyphenated Cultures: Contemporary British-Jewish Theatre" (with J. Malkin, Hebrew University Jerusalem; VW Stiftung 2016) analyses how significant, but hitherto neglected British-Jewish theatre artists have influenced and co-created British theatre. It focuses on the ways in which Jewish religious, ethnic, and cultural inscriptions have found their way into mainstream British theatre.

Neo-Victorianism is a thorough and creative re-interpretation of the European past that has initiated a fascinating cultural dialogue with the life sciences, technology and science studies, and prevalent concepts of class, ethnicity and gender. The research focus assesses the formations and enactments of contemporary neo-Victorianism across media.

Student poster dystopia biopolitics



Publications

- Voigts, Eckart, A. Boller, Eds. Dystopia. Science Fiction, Post-Apocalypse: Classics, New Tendencies and Model Interpretations. WVT Handbuch 17. Trier: WVT, 2015.
- Voigts, Eckart, B. Schaff, M. Pietrzak-Franger, Eds. Reflecting on Darwin. Aldershot: Ashgate, 2014.
- Voigts, Eckart, "Bastards and Pirates, Remixes and Multitudes: The Politics of Mash-Up Transgression and the Polyprocesses of Cultural Jazz." D. Hassler-Forest and P. Nicklas (Eds.): The Politics of Adaptation. Basingstoke: Palgrave Macmillan, 2015, 82-97.
- Voigts, Eckart, "Mashup und intertextuelle Hermeneutik des Alltagslebens: Zu Präsenz und Performanz des digitalen Remix." MEDIENwissenschaft 2 (2015), 146-163.
- Voigts, Eckart, "Literature and Television (after TV)." G. Rippl (ed.): Handbook of Intermediality. Berlin: DeGruyter Mouton, 2015, 306-324.

Institute of Music and Music Education

Prof. Dr. Bernhard Weber

Researcher's Career

- Director of the institute of music and music education
- Professor for philosophy for music education and didactics
- Director of the institute of music education at the university of music of Lübeck
- Professor for music education at the university of music of Lübeck
- Lecturer for music education and popular music at the university Paderborn
- Guest lecturership for music education and popular music at the HKB Bern (Switzerland)
- Dr. Paed. at University of Education, Freiburg
- Dipl. Paed. at University of Education, Freiburg
- Music teacher
- Member of several associations: DFG, GfPM, IASPM-DACH, BMU

Funding

DFG, Bertelsmann-Stiftung, PRO*Niedersachsen, Hochschulbund, Industry

Contact

Technische Universität Braunschweig
Institute of Music and Music Education
Rebenring 58
38106 Braunschweig
Phone: +49 531 391-3487
bernhard.weber@tu-braunschweig.de
www.tu-braunschweig.de/musik

Mission Statement

My research interests are the philosophy and didactics of music education. In this field I develop postmodern education contexts, based on actual heterogeneous music cultures, poststructuralism, constructivism and on the Actor-Network-Theory (ANT) among others in blended learning arrangements.

Research

Digital Cuts in Music Production

With the entry of digital technologies into studios producing popular music, many possibilities arise to manipulate recordings in audio-postproduction. One of the widespread applications are digitals cuts in different modes. In our studies "Inside the Cut" (2010) with novices and experts, we analyze the reception and the evaluation of digital cuts and also the influence of formal instruction.

Poststructuralism aspects in Music Education

In Germany poststructuralism theories, especially by Foucault, Derrida and Lyotard, were mainly received in cultural studies but less so in music education. We transfer different aspects of these theories in didactic contexts and develop prototypes for classroom-teaching. Important subjects are deconstruction (Derrida), postmodern conditions (Lyotard) and analysis of discourses (Foucault).

Blended learning arrangements in music education

Digital media meanwhile influences our daily lives and will perhaps be granted an important role in music didactics. Against this background we develop blended learning arrangements for the classroom, which combine the benefits of face-to-face learning with digital instructional technologies based on various psychological aspects.

Publications

- Die Popmusikhörer, in: Brockhaus/Weber (ed.).Inside The Cut: Digitale Schnitttechniken und Populäre Musik. Entwicklung – Wahrnehmung – Ästhetik, Bielefeld 2010
- Rhapsodie in C-Dur, Prolegomena zu einer künftigen Didaktik Populärer Musik, in: Michael Ahlers (Hg.): Popmusik-Vermittlung zwischen Schule, Universität und Beruf, Münster 2015, pp. 153-170.
- Digitale Medien im Musikunterricht der Grundschule, in: Mechthild Fuchs (Hg.): Musikdidaktik Grundschule, Theoretische Grundlagen und Praxisvorschläge, Innsbruck 2014, pp. 298-311.
- Think different! Poststrukturalistische Impulse für eine musikalische Bildung der Differenz, in: Georg Brunner, Michael Fröhlich (Hg.): Impulse zur Musikdidaktik, Festschrift für Mechthild Fuchs, Innsbruck 2014, pp. 41-60.
- Prozessualität und Präsenz – Streifzüge durch die Posthermeneutik (i. Dr.).

Research Centres

Research Centres

BRICS – Braunschweig Integrated Centre of Systems Biology

Contact
BRICS – Braunschweig Integrated Centre of Systems Biology
Dr. Ida Retter
Rebenring 56
38106 Braunschweig
Phone: +49 531 391-55102
i.retter@tu-braunschweig.de
www.tu-braunschweig.de/brics

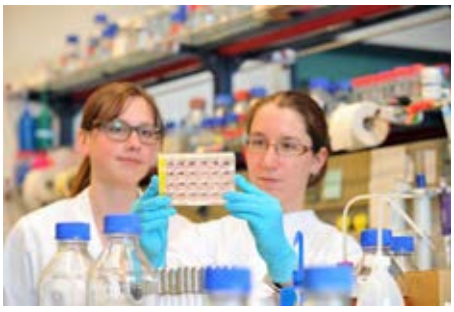
Mission Statement

BRICS is a joint research centre of the Technische Universität Braunschweig and the Helmholtz Centre for Infection Research. The focus at BRICS is research on micro-organisms in infection and biotechnology with systems biology methods. This implies predictive quantitative mathematical models and the integrated analysis of OMICS data.

Research

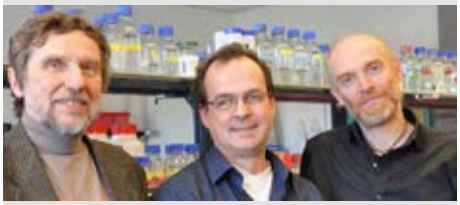
CDiff – Epidemiology and systems biology of the bacterial pathogen *Clostridium difficile*

The bacterial pathogen *Clostridium difficile* causes a high number of cases of disease with hundreds if not thousands of deaths per year. The *C. difficile* associated diarrhea (CDAD) is one of the most dangerous hospital acquired diseases. BRICS coordinates an interdisciplinary research team to generate the scientific basis for development of new diagnostics and therapeutics. The project focuses on systems biology models of genomic, proteomic and metabolomics networks, analysis of structure and function of the *C. difficile* toxins and epidemiological studies to elucidate the dissemination of different *C. difficile* strains. The research consortium was founded in the scope of the "Norddeutsches Zentrum für Mikrobielle Genomforschung". The project is funded by the Federal State of Lower Saxony, Niedersächsisches Vorab (VWZN2889).



BRICS
Braunschweig Integrated Centre of Systems Biology

The Research Centre BRICS
BRICS aims at the collaboration of biologists, chemists, physicists, mathematicians, engineers and computer scientists for interdisciplinary research in the field of systems biology. For this reason, BRICS hosts members of 3 faculties of the Technische Universität Braunschweig and 5 research groups of the Helmholtz Centre for Infection Research. BRICS is headed by (from left to right) Prof. Dr. Dietmar Schomburg, Prof. Dr. Dieter Jahn (speaker) and Prof. Dr. Michael Meyer-Hermann.



The BRICS Building
A new building for BRICS was constructed at the central campus of the Technische Universität Braunschweig. In the vicinity of the Biozentrum, the new building houses seven working groups on 3,500 sqm. On four floors, laboratories, offices and meeting rooms are planned for the joint experimental and theoretical work. The building also provides a training lab, a computer pool and large meeting rooms for student education. The construction sum of 25 million € is provided in equal parts by the State Lower Saxony and the TU Braunschweig itself.

Funding
DFG, BMBF, EU, State Lower Saxony, industry

***Roseobacter* – Ecology, Physiology and Molecular Biology of the *Roseobacter* clade**
This Collaborative Research Centre aims at a systems biology understanding of the globally important *Roseobacter* clade. For the marine model bacterium *Dinoroseobacter shibae* the anaerobic metabolism and the iron acquisition with their underlying regulatory networks are investigated with systems biology methods. The aim is to understand the evolutionary and physiological principles that are the basis for the success of these bacteria. The project is a cooperation with the University of Oldenburg and is funded as SFB-TRR 51 by the German Research Foundation.

ElektroBak – electrochemically active bacteria
Electroactive bacteria produce electricity in a fuel cell by transferring electrons of the cellular respiration to an electrode. In the process, bacteria form a biofilm at the surface of the electrode. The new research initiative "Elektrobak" aims at analysis of this biofilm with systems biology methods. The aim of the project is development of microbial fuel cells for biotechnological and environmental applications.

Publications and Patents

- Chang A, Schomburg I, Placzek S, Jeske L, Ulbrich M, Xiao M, Sensen CW, Schomburg D. BRENDA in 2015: exciting developments in its 25th year of existence. Nucleic Acids Res. 2015 Jan;43 (Database issue):D439-46.
- Schmied JJ, Raab M, Forthmann C, Pibiri E, Wünsch B, Dammeyer T, Tinnefeld P. DNA origami-based standards for quantitative fluorescence microscopy. Nat Protoc. 2014;9(6):1367-91.
- Zhao G, Dharmadhikari G, Maedler K, Meyer-Hermann M. Possible role of interleukin-1β in type 2 diabetes onset and implications for anti-inflammatory therapy strategies. PLoS Comput Biol. 2014 Aug 28;10(8):e1003798.
- Roselius L, Langemann D, Müller J, Hense BA, Filges S, Jahn D, Münch R. Modelling and analysis of a gene-regulatory feed-forward loop with basal expression of the second regulator. J Theor Biol. 2014 Dec 21;363:290-9.
- Moser, J., Lange, C., Krausze, J., Rebelein, J., Schubert, W.-D., Ribbe, M., Heinz, D.W. & Jahn, D. (2013) Structure of ADP•AlF3-stabilized protochlorophyllide oxidoreductase complex. Proc. Nat. Acad. Sci. USA, 110:2094-2098.
- Ebert, M.*, Laaß, S.*, Burghartz, M., Petersen, J., Koßmehl, S., Wöhlbrand, L., Rabus, R., Wittmann, C., Tielen, P. & Jahn, D. (2013) Transposon mutagenesis identified chromosomal and plasmid encoded genes essential for the adaptation of the marine bacterium *Dinoroseobacter shibae* to anaerobic conditions. J Bacteriol., 195:4769-4777.
- Tielen, P., Rosin, N., Dohnt, K., Haddad, I., Jänsch, L., Klein J., Meyer, A.-K., Narten, M., Pommerenke, C., Scheer, M., Schobert., M., Schomburg, D. & Jahn, D. (2013) Regulatory and metabolic networks for the adaptation of *Pseudomonas aeruginosa* biofilms to urinary tract-like conditions. PLOS ONE 8: e71845. doi:10.1371/journal.pone.0071845.
- Biedendieck, R., Borgmeier, C., Bunk, B., Stammen, S., Scherling, C., Meinhardt, F., Wittmann, C. & Jahn, D. (2011) Systems biology of recombinant protein production using *Bacillus megaterium*. Methods Enzymol., 500: 165-195.
- Möbius, K., Arias-Cartin, R., Breckau, D., Haennig, A.-L., Riedmann, K., Biedendieck, R., Schroeder, S., Becher, D., Magalon, A., Moser, J., Jahn, M. & Jahn, D. (2010) Heme biosynthesis is coupled to electron transport chains for energy generation. Proc. Natl. Acad. Sci. USA 107:10436-10441.

Forschungszentrum Küste (FZK)

Contact
Forschungszentrum Küste (FZK)
Dr.-Ing. Stefan Schimmels
Merkurstraße 11
30419 Hannover
Phone: + 49 511 762-9223
office@fzk-nth.de
www.fzk-nth.de

Funding
EU, BMBF, DFG, State Lower Saxony, Industry

Mission Statement

FZK is a Joint Central Institution of Leibniz Universität Hannover and Technische Universität Braunschweig. As a research institution FZK is working in the fields of coastal and offshore engineering with a focus on laboratory experiments in the Large Wave Flume (GWK), a unique facility for large-scale model tests with water waves.

Research

Research at FZK addresses four major topics: Coastal Structures, Sediment Transport, Eco-hydraulics and Maritime Energy. The backbone of scientific investigations is the Large Wave Flume (Großer Wellenkanal, GWK), allowing for dedicated model tests under controlled laboratory conditions and on a large scale, which is of crucial importance for many phenomena including breaking waves, sediment transport, plants or general turbulence governed problems.

Research activities range from fundamental and applied research, supported by public funding agencies, to investigations carried out on behalf of industry clients. Most of the projects are carried out in national and international collaboration with other renowned scientist and research institutions. In this context the EU-supported network Hydralab is of certain importance as it joins the leading European infrastructures in mostly coastal related hydraulic research and FZK is one of the most important partners since the beginning in 1997. The current project Hydralab+ (Horizon 2020, Contract No. 654110) aims at the improvement of laboratory facilities to deal with climate change related issues. FZK will particularly focus on sediment transport and biofilm stabilization and furthermore it offers external European research groups the opportunity to carry out their own experiments in GWK, to which they would usually have no access.

Further current national projects address the hydraulic performance of grouted revetments, the recolonization of sea grass by bio-degradable surrogates and the optimization of shore nourishments as “soft” coastal protection measures. In particular for the topic Maritime Energy, a major upgrade of GWK including larger waves, the generation of currents and a large deepened section are planned and will be applied for in 2016. If this multi-million Euro project should be granted, it would also be very favorable for all other topics and allow for new and worldwide unique experiments.

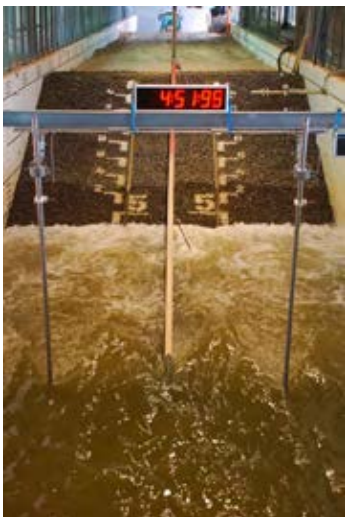
FZK
Forschungszentrum Küste

Forschungszentrum Küste (FZK)
FZK as a Joint Central Institution is supported by four institutes from both universities: Franzius-Institute for Hydraulic, Waterways and Coastal Engineering (FI) and the Institute for Geotechninal Engineering (IGtH) from Leibniz Universit ät Hannover and Leichtweiß-Institute for Hydraulic Engineering and Water Resources (LWI) and the Institute of Soil Mechanics and Foundation Engineering (IGB) at TU Braunschweig. The four professors of these institutes represent the Board of Directors of FZK: Prof. Dr.-Ing. T. Schlurmann, Prof. Dr.-Ing. M. Achmus, Prof. Dr.-Ing. H. Oumeraci and Prof. Dr.-Ing. J. Stahlmann. FZK is managed by the Operations Manager Dr.-Ing. S. Schimmels.

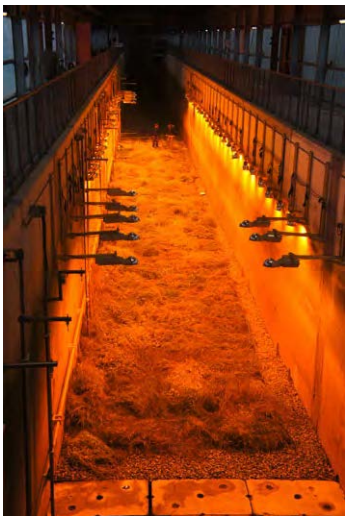
The Board of Directors with the Operations Manager. From left to right: Prof. Dr.-Ing. Torsten Schlurmann, Prof. Dr.-Ing. Joachim Stahlmann, Prof. Dr.-Ing. Hocine Oumeraci, Prof. Dr.-Ing. Martin Achmus, Dr.-Ing. Stefan Schimmels.

The Large Wave Flume (GWK)
GWK is the core facility of FZK and in service already since 1983. But still, with about 300 m length, 5 m width and 7 m depth it is one of the largest wave flumes worldwide. The computer controlled dry back wave maker is driven by oil hydraulics with a maximum power of 900 kW and can generate regular waves and natural sea states with maximum wave heights of more than 2 m. An active absorption system cancels out reflected waves, which allows for long test runs and minimizes the time to calm down the water surface after a test. Besides wave generation GWK has also a significant pool of instruments, which is continuously updated to allow for unprecedented measurements and high-quality data as a basis for top-level research in the fields of coastal and offshore engineering.

Breaking Freak Wave with 3 m height



Test of a special PU-bonded revetment



Eco-hydraulic experiments with real salt marshes

Wave forces on an offshore windenergy device entrance platform

Publications and Patents

- de la Torre, M.; Vousdoukas, M.; Schimmels, S.; Fernández, H.; Kirupakaramoorthy, T. (2014): Large scale tests of beach profile response sensitivity to the initial topography under erosive or accretive conditions., Proceedings of the IAHR Europe Congress, Porto, Portugal.
- Fernández, H.; Sriram, V.; Schimmels, S.; Oumeraci, H. (2014): Extreme wave generation using self correcting method — Revisited. , Coastal Engineering 93, 15–31.
- Möller, I.; Kudella, M.; Rupprecht, F.; Spencer, T.; Paul, M.; van Wesenbeeck, Bregje K.; Wolters, G.; Jensen, Kai; Bouma, Tjeerd J.; Miranda-Lange, M.; Schimmels, S. (2014): Wave attenuation over coastal salt marshes under storm surge conditions, Nature Geoscience 7(10), p. 727–731. DOI: 10.1038/ngeo2251
- Paul, M.; Gillis, L.G. (2015): Let it flow: how does an underlying current affect wave propagation over a natural seagrass meadow?, Marine Ecology Progress Series 523, 57-70 DOI: 10.3354/meps11162
- Ramachandran, K., Schimmels, S., Stagonas, D., Müller, G. (2013): Measuring Wave Impact on Coastal Structures with High Spatial and Temporal Resolution – Tactile Pressure Sensors a Novel Approach, 35th IAHR World Congress, Chengdu, China
- Schimmels, S., Sriram, V., Didenkulova, I. (2016). Tsunami generation in a large scale experimental facility. Coastal Engineering, 110, 32-41. DOI: 10.1016/j.coastaleng.2015.12.005
- Sriram, V.; Schlurmann, T.; Schimmels, S. (2015). Focused wave evolution using linear and second order wavemaker theory. Applied Ocean Research 53, 279-296. DOI: 10.1016/j.apor.2015.09.007
- Vousdoukas, M.I., Kirupakaramoorthy, T., de la Torre, M., Wübbold, F., Wagner, W., Schimmels, S., Oumeraci, H. (2014). The role of combined laser scanning and video techniques in monitoring wave-by-wave swash zone processes. Coastal Engineering, 83, 150-165.

Laboratory for Emerging Nanometrology (LENA)

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Contact
LENA – Laboratory for Emerging Nanometrology
Executive Director: Dr. Thorben Dammeyer
Phone: +49 531 391-3801
t.dammeyer@tu-braunschweig.de

Speaker of the Management Board:
Prof. Dr. Andreas Waag
a.waag@tu-braunschweig.de
Phone: +49 531 391-3774

Hans Sommer Str. 66
38106 Braunschweig
www.tu-braunschweig.de/mib/lena

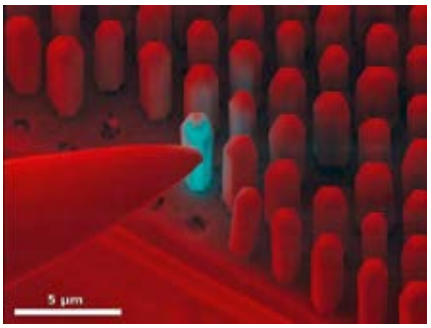
Mission Statement

The research center LENA is focusing on the development and application of nanometrology – precise measurements at the nanometer scale – to enable and support novel science and applications in nanotechnology.

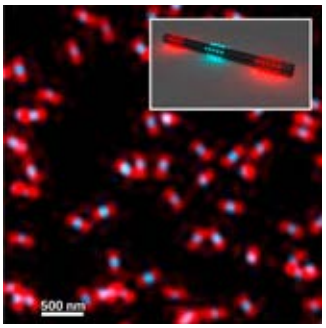
Research

LENA performs interdisciplinary fundamental research from synthesis, analytics and theory of nanomaterials to nanotechnological applications. Its scientific activities can be grouped into three core research areas: 1) Precise characterizations of nanomaterials and 3D-nanosystems with assessment of measurement uncertainties and retraceability of measurands to SI units. 2) Improvement of nanoanalytics for continuously enhanced sensitivity and precision of the applied methods. 3) Development of ubiquitous sensors, for example, to detect nanoparticles or exploit the unique properties of nanomaterials to build small ultra-sensitive sensors for various applications like biomedical diagnostics or environmental online monitoring, or nano-standards that can serve as points of reference for calibrations everywhere.

As a nano-analytics center par excellence LENA will be equipped with a unique combination of high-end instrumentation. High-resolution imaging methods, spatially and temporally resolved spectroscopy, surface manipulation and analytics as well as particle property measurement instrumentation will be operated by the expert member groups of LENA.



Electo-optical characterization of 3D-LEDs with a scanning electron microscope: Light emitting region of a contacted core-shell LED inside an ensemble visualized by EBIC and SE imaging. (TU-Braunschweig, Institute of Semiconductor Technology, J. Ledig)



Fluorescence microscopy of DNA-Origami nanorulers with structured illumination microscopy: GATTA-SIM nanoruler with fluorescent marks containing ATTO647N (red) and Alexa488 (blue) within distances of 160nm (red-red) and 80nm (red-blue) imaged on a Zeiss ELYRA system. (TU-Braunschweig, Institute for Physical and Theoretical Chemistry, GATTAquant)

LENA Laboratory for Emerging Nanometrology

Organisation

The LENA Management Board:
Prof. Dr. Andreas Waag (speaker),
Prof. Dr. Meinhard Schilling (vice speaker),
Prof. Dr. Georg Garnweitner, Dir. and
Prof. Dr. Harald Bosse and Dir. and
Prof. Dr. Fritz Riehle.

Research Infrastructure

A new research building for LENA is under construction, planned to be operative end of 2017. The total investment of more than 33 million € is divided into construction (2/3) and instrumentation sum (1/3) and provided by the German Federal Government (14.5 million €) and the Federal State of Lower Saxony. One part of the LENA building will include laboratories and analytical instrumentation (two floors, ~1,400 sqm), a second part will include offices and seminar rooms (3 floors, ~ 1,200 sqm) for more than 100 scientists, technicians and students.

Funding

DFG, State of Lower Saxony, EU, BMBF, BMWi, Industry

The Research Centre LENA

LENA – one of the Carolo-Wilhelmina research centers of Technische Universität Braunschweig (TU-BS) – combines research activities of 12 groups from TU-BS and 8 groups of the Physikalisch Technische Bundesanstalt (PTB) Braunschweig, including electrical-engineering, semiconductor-, microsystems-, and particle-technology, physics, chemistry, optics, production measurement technology and more, to enable interdisciplinary research in the field of nanometrology, being one of the key research areas of TU-BS. LENA, being part of the "Metrology Initiative Braunschweig" (MIB) pooling further joint metrology activities like joint TU-BS/PTB appointments and graduate education programs, will also include several junior research groups.

Members of the Institute of Semiconductor Technology are coating nanostructures using an atomic layer deposition (ALD) system.

Publications and Patents

see also www.tu-braunschweig.de/mib/lena and member author' s literature search (e.g. Scopus database)

- Puchkova, C. Vietz, B. Wunsch, D. Wang, G.P. Acuna, P. Tinnefeld: DNA Origami Nanoantennas with 5000fold Fluorescence Enhancement. Nano Lett., (2015) 15 (12).
- S. Bley, M. Diez, F. Albrecht, S. Resch, S. R. Waldvogel, A. Menzel, M. Zacharias, J. Gutowski, and T. Voss: Electron tunneling from colloidal CdSe quantum dots to ZnO nanowires studied by time-resolved luminescence and photoconductivity experiments. J. of Phys. Chem. C, (2015) 119.
- T. Langer, M. Klisch, F. A. Ketzer, H. Jönen, H. Bremers, U. Rossow, T. Meisch, F. Scholz, and A. Hangleiter: Radiative and nonradiative recombination mechanisms in nonpolar and semipolar GaInN/GaN quantum wells. Phys. Status Solidi B, (2015) 1–7.
- S. Chaudhuri, S. Sardar, D. Bagchi, P. Saha, P. Lemmens, and S. K. Pal: Photoinduced Dynamics and Toxicity of a Cancer Drug in Proximity of Inorganic Nanoparticles under Visible Light, ChemPhysChem., (2015).
- S. Zellmer, G. Garnweitner, T. Breinlinger, T. Kraft, C. Schilde: Hierarchical structure formation of nanoparticulate spray-dried composite aggregates. ACS Nano, (2015) 9(11):10749-57.
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The Automotive Research Centre Niedersachsen (NFF)

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Contact
Dr. Kathrien Inderwisch-Bitter
Automotive Research
Centre Niedersachsen (NFF)
Managing Director-Research
Hermann-Blenk-Straße 42
38108 Braunschweig
Phone: +49 531 391-66000
nff@tu-braunschweig.de
www.nff.tu-braunschweig.de

Funding
BMBF, BMWi, BMUB, BMVI, DFG, EU

Management board
- Dr. Udo-Willi Kögler (Speaker)
- Prof. Dr. Markus Henke, Institute for Electrical Machines, Traction and Drives
- Prof. Dr. Ferit Küçükay, Institute of Automotive Engineering
- Prof. Dr. Ina Schaefer, Institute of Software Engineering and Automotive Informatics
- Prof. Dr. Thomas Spengler, Institute of Automotive Management and Industrial Production
- Prof. Dr.Thomas Vietor, Institute for Engineering Design
- Prof. Dr. Bernd Ponick, Institute for Drive Systems and Power Electronics (LU Hannover)
- Prof. Dr. Andreas Rausch, Institute for Software Systems Engineering (TU Clausthal)
- Prof. Dr. Thomas Form (Industry)

Mission Statement

The Automotive Research Centre Niedersachsen (NFF) is part of the TU Braunschweig and one of the largest, most modern mobility research centres at a German university. The NFF examines road and rail transportation with the vision of sustainable mobility in five fields of scientific research.

Research

The research field titled **"Intelligent vehicles and connected driving"** covers the development of methods and technologies to build up new Car-2-X communication infrastructures, with environment detection, self-representation and anticipation as the path from assisted to automated driving. The aim is to derive user-customised driving strategies to improve road safety and efficiency, driver acceptance, fulfilment of mobility demands and enhance the "city compatibility" of future vehicles by applying cooperative approaches. The driver, vehicle and infrastructure domains as well as the man-machine interaction are examined with regard to the systems themselves, increasing automation and cooperative networking. The research infrastructure is focusing on "Functional Development", "Security & Privacy Engineering" and "Safety Engineering". *Management: Prof. Dr. Ina Schaefer and Dr. Roman Henze.*

The **"Low-emission vehicles"** research field looks at the overall efficiency of the vehicle lifecycle ("cradle to grave") covering efficiency of vehicle production, drive energy production and provision ("well to tank"), the efficiency of vehicles in use ("tank to wheel") and the final recycling of the vehicle. This makes it possible to assess the potential of different optimisation approaches in terms of CO_2 emissions, energy efficiency and resource utilisation. Research focusing on the vehicle usage phase includes manufacturing processes and disposal concepts for sustainable biofuels besides continuous improvement of conventional drive systems. New drive concepts from hybrids through to fully electrical drives plus energy management and emission optimisation are additional topics. Also networking and automation with the aim of increasing vehicle and drive system efficiency, driveability, comfort and safety are considered.
Management: Prof. Dr. Ferit Küçükay.

"Flexible vehicle concepts and vehicle production" is the field where new vehicle concepts and production systems are researched for modular, adaptable, light and resource-efficient vehicle concepts which are flexibly adaptable to market requirements. Methodical principles are developed for flexible and resource-efficient vehicle concepts. New production concepts and process chains are researched for flexible, economic vehicle production. One key aspect is the development of integrated mass production technologies on the overall vehicle level and the component level. Important infrastructures in this field are the Open Hybrid LabFactory (OHLF),

Organisation
Implementing this research vision requires broad, structurally anchored, interdisciplinary collaboration between natural and engineering sciences plus economic and social sciences as is now happening among the 19 permanent members (TU Braunschweig, LU Hanover, TU Clausthal, DLR) and 23 associate members (TU Braunschweig, HBK Braunschweig, LU Hanover, Ostfalia) with more than 700 scientific staff and 70 chief engineers and post-doctorates.

Research Infrastructure
Since August 2014, the required scientific expertise from the institutes and working groups involved has been moving into the new NFF building. This 7500 m² location is the result of a € 60 million investment. It consists of offices and laboratories and is conceptualised as a project building for all the institutes and universities to allow them to take their scientific project cooperation to a new level.

The offices provide 150 workspaces for scientific staff from the member institutes. The Technical Centre and the large-scale test-bench area offer a range of testing equipment which all the institutes can use for their research programs. This includes a modular drive train test bench which allows, as an example, full drive train systems to be built up in prototype form and allow the interaction between the components (electric motor, performance electronics, battery and combustion engine) to be analysed with regard to their functionality and their dynamics. Electric engine test benches and a research laboratory for performance technologies are being installed to allow research into these technologies.

For research on Intelligent Vehicle Systems an innovative research laboratory has been set up. A total vehicle simulator offers unique characteristics for researching active chassis and drive train regulation systems. The testing facilities are supplemented by an all-wheel drive rolling test bench with climate control to realistically assess drive systems. The development of operating strategies and the analysis of relevant fuel influence parameters on the behaviour of the combustion engine are facilitated by engine test benches and fuel analysis laboratories.

for sustainable manufacturing and production technologies for hybrid lightweight components suitable for mass production and the Battery LabFactory Braunschweig (BLB) as an Interdisciplinary Research Factory for Lithium-Ion Battery Cells.
Management: Prof. Dr. Klaus Dröder and Prof. Dr. Thomas Vietor.

The interdisciplinary research field named **"Mobility management and logistics"** focuses on established and innovative mobility concepts which address traditional mobility and logistic needs and combine them with new mobility-related services. Innovative concepts for individualised, safe passenger and freight transport are developed in the form of services and business models which meet technical, ecological and economical demands at any time and place in order to fulfil society's changing mobility and logistic needs. Framework conditions for sustainable mobility are created on this basis. Specific research projects look at market scenarios for e-mobility, the development of economic and ecological operation and usage concepts for electric vehicles within car-sharing programmes and company fleets, future laws on CO_2 in the automobile industry, the reduction of CO_2 emissions and increasing profitability in logistics.
Management: Prof. Dr. Thomas Spengler and Prof. Dr. David Woisetschläger.

Dynamic Vehicle Road Simulator for Testing Intelligent Vehicle Systems
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One of 16 Engine Test Benches in Use at the NFF
© NFF/Bierwagen

"E-mobility" demands innovative research approaches in different fields due to its new framework conditions. Such drivetrains require efficient electric engines consisting of an electric motor and electrical performance control units which are designed and assessed on the basis of optimised system characteristics. Storing energy in the vehicle requires new materials, cell components and battery systems. New business models and operator concepts are required to integrate the vehicles into the existing energy supply networks. The aim of this research field is therefore to push forward with fundamental research, to support partners in industry to becoming leading providers and develop Germany as a leading market for electromobility.
Management: Prof. Dr. Regine Mallwitz and Prof. Dr. Markus Henke.

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NFL Aeronautics Research Centre Niedersachsen

Contact
NFL – Aeronautics Research Centre Niedersachsen
Dr.-Ing. Shanna Schönhals
Hermann-Blenk-Straße 27
38108 Braunschweig
Phone +49 531 391-9822
s.schoenhals@tu-braunschweig.de
www.nfl.tu-braunschweig.de

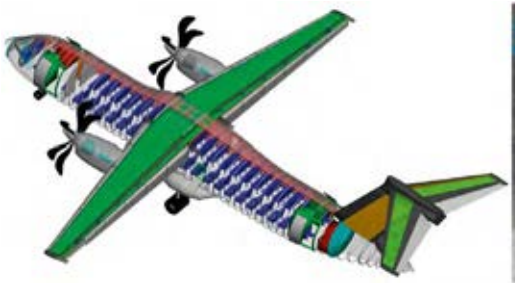
Mission Statement

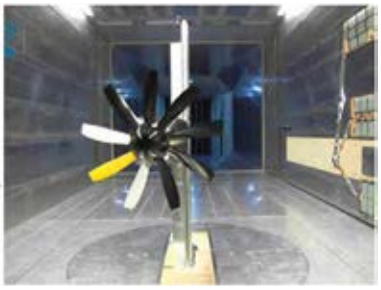
NFL is a research centre of Technische Universität Braunschweig in cooperation with German Aerospace Centre DLR, Leibniz University Hanover, PTB, and Fraunhofer Gesellschaft. The NFL focuses on coordinated fundamental research in the key areas of aeronautics guided by the needs of flight safety, environmental sustainability, and efficiency.

Research

Bürgernahes Flugzeug – Metropolitan Aircraft

The coordinated research program Metropolitan Aircraft of NFL developed a vision of future commercial aircraft that will enable inter-European air transportation from small airports close to cities, providing efficient point-to-point connections. From 2009 until 2014, the inter-disciplinary research team coordinated by the NFL developed technology enablers in the fields of flight physics, propulsion, structures, as well as aircraft and air traffic systems. The project was funded by the Federal State of Lower Saxony, Niedersächsisches Vorab (VWZN 2499, 2551, 2634, 2707) and the project partners TU Braunschweig, DLR and LU Hanover in equal parts.





SFB 880 – Fundamentals of High Lift for Future Civil Aircraft

The Collaborative Research Centre SFB 880 develops fundamentals of active high-lift for environmentally friendly future transport aircraft, following the vision of Metropolitan Aircraft for sustainable growth and enabling efficient point-to-point connections, short runways for take-off and landing, and drastic reductions of aircraft noise. This requires fundamental research in aeroacoustics, efficient active high-lift, and flight dynamics. SFB 880 has been funded by the German Research Foundation, DFG, since 2011.

NFL
am Campus Forschungsflughafen

The Research Centre NFL

NFL aims at interdisciplinary cooperation across institutions. For this reason, NFL hosts 22 members from 19 institutes representing their research disciplines at the five contributing institutions. Members of Technische Universität Braunschweig and DLR are equally represented in the executive board that is headed by the NFL speaker Prof. Dr.-Ing. Rolf Radespiel.

Research Infrastructure

A new building for NFL was completed at the Braunschweig Research Airport in 2012 that houses two institutes (Fluid Mechanics and Jet Propulsion/Turbomachinery). Thus, by collocating all aerospace institutes of Technische Universität Braunschweig at this campus in close vicinity to the large aeronautical site of DLR, collaboration at NFL now builds on an excellent infrastructure.

The new building accommodates offices, meeting rooms and a lecture room. It also includes a large technical centre with specialized wind tunnels and engine test facilities. The propulsion test rig, located in an own separate building, offers a unique research facility for next generation propulsion concepts. The investment also covered acquisition of large test rigs for aircraft structures and materials, as well as aircraft simulation and navigation technologies.

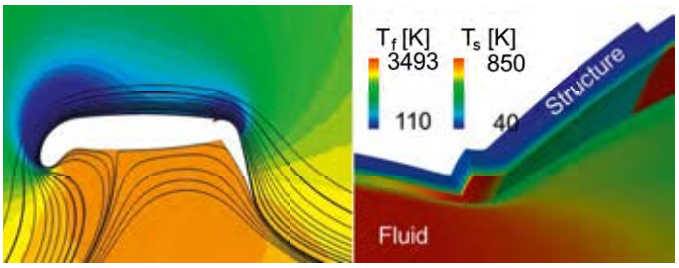
The necessary investment of 29 million € was provided by the State of Lower Saxony, the Federal Government, and by using basic funds of TU Braunschweig.

Funding

DFG, BMBF, BMWi, HGF, EU, state of Lower Saxony, industry

SFB-TR 40 – Technological Foundations for the Design of Thermally and Mechanically Highly Loaded Components of Future Space Transportation Systems

Next-generation space transportation systems will be based on rocket propulsion systems which deliver the best compromise between development and production cost and performance. The SFB-TR 40 focuses on liquid rocket propulsion and its integration into civil space launchers. Reusability of thermally loaded structures and reducing design margins by new simulation capabilities are in the main focus of the project. TR 40 is a co-operation with partners from industry and academia in Aachen, Munich, Stuttgart and Braunschweig, funded by the German Research Foundation, DFG, since 2008.



SuLaDi – Supercooled Large Droplets Icing

Aircraft icing can pose problems to flight safety and is of particular importance since some accidents happened due to icing caused by so-called Supercooled Large Droplets, SLDs, occurring in the atmosphere under certain weather conditions. Due to new certification regulations for flights under SLD icing conditions published begin of 2015, certain research areas are of high interest. The SuLaDI project focuses on basic SLD research within the scope of DLR@Uni initiative funded by the Helmholtz Association Fonds, HGF, since 2011.

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PVZ – Center of Pharmaceutical Engineering

Contact
Center of Pharmaceutical Engineering (PVZ)
Franz-Liszt-Straße 35a
38106 Braunschweig

till January 2017
Center of Pharmaceutical Engineering (PVZ)
c/o Institut für Partikeltechnik
Volkmaroder Str. 5
38104 Braunschweig

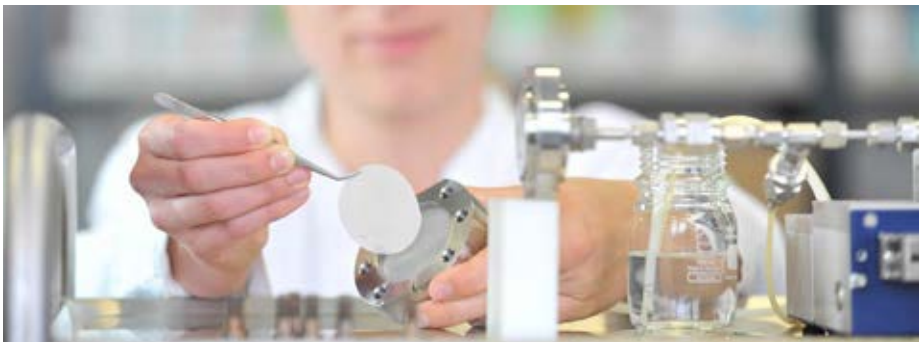
Dr.-Ing. Jörg Stieghan
Phone +49 531 391-9624
j.stieghan@tu-braunschweig.de
www.tu-braunschweig.de/pvz

Mission Statement

As Carolo Wilhelmina research center of the TU Braunschweig, the PVZ aims at the production of tailor-made pharmaceuticals at low cost. Three main topics are explicitly addressed: (i) making production processes more efficient by in-depth understanding, advanced design methods and continuous processes, (ii) making drug formulations more effective by processing and formulating poorly soluble or stress-sensitive drugs adequately, and (iii) individualizing medicines to fulfill the needs of special patient groups.

Research

Research competencies:
The PVZ efficiently combines expertise from different fields of research at the TU Braunschweig: pharmaceutical scientists closely cooperate with process and chemical engineers, strengthened by micro and production technology engineers. This enables the processing of very small product amounts, in particular for early screening in pharmaceutical development, personalized medicine as well as for inline process analytics. The PVZ covers the complete value chain from chemical and biotechnological API synthesis over purification and formulation to packaging. Its research efforts are organized between individual projects up to large joint projects such as SynFoBiA and µ-PROPS.



SynFoBiA – Innovative Synthesis and Formulation Processes for Sensitive Biopharmaceuticals and Poorly Water-Soluble Active Pharmaceutical Ingredients (APIs):
SynFoBiA was launched in summer 2013 as PVZ's first large joint research project. As profound starting point, 30 young scientists work in the strategic research areas of the PVZ.

pvz
Zentrum für
Pharmaverfahrenstechnik

The Research Centre PVZ

The PVZ fosters close interdisciplinary cooperation of pharmaceutical scientists, chemical engineers, process engineers, and micro and production technology engineers in the context of active pharmaceutical ingredients, processes, and formulations. To achieve this objective, 120 scientists and technicians from more than 20 institutes of the TU Braunschweig and partner organizations will work together in this center. PVZ is headed by Prof. Dr. Heike Bunjes, Prof. Dr. Andreas Dietzel, Prof. Dr.-Ing. Arno Kwade (speaker), Prof. Dr. Christel Müller-Goymann (deputy speaker), and Prof. Dr.-Ing. Stephan Scholl.

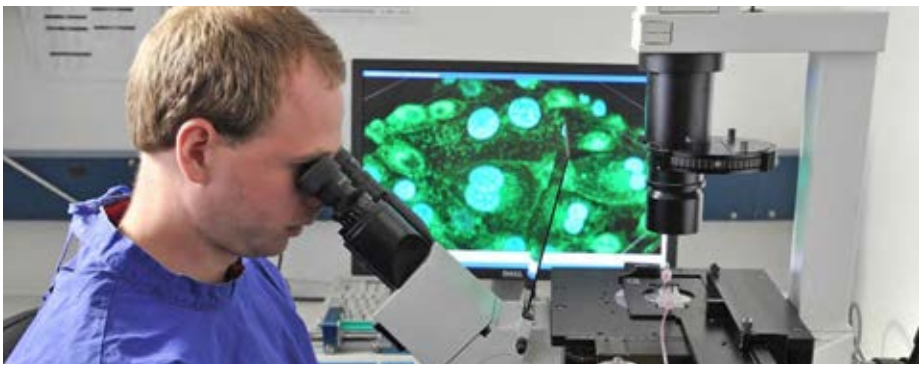
Research Infrastructure

The PVZ will be housed in a new building at the eastern campus of the TU Braunschweig. It is developed to jointly accommodate four key departments and two cross-sectional working groups on 3,300 sqm. Specialized laboratories will facilitate the clean and safe production of pharmaceuticals as well as micro-
systems and the chemical and biotechnological synthesis from micro to pilot scale. The building also provides modern offices, meeting rooms as well as a computer pool and seminar rooms for scientific exchange. The overall investment of 29 million € is provided in equal parts by the Federal Republic of Germany and the Federal State of Lower Saxony.

Funding

DFG, BMBF, BMWi, EU, state of Lower Saxony, industry

Biotechnological and biological methods are applied to produce and characterize antibody fragments and low molecular weight biological APIs. Additionally, micro-analytical strategies for API quantification are developed. Continuous processes for chemical synthesis of APIs are designed, and scale-up strategies for production scale are developed. The special formulation needs of poorly water-soluble molecules are systematically addressed. To reduce animal testing and to allow for quick in vitro assays for API and formulation testing, microscale devices are developed and evaluated for cell cultures.



µ-PROPS – Processing of Poorly Soluble Drugs at Small Scale:
Started in fall 2014, this program creates an inspiring setting for 17 young researchers in the area of pharmaceutical engineering and provides intensive education in this highly interdisciplinary field. The PhD projects are centered around the question how poorly soluble drugs can adequately be produced, formulated and processed into applicable and effective medicines. As newly identified drug candidates are usually available only in very small amounts, the projects also aim to solve these questions in a manner that saves on materials.

SynFoBiA (VW-Vorab) and µ-PROPS (Niedersächsisches Promotionsprogamm) are funded by the Ministry of Science and Culture of the Federal State of Lower Saxony.

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tubs.CITY – Center for Informatics and Information Technology

Contact
tubs.CITY
Center for Informatics and Information Technology
Anna M. Jankowski
Mühlenpfordtstraße 23
38106 Braunschweig
Phone: +49 531 391-8118
Anna.Jankowski@tu-braunschweig.de
www.tu-braunschweig.de/tubscity

The research center tubs.CITY
25 professors and junior researchers from 17 institutes join tubs.CITY as members, including about 220 PhD students.

Funding
DFG, EU, BMBF, BMWi, Industry

Mission Statement

tubs.CITY is a research center of the TU Braunschweig, bringing together members from computer science, electrical engineering, information technology, psychology, civil engineering and economics. The focus of tubs.CITY is research on computer sciences and information technology, and its various applications.

Research

Research Unit FOR 1800: Controlling Concurrent Change (CCC)
The research group studies continuous change in safety-critical and high-availability systems without the need for expensive and time-consuming lab integration tests, even for open systems. Eight scientists from Electrical Engineering and Computer Science combine principles of contracting, self-protection, monitoring, self-optimization with new methods of timing and safety analysis in order to achieve a coherent approach to this engineering challenge. CCC is developing ways to control the variety of updates of different software applications in order to anticipate side effects, and to make computer platforms more robust, thus ensuring proper functioning of the various software subsystems.

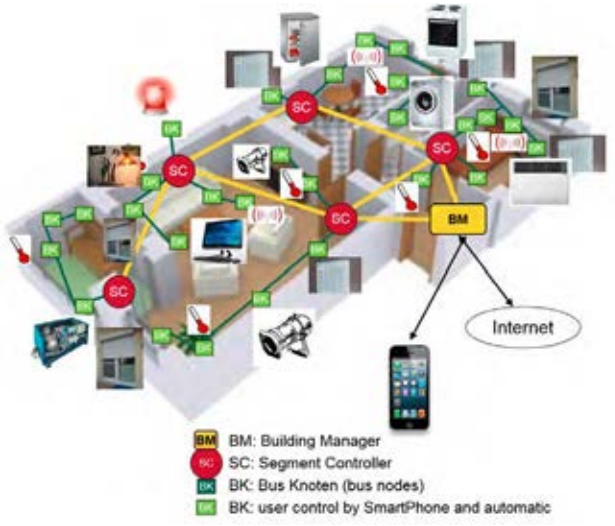
cooperITe – Cooperation as the principle for the interaction between humans and technology
The recent developments of information technology and computer science will continue to induce dramatic changes - not just for science and industry, but for our society as a whole, and for the connections between humans and technology. One of the most important challenges is to ensure that technological components (which lack human empathy to facilitate collaboration) do not only pursue self-interest, but are able to contribute to efficient, stable and cooperative complex systems.

The Digital Society, fotolia © Kurhan

tubs.CITY
Center for Informatics and Information Technology

Building Automation by a Scalable & Intelligent System

Current challenges in building automation are addressed by information technology. Demographic changes and health care needs at home are as important as energy-efficient homes and climate conserving strategies. Developments in the mobile device sector are pushing the needs for usable, secure and flexible home automation solutions. Primary goal of the project is the development of a flexible and energy saving infrastructure for home automation. By integrating all stakeholders into one system, cost is reduced, benefit is raised and symbiotic effects can be used on all layers of interaction.



Internationalization – Example India

In many countries, Computer Science is the field that attracts the most outstanding talents. Over the last five years, tubs.CITY has established an official partnership between TU Braunschweig and the Indian Institute of Technology (IIT) Bombay, the most prestigious Indian elite university.

Every year, 80 of the best Indian students (all from the top 200 out of a cohort of 1.5 million) apply for an internship in tubs.CITY institutes. This puts tubs.CITY into the same exclusive category as Google and Microsoft.

Visiting students from IIT with Prof. Fekete

Jointly organized events:

- tubs.CITY expert meeting 2016 on “IT-Security”
- tubs.CITY Symposium 2014 “Cooperation in a Digital Society”
- tubs.CITY Symposium 2013 “Managing change and autonomy for critical applications”
- EuroCG2013
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Imprint

Published by
Technische Universität Braunschweig
Pockelsstraße 14
38106 Braunschweig
Germany

Telephone +49 531 391-0
Email: d.jahn@tu-braunschweig.de
www.tu-braunschweig.de

Responsibility of: Prof. Dr. Dieter Jahn
English Proofreading & Translation:
Paul David Ronning, pronning@gmx.de
Layout and Design: www.hurtig-design.de

Photo Cover: fotolia © kras99