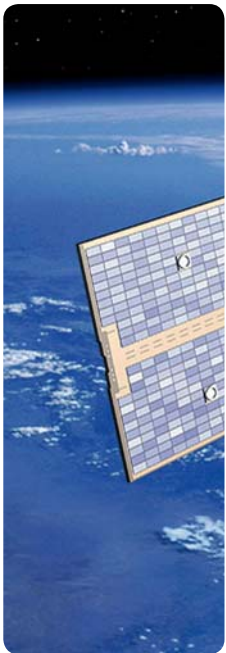




Braunschweig

Die Löwenstadt

from Gauß to Galileo



Braunschweig:

The Lion among Research Cities

A Region Promotes Mobility:

From Braunschweig into the world

Modelled on Nature:

Modelling instead of experimenting

Precision on the Smallest Scale:

Innovations in the fields of optical and metrological technologies

On the Same Wavelength:

Information and Communication Technologies of tomorrow

Using Green Energy:

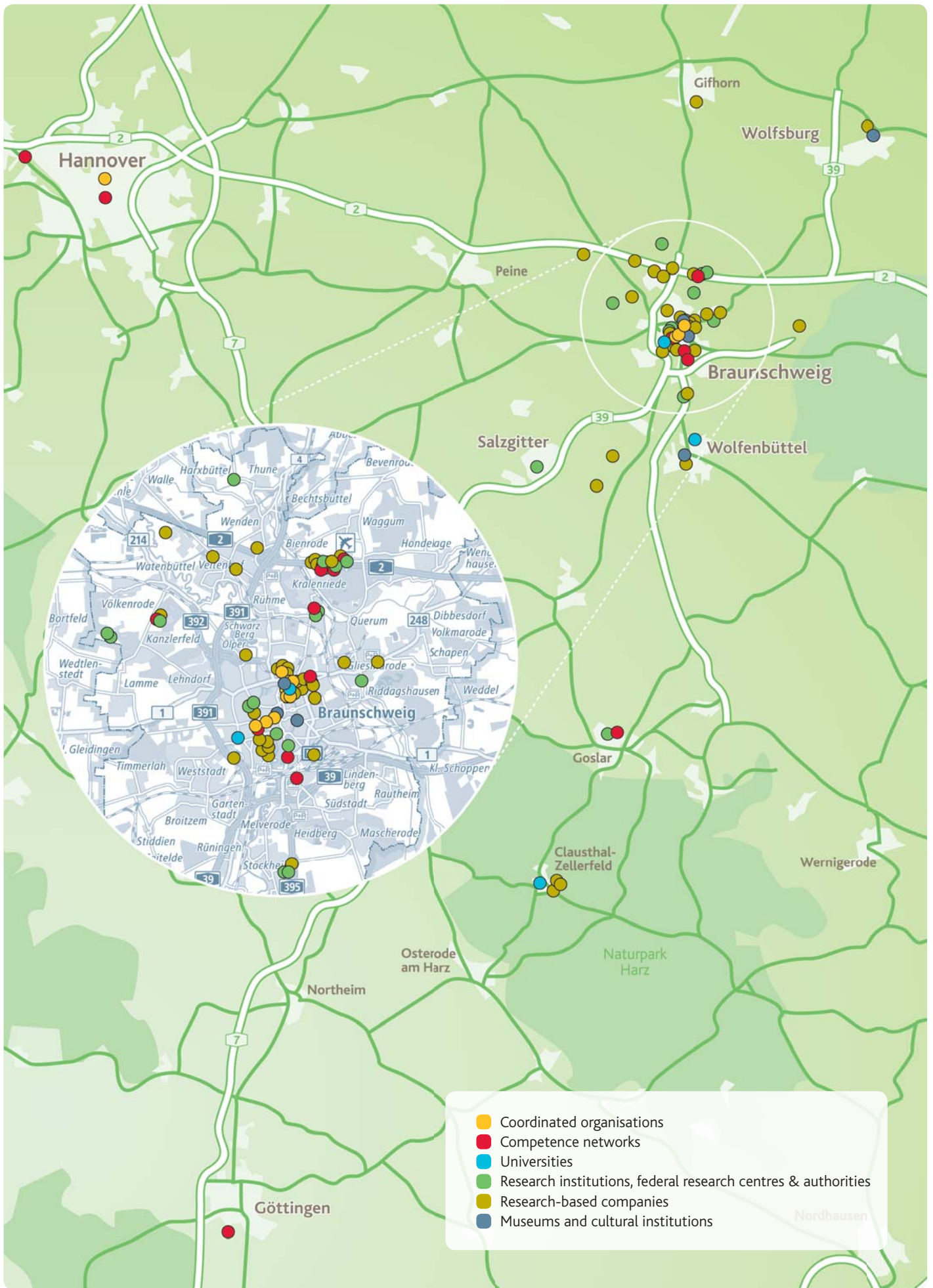
Agriculture and Renewable Resources

Promoting Dialogue:

Culture and Communication

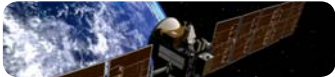
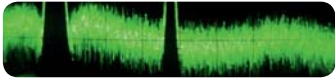
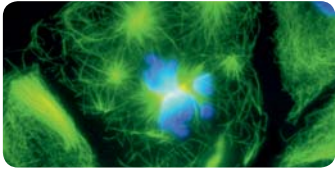
Europe's most research intensive region.

■ **Kitchen of Ideas Braunschweig**



Europe's Most Research Intensive Region

Kitchen of Ideas Braunschweig

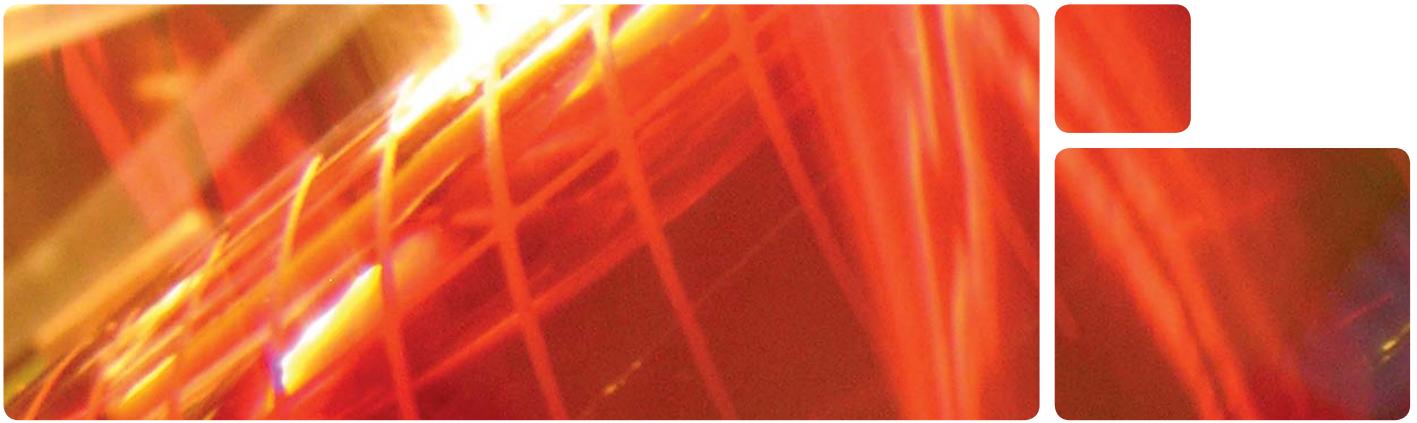


	Research landscape	2
	Table of contents	3
	Word of welcome	4
	Braunschweig – The Lion among Research Cities	5
	A Region Promotes Mobility – Mobility and Transport Technology, Aviation and Aerospace	12
	Research in the name of aviation	12
	Can cars think?	12
	From Braunschweig into the world	13
	Searching for the car of the future	14
	Mission: eco-friendly flying!	15
	Where research achieves a great deal – The Research Airport	17
	Modelled on Nature – Biotechnology and Systems Biology	20
	Modelling instead of experimenting	20
	Thriller scene: cropping soil	21
	Braunschweig – Integrated Centre for Systems Biology	22
	Precision on the Smallest Scale – Optical Technologies, Microsystems Technology and Surface Technology	24
	On the Same Wavelength – Information and Communication Technologies	27
	Using Green Energies – Agriculture and Renewable Resources	31
	A pipeline leading the way	31
	Biomass as a source of energy	31
	Little helpers on a great mission	32
	Establishing Business Relations, Promoting Dialogue – Culture and Communication	34
	Try out, get involved and join in the discussion	38
	An experimental science centre to marvel at	39

Service Section:

Research Region Braunschweig – In Brief

The enclosed service brochure of the research region Braunschweig is meant as an introduction to its diverse research landscape which includes numerous internationally renowned research establishments and scientific research-based companies. Here, you will find the details of expert contact partners for each area of expertise who can provide you with information regarding your specific research and education topics. The service brochure features following categories: Coordinated Organisation, Competence Networks, Universities, Research Institutions, Federal Research Centres & Authorities, Research-based Companies, Museums and Cultural Institutions. **To download this brochure "From Gauß to Galileo", please visit: www.braunschweig.de/wissenschaft.**



Dear Reader,

With this brochure we would like to invite you to learn more about the research region Braunschweig. It gives you an insight into the strong network between research institutions, universities and research companies and it portrays the core competencies in our region: amongst them aerospace, road and rail technology, optical and metrological technologies, microproduction, communication technology as well as the use of renewable raw materials.

Being the centre of the most research intensive region in Europe and an international research location puts Braunschweig into an excellent position. Not only EU statistics underline this outstanding position, but it is also confirmed again and again by studies and ranking tables. We primarily owe these advantageous conditions to the large number of scientific institutions which are linked together in the ForschungRegion Braunschweig e.V. (Research Region Braunschweig e.V.). Furthermore, our city is the heart of the most important industrial region of Lower Saxony: more than 500 high tech companies are based in this region and provide an innovation potential which is second to none. Amongst them are global companies such as Volkswagen, Intel or Siemens that are cooperating closely with local research institutions.

Braunschweig was named Germany's "City of Science 2007", a title which has contributed lastingly to Braunschweig becoming even more distinguished as a research location and which gave an important impulse for an even more effective network in this region. The "Haus der Wissenschaft" (House of Science) that was set up in cooperation with science, industry and the city continues this development. As a central meeting place its objectives are to intensify the dialogue with the public, create new contacts between researchers and businessmen and deepen already existing contacts. This is meant to create even better conditions for technology transfer and for further future initiatives.

Current major projects like the extension of the Research Airport Braunschweig, the Lower Saxony Research Centre for Automotive Technology (NFF) and the Braunschweig Integrated Centre for Systems Biology (BRICS) demonstrate that this region will continue to develop sustainable structures and innovations in the future. By focussing on the central core competences the research region Braunschweig is very well positioned on a national and international level.

The enclosed service section "Research Region Braunschweig – Short and Compact" gives you a detailed overview of local research institutions and scientific research companies. The brochure provides details of expert contact partners for your research and education questions.



Dr. Gert Hoffmann
Mayor of Braunschweig



Prof. Dr.-Ing. Dr. h. c. Jürgen Hesselbach
Chairman of ForschungRegion
Braunschweig e.V. and President of the
Technical University of Braunschweig

Dr. Bernd Meier
Chief Executive of the Chamber of Commerce
and Industry (IHK) Braunschweig

Braunschweig

The Lion among Research Cities

A proverb says "I can prove anything by statistics except the truth". But how does someone who is pictured in a good light by the statistics deal with this? The present EU-study granted Braunschweig the title of "Most research and development intensive region in Europe". The fact that Braunschweig spends 5.8 percent of its gross domestic product on research and development just documents this. This not only puts this region into the leading position within Europe but also into the top league of research locations on an international level. Eurostat certifies the region of Braunschweig an exceptionally high "research density": the share of employment in research and development fields with 3.9 percent is the highest in Germany (source: Eurostat-Statistic, 2009).

Information

No doubt, Braunschweig is shaking off its mousey image and is more and more considered as one of the top technology locations in the country.
(Handelsblatt, 18.11.2010)

The 'Zukunftsatlas 2010' compiled by Prognos and Handelsblatt also gives Braunschweig an excellent reference as a place of innovation. Especially for the number of newly founded companies Braunschweig receives good marks: here the city ranks number 2 of the total 412 cities and counties. But Braunschweig's strong points are also the number of employees in the research- and development sector and the registration of patents. In total, Braunschweig made a huge jump from place number 48 to number 22. In the latest city ranking of 2010 carried out by the 'Initiative Neue Soziale Marktwirtschaft' in cooperation with the 'Wirtschaftswoche' it becomes apparent that the number of highly qualified employees in Braunschweig grew twice as much as the average number of other cities. According to a survey conducted by IW Consult and the University of Bonn, 75,8 percent of all the interviewed

entrepreneurs described Braunschweig as business-friendly.

It is therefore evident that the region offers excellent conditions for research, science and associated business sectors. However, critically-minded scientists remain kind of sceptical as soon as the buzzword "statistics" is being mentioned. Every scientific finding – especially a result as outstanding as this – needs to be proven. Let us bring those dry figures to life. Which people, institutions and (future-)projects are behind the gross domestic product of 5.8 percent? What investments are made? And, all importantly, what is the motor behind it all?

Research in Braunschweig – A partnership with a history and a future

Braunschweig's good reputation in research and science has a rich tradition. In 1745, the Collegium Carolinum was founded, which has been the forerunner of the current **Technical University Braunschweig** and has the longest-standing tradition in Germany. Carl Friedrich Gauss, the "Princeps mathematicorum", was born in Braunschweig in 1777 and studied at the Collegium Carolinum. As early as 1932, Agnes Pockels received an honorary doctorate of the University of Braunschweig for her auto-

didactic research work in the field of surface tension and interfacial surface tension. She developed a measuring device for the quantitative analysis of surface films which is still used today. The device was developed further by Irving Langmuir, who received the Noble Prize for this work in 1932.

During the 20th century, more and more scientific institutions were drawn to Braunschweig. Hence over 24 research institutions are nowadays based in this region, amongst them universities, federal research centres, Helmholtz-Institutes, Fraunhofer-Institutes, research institutes of the Leibniz Association and museums. More than half of these institutions are not only of nationwide importance, but also have an excellent reputation well known beyond the German borders. Just take a moment to consider that the **PTB, the national metrology institute providing scientific and technical services**, defines the clock pulse for the time that is valid all over the world.

Likewise, global travel is continuously increasing in today's society and with that, as we know, the spread of pathogenic germs. Staff at the **Helmholtz-Centre for Infection Research, HZI**, is standing up to the challenge by developing new antibiotics and vaccines. It is also interesting that, due to international co-operation, knowledge is increasingly exchanged so that, for instance, traditional African medicinal plants or specific forms of bacte-

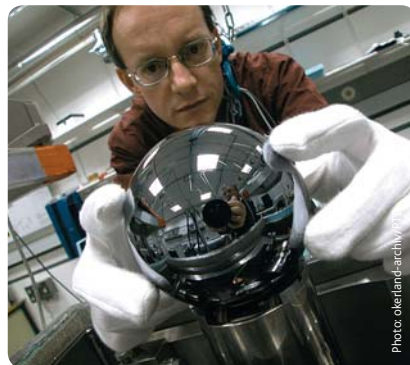


Photo: okerlandarchiv.de



Photo: DSKMZ

ria are used more and more in research. As our world is becoming evermore densely populated, maybe even precisely those countries where food is plentiful will have to confront issues concerning strategies for securing food and nutrition worldwide. As one of four federal research institutes under the auspices of the Federal Ministry of Food, Agriculture and Consumer Protection the **Johann Heinrich von Thünen-Institute (vTI)** in Braunschweig provides fundamental scientific information as decision-making tools for the policies of the German Federal Government, and with its application-oriented and praxis-related research it also serves the development of tomorrow's society.

Particularly closely involved with this issue is the Federal Research Centre for Cultivated Plants, the **Julius Kühn-Institut (JKI)**. As a departmental institution, it is responsible for the protection objective "Cultivated Plant" in

its entirety. This responsibility comprises the areas of plant genetics, crop production, plant nutrition and soil science, as well as plant protection and health and this enables the JKI from now on to develop holistic concepts for the whole spectrum of crop production, plant production and plant care. The list of research institutions based at Braunschweig is long. And behind each name a fascinating world of subjects, questions and projects opens up not only to the scientist but also to any interested layperson.

Focus of attention – making the best use of Braunschweig's potential

One of the crucial qualities defining Braunschweig as a prime research or business location is the existence of close links between scientific research and industry. The **ForschungsRegion Braunschweig e. V.** pools the know-how and expertise of currently 27 institutions in Braunschweig and its surrounding region, amongst them many which are highly respected and internationally recognised for their research work. This consortium is growing continuously as it is joined by new partners from the research and the business sectors, thus forming an effective network for successful knowledge transfer. In addition, the position of the Braunschweig region with its joint research projects and clusters is strengthened further by the alliance of the universities of Braunschweig, Hanover and Clausthal in the **Lower Saxony Technical University, NTH**, whose aim it is to reorganise the disciplines

of engineering and natural sciences by coordinating development planning in the future. The overall aim is to combine, strengthen and improve the visibility of strategic key research areas in an interdisciplinary manner.

A new research building is scheduled to be constructed on the campus of the Technical University of Braunschweig. The TU Braunschweig and the Helmholtz Centre for Infection Research are in the process of establishing the new **Integrated Centre for Systems Biology – BRICS**. At this centre, biologists, mathematicians, computer scientists and engineers will be working together on ways to better understand, model and simulate complex biological processes in their entirety. Biomedical research will consequently become significantly more efficient.

Technology transfer as lived reality

The chip manufacturer Intel has also realised this early on and, having based its European operational research at Braunschweig, is now benefiting from it. "Ultimately, we realised that Braunschweig is an extraordinarily attractive city. On the one hand, our team here has the necessary know-how, and on the other there is an interdisciplinary environment which allows the acquisition of highly talented personnel", says Nikolaus Lange, Engineering Director of Intel Braunschweig.

Information

"The days when research took place in an ivory tower are long gone. 'Networking' has become the buzzword of our times. And Braunschweig is particularly well-positioned in this context. The close integration of science with science, science with business and even culture has been particularly successful in the City on the Oker".
(VDI-Nachrichten, March 23, 2007)



Information

"More than 100 engineers work on the processors of the future – the heart of every computer – here at the Research and Development Centre of the American Chip Producer Intel. (...) Braunschweig is the largest development centre of this world market leader in chip production in Europe." (Die Welt, 11.02.2010)

Unique in Europe – The Research Airport Braunschweig, a cluster of expertise

One particular characteristic defining the unique position of Braunschweig is the high number of companies, research institutions and authorities located in the region which are working in the mobility sector, specifically in aviation technology, air traffic management, aerospace industry and transport. The region follows its tradition in the aviation engineering sector with the **Research Airport Braunschweig**, whereby the immediate industrial surrounding facilitates the extension of these areas of expertise onto other sectors. This research cluster offers superb development prospects for avionic- and traffic engineering-oriented companies or

institutions. Research, product development and services provided by more than 30 companies and as many institutes are combined in a centre of excellence at the research airport.

The internationally oriented application centre for the European satellite project Galileo is currently being built with support from the Federal State of Lower Saxony and is just one successful example for the continuous development of the research airport as a centre of excellence. Traffic applications are being simulated, tested and certified at the Galileo Centre for the whole of Europe. The current investment of almost 40 mill. EUR into the research infrastructure at the internationally recognised Research Airport Braunschweig provides Braunschweig the possibility to raise its profile as technology hotspot in Europe even further. Funded by the federal and state governments, 23 mill. EUR have been invested in the construction of a new research facility featuring a test hangar and an engine test bed at the Technical University of Braunschweig. The German Aerospace Centre has set a further new standard for aerospace research with the construction of the Simulator-Centre. The most modern high-performance computer for aeronautics research is operated by the German Aerospace Centre here in Braunschweig, providing the possibility to simulate the aeronautical properties of an aircraft at a very early design stage. And Europe's largest research aircraft, the Airbus A320 D-ATRA, is operated from the research airport Braunschweig. The **"Campus Research Airport"** combines thus the efforts in excellent aeronautical research.

The intelligent car of the future comes from the region of Braunschweig

The development of communication systems between different vehicles is one of the main research areas in the region. Unmanned aircraft and standardized safety features and equipment for Europe's rail network are in the focus of research here. Research on "autonomous driving" and autonomously driving robot vehicles is particularly well advanced. Leonie, one of the research vehicles of the Technical University of Braunschweig, named after Henry the Lion, drives all by itself. For security reasons there is still a driver sitting behind the steering wheel but Leonie autonomously masters parts of the city ring, stays in lane, keeps the right distance to the cars in front, indicates, watches out for obstacles and all by itself performs a U-turn. This makes Leonie one of the first vehicles worldwide that is al-

Information

"The interdisciplinary team of the City Pilot Project is made up of the Institute of Control Engineering, the Institute for Flight Guidance, and the Institute of Operating Systems and Computer Networks of the TU Braunschweig and works at the Lower Saxony Research Centre for Automotive Technology (NFF) located at the MobileLifeCampus in Wolfsburg. The City Pilot Project is designed as long term research project intended to bring real benefit to the mass production vehicles of the future". (Heise-Online, March 20, 2009)

lowed to drive automatically in real traffic conditions. The researchers have an ambitious goal: The whole city of Braunschweig shall be extended into a test platform for intelligent driving.

The TU Braunschweig and the Volkswagen AG have decided to take their collaboration to an entirely new level with the foundation of the **Lower Saxony Research Centre for Automotive Technology**. Attention is focused on interdisciplinary research projects in the field of automotive engineering in close collaboration with partners of the industry and science sector. Research spans the whole spectrum from autonomous driving, to sustainable propulsion concepts and safety systems, to automotive industry and transportation design. The first site is based at the MobileLifeCampus in Wolfsburg, a second site is being established at the Research Airport Braunschweig. The effects are manifold: ultimately, the research airport will become the campus for transport research with significant international influence. In no other location experts for flying and driving can work together that closely and exchange opinions on topics like locating, safety, comfort and intelligent mobility.

Despite all the science and technology involved, these examples show that the energy behind the research and science location Braunschweig are its people who show initiative and bring forward new ideas: all those involved – representatives of the city, science or industry – are always focusing on developing this network further and finding new synergy effects. "It is not knowledge, but the act of learning, not possessing, but the act of acquiring, not being, but the act of getting there which grants the greatest enjoyment." It seems as if those words by Carl



Photo: Braunschweig, Stadtmärkte GmbH/Overland-archiv

Information

The Georg-Eckert-Institute has become a "hub for the subject of school books. Scientists from all over the world come to Braunschweig to do their research."
(Sueddeutsche Zeitung, 15.02.2010)

Friedrich Gauß have been tailor-made for these people.

The technology park creates the necessary leeway for young scientists

Braunschweig provides new opportunities to encourage this kind of learning and striving: the **Technology Park Braunschweig** is run by the business development agency Braunschweig Zukunft GmbH and offers business premises to young, technology-oriented businesses. The technology park is open to entrepreneurs striving to develop and market innovations within their own company. Attractive rental rates and an existing office infrastructure help to ease the start-up and beginning phase considerably. In September 2007 as the first founder centre in Lower Saxony, the technology park has set up a training network. Together with young companies based at the founder centre, apprentices are trained in information technology and office communication.

Since 1986, over 100 successfully operating businesses have been based at the technology park, in which far more than 1,000 highly skilled engineers and technicians find employment.

Design and research – Area of tension with practical relevance

The **Institute for Transportation Design (ITD)** of the Braunschweig University of Art represents a particularly interesting example of the collaboration between business, science and culture. The institute researches the future of mobility. In research and education, the ITD reaches far beyond the product design of transport systems as such, and is also working on the design of mobility services as well as the research into novel mobility systems.

The prerequisite for this lies in the interdisciplinary structure of the ITD, which in the frame of research, training and project work does not only rely on design technologies, but

also includes findings of transportation and engineering sciences, economic research and futurology as well as sociology and psychology.

In numerous third party funded projects the ITD, together with representatives of the mobility sector, has succeeded in realising praxis-oriented and marketable designs and with that it has sparked growing interest from the industry.

City of Science – A region on the move

Since the Association for the Promotion of Science and Humanities in Germany has awarded Braunschweig with the distinction of being named "City of Science" in 2007 science and research have been in the forefront of public attention in the region. The common goal of partners from science, commerce and the city strengthen the identification of the region with its research, to link science and industry even more closely and to make the region more attractive for young scientists has been achieved. The spirit of change permanently and constructively led to the development of two new institutions in the City of Science. These ensure that science is well presented in this region and allow and encourage an open dialogue with the public. Since 2007 the **Braunschweig Research Prize** which carries a value of Euro 30,000 is awarded every two years for interdisciplinary, internationally high regarded research work in the areas of technology, life and cultural sciences. After Prof. Dr. Sebastian Thrun won it in 2007, the Swiss flight pioneers Dr. Bertrand Piccard and André Borschberg received the award in the year 2009 for their project "Solar Impulse". This is an aeroplane that is solely powered by

solar energy with which they gave new impetus to sustainable energy systems. After their first mile stone development of emission free flying, everyone in Braunschweig follows the researchers' next steps on their way to circle the earth.

The **Haus der Wissenschaft (House of Science)** that was established on the premises of the former Kant University next to the Natural History Museum has also since the year 2007 been a firm anchor and a central platform for this region of science.

The Haus der Wissenschaft promotes the dialogue between industry, science and ordinary people. It is a meeting place where scientists and business people have the opportunity to exchange views, ideas and information, and develop new projects, cooperations and "concepts for the future". The Haus der Wissenschaft set a new successful trend in Germany with the "Science-Slam". This is a competition for short scientific lectures. Exciting exhibitions, discussions and an interactive programme for kids and youngsters in the Haus der Wissenschaft appeal to a broad public. A special concern is the promotion of young people. Although, this subject is not only close to the heart of the Haus der Wissenschaft. This region has to offer various types of school laboratories and initiatives

Information

"There is hardly any other region which has as many first-class research institutes as Braunschweig"
(WirtschaftsWoche, January 8, 2007)



Photo: Braunschweig, Stadtmaking GmbH/Oderland-archiv



for young people. For example, the education initiative "Little Scientist's House" encourages little ones in Kindergartens to playfully approach science and research. The Agnes-Pockels school laboratory, the DLR_School_Lab or BioS, the bio-technological school laboratory, are but a few of the numerous offers for pupils.

A charming city offering a high quality of life

Braunschweig's outstanding economic and scientific position is embedded in the livable and loveable surroundings the city and its region has to offer. With some 250,000 inhabitants, Braunschweig is a compact major city. Even when living in the green surroundings, the lively pedestrian area with many shops and coffee bars is within cycling distance and can be reached in 10 minutes. Since 2007, Braunschweig's Ducal Palace also attracts visitors. Its impressive facade has been rebuilt using many original parts of the Guelph Castle built in the middle of the 19th century. The palace houses the municipal library, the town archive and the cultural institute of the city. On the portico of the Ducal Palace is Europe's big-

gest quadriga with "Brunonia" the town's goddess, as charioteer.

Braunschweig also has a vibrant and lively arts and culture scene. Throughout the year, it features a host of festivals and events such as the Braunschweig Classix Festival, the Culture Night, the CityJazzNight, the International filmfest or the opera open-air of the State Theatre. They all provide a platform for artists of regional, national and international fame as well as unknown, young talents.

The "Volkswagen Halle" Braunschweig is a venue for large-scale events of international standing. Orchestras like the New Yorker Philharmonic perform there and sporting events such as the horse show "Löwen Classics" or the World Ballroom Dance Championship, in which the dancers of the "Braunschweig Tanzsportclub" have previously won seven times, take place at this venue.

One of the outstanding museums in Braunschweig is the Herzog Anton Ulrich-Museum, was opened more than 250 years ago and was the first art museum in Germany and Continental Europe which was open to the public. The art collection of

the museum includes works of French, Dutch and German Masters, such as Jan Vermeer van Delfts "The Girl with a Wine Glass" and Rembrandt's "Family Portrait". After current and substantial extension and modernisation measures for a modern presentation of the internationally renowned collection, the museum in future will have over 2,617 sqm of floor space on three floors with modern rooms to accommodate restoration workshops, storerooms, libraries, the "Kupferstichkabinett" (print collection), administration offices and rooms for a museum education visitor's centre. The Municipal Museum Braunschweig that is also being renovated at the moment is one of the most important community museums of Northern Germany as it has an extensive collection on the art and cultural history of the City of Braunschweig. Furthermore, the museum is in possession of the prestigious "Bönsch" collection with some 3,500 paintings, sculptures and graphics.

As a nature reserve and one of Europe's bird sanctuaries, Riddagshausen offers ample local recreation opportunities and leisure activities and contributes to the high quality of life. You can circumnavigate almost the entire city centre by boat on the Oker.

And last but not least, the lion city is within easy reach of the Lüneburger Heide (Luneburg Heath) and the Harz (Harz Mountains) which makes it the perfect base for touring this remarkable cultural and nature region. The German capital Berlin can be comfortably reached by train in 90 minutes.

Braunschweig – a congress city with perfect conditions

A huge variety of internationally renowned research institutions, universities and research institutes, excellent traffic accessibility as well as a high standard of living combined with a large cultural offer and a relaxing but at the same time lively city centre make Braunschweig an ideal congress city. As a large city Braunschweig fulfils all wishes and qualifications for a conference location. Short distances and a nice atmosphere supply a compact framework to insure that conference participants don't lose sight of each other. The broad spectrum of high quality conference and event locations is the perfect qualification for a successful event – for small as well as for large groups.

Braunschweig Stadtmarketing GmbH with its **Convention Bureau Braunschweig** offers a competent service from the original idea to a detailed preparation and organisation right through to the professional execution of the supporting programme. Together with its partners, the Convention Bureau supplies a package deal for every conference or event organiser and helps with much enthusiasm, team spirit, creativity and unusual ideas to

ensure that each event will be a very special experience. Lately, large events like the 8th ICCG, "the International Conference on Coasting on Glass and Plastics" in June 2010 with approx. 800 participants or the "60th German Lawyer's Day" in May 2009 with over 1,200 guests were held in Braunschweig. Michael Ebeling, Chairman of the Braunschweig Lawyers Association, recalls: "It was a fantastic event. We hope that in the future further large events like this can be organised in Braunschweig with the help of the Convention Bureau Braunschweig." In the year 2012 Braunschweig will host the European Conference of the Junior Chamber with over 2,500 expected participants. ■

Contact

Braunschweig Stadtmarketing GmbH
Schild 4, 38100 Braunschweig
Phone: + 49 (0)531/470-21 04
Email: stadtmarketing@braunschweig.de
www.braunschweig.de/wissenschaft

Convention Bureau Braunschweig c/o Braunschweig Stadtmarketing GmbH
Nina Bierwirth
Schild 4, 38100 Braunschweig
Phone: + 49 (0)531 / 470-20 51
Email: congress@braunschweig.de
www.braunschweig.de/congress

Services of the Convention Bureau Braunschweig

Event location

- *competent advice about possible events in and around Braunschweig*
- *preparation of individual offers*
- *organisation of on-site inspections*
- *supply of additional services (technical equipment, furniture, etc.)*

Hotel allotments and room reservations

- *management of hotel reservations*
- *coordination and checking of hotel allotments*
- *acquisition and processing of bookings*
- *reservation confirmation to participants*
- *preparation of an internet site with online booking facilities for hotels*
- *preparation of a hotel reservation form*

Hostess and interpreting services

- *procurement of hostesses for fairs*
- *procurement of interpreters and translators*

Supporting programme

- *individual proposals and project planning*
- *booking and handling*
- *procurement of artists, performers, etc.*

Transportation

- *organisation of shuttle services and train tickets*

Catering Service

- *organisation of catering services*

Information material

- *advance supply of information materials*
- *supply of information portfolios for participants on site*
- *support with official applications*





Photo: Braunschweig Stadtmarketing GmbH/oketland-archiv

Carl Friedrich Gauß – Genius born in Braunschweig

Gauß is considered the greatest German scientist of his time in the fields of abstract and applied mathematics. He was born on April 30, 1777 in Braunschweig. His pioneering scientific successes distinguish him as an exceptional German scientist with an outstanding international reputation. Following his studies in Göttingen, he was a private scholar in Braunschweig and earned a doctorate at the University of Helmstedt. In 1807, Gauß became Professor for Astronomy and director of the observatory in Göttingen. The Law of Error ("Gaussian normal distribution"), discovered by Gauß, is among those achievements which are still widely known today. The invention of the first electro-magnetic telegraph is also owed to him. Carl Friedrich Gauß was made an honorary citizen of Braunschweig in 1849.

Culture and Communication

Renewable Resources

Information Technology

Optical Technologies & Metrology

Systems Biology

Mobility

In Profile

A Region in Motion

Mobility and transport technology, aviation and aerospace



Research in the name of aviation

How can a "metropolitan aircraft" that is safe, environmentally friendly, economical and easily usable by people without a long journey to airports look in the future? The first joint research venture at the campus research airport pursues the vision to conduct substantial amounts of air traffic within Europe from small, local city airports in the future. This will spare passengers long journeys to the airports that nowadays take longer than the actual flight.

The thought behind this is to improve the compatibility of new transportation aircraft with the needs of citizens in the metropolises through the integration of modern planes that only need short take-off and landing runways. Essential to this research programme is the demand for those planes to be environmentally sound, safe and economical. Researchers at the TU Braunschweig and the Deutsches Zentrum für Luft- und Raumfahrt, DLR (German Aerospace Center) are focussing on this problem by combining their diverse skills.

Together with partners from the Leibniz University Hanover they have founded the institution "Campus Research Airport". Aeronautics research at the research airport is going to serve the future mobility requirements of

our modern society. With today's complicated traffic systems, this can only work if the partners combine their fundamental and strategically important research projects. Together, State and Federal institutions, the Helmholtz Institute and the Technical University Braunschweig invest in new research buildings with the most modern equipment: These are the best qualifications for allowing the research infrastructure at the Braunschweig Research Airport to achieve an international top position within the next few years. ■



Photo: IFF TU Braunschweig

Contact

TU Braunschweig
Carsten Butzmühlen
Hermann-Blenk-Straße 27,
38108 Braunschweig
Phone: + 49 (0)531/391-98 22
Email: cff@tu-braunschweig.de
www.campus-forschungsflughafen.de



Photo: Flughafen Braunschweig / Wollburg GmbH



Photo: TU Braunschweig

Can Cars think?

Of course, they cannot but they are definitely becoming more "intelligent". Leonie, one of the research vehicles of the Technical University Braunschweig, drives autonomously through normal traffic along the city ring road. This car was developed by scientist of the TU Braunschweig at the Lower Saxony Research Centre for Automotive Technology NFF.

With a speed of up to 60 km/h on the dual carriageway of the city ring, the Passat that is fully loaded with high tech sensors and a high performance GPS receiver can stay in lane, make allowances for junctions, regard

obstacles as well as adjust distances and speed according to the flow of traffic. The course includes part of the Braunschweig city ring road and leads from Hans-Sommer-Straße to the intersection at Mühlentorstraße and back again. A safety driver in the car who can interfere if necessary is mandatory.

"Leonie does not only need to know all traffic rules but everything else that a human needs for driving a car. It needs to 'see' its environment, make decisions and autonomously use the gas pedal, the break pedal and the steering wheel. These first auto-



ous drives along the Braunschweig city ring are a milestone in development due to the realistic urban environment and form the basis for many more years of research”, says project manager Jörn Marten Wille.

With this project, researchers do not intend to shift responsibility away from the human drivers in the future, but instead, above all, they aim at improving driver assistance systems which have the purpose of making mobility, in particular in the cities, safer and more comfortable for us. At the new research complex of the NFF, in the immediate vicinity of the Campus Research Airport, research pursues a clear vision: to develop the “Metropolitan-Car”, a car for the city of

the future – Leonie is one of the outcomes of this major project. Cars should become intelligent, flexible and have low emissions in order to become widely accepted on urban roads in future. The objective of the NFF is to work on interdisciplinary research projects in the field of automotive engineering in close collaboration with partners of the industry and science sector. In addition, training programmes are to be offered with the purpose to train highly qualified young researchers for the automotive industry. The Federal State of Lower Saxony, the Volkswagen AG and the Technical University of Braunschweig are investing in the NFF together with other partners with top-level international research. ■

From Braunschweig into the rest of the world

Rail automation systems from Siemens Mobility

In the field of railway signaling systems, Siemens Mobility in Braunschweig is world market leader and the rail transportation think tank for both today and tomorrow. The rail automation systems developed by Siemens create the relevant conditions for safety, punctuality, speed and capacity both on open lines and at stations. They open up the way for trains in rail networks and determine just when and where trains have to run and how fast.

In signaling and control systems, Siemens has played a decisive role in the process of transformation from mechanical systems through to electronics and computer control. About 6,000 staff throughout the world are engaged in developing and producing operations control systems and monitoring, control and dispatching components for safe, efficient mass transit and mainline rail services. Today, the majority of staff is employed in software development, implementing innovative ideas for automation on all levels of rail infrastructure. These ideas can be used to achieve

benefits in terms of both performance and cost-effectiveness. In Germany, Siemens has demonstrated its competence by, for example, planning, developing and supplying German Railways’ seven operations control centres which control the entire nationwide mainline network.

Global market presence

However, it is not only on a national scale but also internationally that Siemens has made a name for itself worldwide by equipping numerous mass transit and mainline routes. For example, Siemens has supplied a complex operations control system for New York’s subway with an automatic train supervision system and rail automation systems for the metros in New Delhi and Bangkok and has also developed the entire control system for the 430 km/h Transrapid maglev line. Another major order has been the supply of the railway signaling system for the line from Beijing to the Chinese port of Tianjin. At present, Europe’s largest fully automatic marshaling yard in Maschen near Hamburg is being upgraded. Another project in Hamburg involves modernizing

Contact

Niedersächsisches Forschungszentrum Fahrzeugtechnik
 Dr.-Ing. Lars Bergmann,
 Langer Kamp 19, 38106 Braunschweig,
 Phone: + 49 (0)531/391-79 80, Email:
 l.bergmann@tu-braunschweig.de,
 www.nff.tu-braunschweig.de



two lines of the city’s metro system. Other current major projects include the implementation of a driverless metro line in Helsinki and the supply of an operations control system for one of Canada’s largest stations in Toronto. ■

Contact

Siemens AG
 Annette Lemke, Ackerstraße 22
 38126 Braunschweig
 Phone: + 49 (0)531/226-20 47
 Email: annette.lemke@siemens.com
 www.siemens.com/mobility

Searching for the Car of the future

Wind, water and sun – these renewable energy sources are meant to power the cars of the future. But it is probably going to take centuries before the questions that cause us such headaches today are going to be solved – from the adequate production and supply of renewable fuels right through to suitable in-vehicle battery technology. That the electric motor is the central drive for the near future is a fact for the car manufacturer based in Lower Saxony.

Besides alternative drive technologies further innovations are the focus of research. Vehicle-to-X communication stands for communication between different vehicles (Vehicle-to-Vehicle) as well as for communication between vehicle and infrastructure (Vehicle-to-Infrastructure). The exchange of information between different road users and the infrastructure is going to be an essential part of future modern traffic. Ideal traffic management – efficient traffic flow – will characterise the mobility of tomorrow in which we will move and be moved. Driver assistance systems will offer the driver an invariably larger spectrum of support and comfort functions.

The car of the future will help with single tasks (e. g. automatic parking) as well as with more complex tasks (e. g. automatic driving in stop-and-go traffic). By delegating driving tasks, the driver himself develops into an attentive observer who nevertheless has full responsibility for his vehicle at all times. ■

Contact

Volkswagen AG
Dr. Natascha Künstner
Assistentin Forschungsleitung
Konzernforschung (K-EF)
38436 Wolfsburg
Phone: + 49 (0)5361/9-22 03
Email: natascha.kuenstner@volkswagen.de, www.volkswagen.de



Photo: Ostfalia Hochschule



Photo: clearland-archiv/TU BS

Mission:

Eco-friendly Flying

Something can be done to reduce aircraft noise – scientists of the German Aerospace Centre are sure about this. They are determined to, not quite reinvent, but significantly improve the conventional aircraft design technically and in particular aerodynamically. For all the fascination the dream of flying may hold, there has always been one unpopular downside to it – aircraft noise. Perhaps this was not relevant in Lilienthal's time, but ever since engines and turbines were invented, flying has inevitably been accompanied by droning noise. When the German songwriter Reinhard Mey sings about "wet asphalt shuddering" it might still sound romantic, but anyone living in the immediate vicinity of an airport, will only ever love to hear the sound of a starting jumbo jet, when they themselves are travelling on board the aircraft – most likely less so any other time. The aircraft of the future should therefore be quieter! Oh yes, and fuel consumption should be more economic, too!

And this is where the dilemma, which the aerodynamic expert Heiko Freiherr Geyr von Schweppenburg is determined to solve, begins. Together with his colleagues at the DLR in Braunschweig, he is working on aircraft configurations which should be significantly quieter and additionally more economic to fly. This presents a dilemma as such since technically the solution to this scientific challenge entails reconciling conflicting requirements. One possible

approach in this direction would be to install engines above the wings, wherein the downwards reflection of sound could be avoided. The aircraft would fly with a sort of integrated noise barrier. This sounds ingenious!

By 2020, noise exposure and fuel consumption should be reduced by 50 percent. The European aircraft manufacturer Airbus commissioned this series of research projects and is therefore particularly interested in learning how the aerodynamic experts at the DLR in Braunschweig want to shape the air traffic of tomorrow. "Conventional aircraft configurations cannot serve this purpose", say the engineers and project a three dimensional display of the new designs on a special screen. Futuristic shaped models glide through virtual space." There is only little chance that such aircrafts will ever come onto the market without pressure from the German legislature, as their realisation requires enormous investments. Assembly lines need to be converted and the interior of the aircraft will see considerable change", notes Geyr von Schweppenburg, and yet he is convinced that this will be the future of aviation tests are carried out in wind tunnels to see to which extend technical designs are fit for purpose.

The adjustable arm holding the aircraft into the simulated airstream allows that any aircraft bank angle or angle of inclination can be tested. Test runs are recorded by com-

puter and camera, visualising the aerodynamic characteristics of the aircraft in each situation. But already in the virtual wind tunnel, which is a computer simulation of the airstream of the aircraft, countless calculations are carried out determining the exact form of the aircraft, such as for instance the form on the wings. And this is real basic research which does not only include designing new models, but also programming software suitable for calculating the data for the configurations. At the DLR it goes without saying that wind tunnels cannot be ordered and delivered just like other equipment, but instead they have to be elaborately constructed in painstaking detail and continuously adapted to new research areas. This task is carried out at the European DNW foundation (German-Dutch Wind Tunnels).

Some 6,900 staff members are working for the DLR in 33 institutes and facilities at 13 locations, focusing on issues concerning aeronautics, space, transportation and energy. Over 1,000 members of staff are working in Braunschweig, on premises in the immediate vicinity of the Braunschweig-Wolfsburg airport. Different research aircraft can take off and land at the airport, and contribute to resolving numerous issues in flight tests. The research aircraft ATTAS (Advanced Technologies Testing Aircraft System) is particularly versatile. With the aid of sophisticated technology, this aircraft can simulate any required aircraft

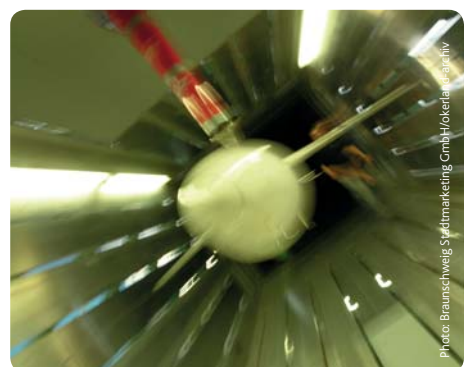




Photo: Braunschweig Stadtmarketing GmbH / okerland-archiv

in the air, up to an airliner five times its size. Thus every now and then and virtually unnoticed by the public, large airliners take off at the small airport in Braunschweig.

Apropos airliner! – What is more likely to awaken the urge to get away than those white vapour trails in the sky left behind by

» The application platform for intelligent mobility (AIM) is particularly exciting in Braunschweig. Here, the DLR in partnership with Lower Saxony, the city of Braunschweig and further partners creates a **unique opportunity for a network of research**, for the development and application of intelligent transport and mobility services. The future is created here – and we need to be part of it. «

Prof. Dr.-Ing. Johann-Dietrich Wörner, DLR

a holiday plane? But despite appearing seemingly harmless, those wake turbulences, which is the correct term for this phenomenon, are causing considerable difficulties for air traffic. Pilots of following aircraft are not always able to compensate the effects of those dreaded turbulences through pure manoeuvring skills. But luckily, planes are usually flying at dif-

ferent attitudes. However, on the ground this phenomenon sets clear boundaries to the utilisation of an airport. Safety margins must be observed for take-off and landing in order to prevent an aircraft from getting caught in the wake turbulences of a previous plane. At the DLR institutes in Braunschweig and Göttingen, experts are working on solutions to keep safety margins to a minimum. Wind speed is one factor which helps to disperse wind turbulences more quickly. If waiting times between starts were to be adapted according to prevailing weather conditions, then aircraft could take-off in more rapid succession than generally valid regulations allow. Any airport operator would be grateful for a few extra take-offs per hour.

And driving safely

The man-machine interface is one aspect which is not just interesting in regard to aeronautical issues. The DLR not only undertakes research on aviation and aerospace, aircraft-, helicopter-, and airport technology, on the same premises teams of scientists are also working on problems of road and rail transport.

Driver assistance systems are for instance developed with the assistance of psychologist- specifically focusing on human factors. The person behind the wheel is still considered the number one reason for car accidents. Assistance systems may provide relief and support to the driver and consequently contribute to increasing road safety. The evaluation of psychological tests with test subjects of all age groups demonstrated which type

of assistance serves the driver best in certain situations. For instance, a warning symbol lighting up, a bleeping audio warning or an active brake assistance system. In order to provide a basis, the normal driving behaviour of a test driver was analysed at the beginning of a test. Test drivers drive along real roads in a test vehicle while cameras are recording their eye movements. Using a driving simulator test drivers encounter prototypes of assistance systems during virtual drives. What happens, for example, if a car comes off the road? Psychologists establish how effective the individual systems really are in assisting the driver. Dangerous situations do of course not present a serious problem at the simulator: if you come across a tree in the road and drive into it, the drive still remains accident free.

In terms of rail traffic, the DLR undertakes research as to how technology and operation can be organised in an efficient and safe way. Currently a standardised train control system is being established across Europe, replacing a multitude of different rail systems still in use at present. The interaction of technologies will thereby be examined very carefully in the laboratory. ■

Contact

Deutsches Zentrum für Luft- und Raumfahrt
 Jasmin Begli, Lilienthalplatz 7
 38108 Braunschweig
 Phone: + 49 (0)531/295-21 08
 Email: DLR-Braunschweig@dlr.de
 www.dlr.de/braunschweig



Where research achieves a great deal

The Research Airport – Centre of Competence for Mobility Issues

An airport is normally a place where passengers arrive or take off. This is also the case at the airport Braunschweig-Wolfsburg (ICAO-Code: EDVE/IATA-Code: BWE). Under those circumstances Braunschweig is "only" a regional airport although besides Hanover the second one in Lower Saxony. With over 30,000 flights and over 100,000 passengers per year it has proven itself as an attractive and efficient partner, in particular in the business field. The maintenance department of the Aerodata AG, for example, offers a seven day service on over 3,600 sqm for a variety of aircraft types and is an official service centre for Hawker Beechcraft.

But there is another side to this "infrastructural facility", the research airport. The speciality of this airport is its internationally unique infrastructure with research planes, wind tunnels, simulators and test stands as well as the normal airport infrastructure combined in one place. A licensing authority like the LBA (Department of Aviation) and the BFU (Aircraft Accident Investigation Bureau) add to the network.

The Research Airport Braunschweig is one of the most innovative business and research clusters in Europe. With its portfolio that covers all types of transport it is developing into the leading centre of competence for mobility issues in Europe – for mobility/automotive, aviation, rail, certification and electric mobility. The scope of service reaches from fundamental research right through to application-oriented technology developments and trials. A visitor once stated: "People from Braunschweig like simulation." This cannot be contradicted. Simulation is an important issue in scientific institutions as well as in business enterprises.

For example, the company Simtec Simulation Technology GmbH is the producer of the world's only full flight simulators for the aircraft type Dornier 228 and uses this in the adjoining training centre. Pilots from all over the world come here to train. Simtec Systems GmbH is one of the world market leaders in the area of realistic simulation of complex movements in aerospace and vehicular traffic as well as in

the entertainment industry. The company is an excellent example for competence covering all types of traffic.

Mobility in all its forms is a basic need as well as a topic of the future. The growth forecast for aviation alone is impressive: six percent per year for the next 15 years. No other means of transport grows as quickly and combines as many new technologies. Carola Meyer, Managing Director of the Research Airport Braunschweig GmbH agrees with this: "Aviation is a key industry worldwide and a driving force for innovation in other areas. Important topics for the mobility economy like lightweight construction, new materials, simulation, communication, control and regulation, flight guidance, air traffic management, aerodynamics or new drive engineering are being developed and influenced substantially by the aerospace sector."

But all participants know that, despite the capability of all the enterprises and research institutions involved like the Technical University Braunschweig or the

German Aerospace Centre (DLR), this site can only move forward if all of them work together. Triple-Helix-Cluster is the key idea for the Research Airport Braunschweig: the close networking between the university and research institutions, trade and industry and public authorities. Projects are planned and executed with pragmatic team work in which particularly the smaller companies contribute substantially and are recognized as even partners. This is an ideal win-win situation, in particular for participation in Europe.

The name "Research Airport" is a perfect interpretation of what makes this location special: the effective link between research, science and trade and industry. Here an added value is created that adds up to far more than the individual achievements. Air traffic will double in the next 20 years. This growth of mobility needs, resource depletion and environmental pollution are important drivers for research and development activities for future flight systems. In order to use existing resources wisely and efficiently and to meet the needs of increasing traffic, interdisciplinary and networking solutions are necessary.

A good example for conserving resources are the products of the company Delair Air Traffic Systems GmbH. Delair is a global company founded in 1997 at the Research Airport Braunschweig and which offers innovative systems to optimize processes and

procedures at airports and in the surrounding airspace. Users of their systems are air traffic control, airport operators, airlines and handling agents. The company's software reduces holding patterns, arrival flight times and taxi times and optimises various air-side processes at the airport. This enables a reduction of fuel consumption as well as noise and pollutant emissions. Airports like Zurich, Frankfurt and Vienna already use these products developed by Delair.

The Research Airport also has several large-scale projects besides these products from different companies. The Campus Research Airport and the Lower Saxony Research Centre for Automotive Technology (NFF) are being developed on an area of over 34,000 sqm and with a financial investment of over 70 Million Euros. Here related sectors are moving closer together. The Campus Research Airport and the NFF are interdisciplinary centres for basic and application-oriented research. These two projects are already attracting more companies to relocate here. This helps to establish Braunschweig as an international centre for mobility and traffic and therefore making it a showcase for innovative methods and technologies.

A further component is satellite navigation and the associated trials, certifications and validations. Braunschweig dealt with this subject early on and in the year 1989 conducted the first fully automated GPS landing. Now Galileo is the main subject in satellite navigation.

Within the framework of the Campus Research Airport a Galileo laboratory is currently being built. Already in use is the AviationGATE, an experimental facility of the TU Braunschweig at the airport Braunschweig-Wolfsburg. Already AviationGATE simulates (long before the operational release of the Galileo system) real operating conditions for extremely precise aviation applications. The TU with its research planes and the DLR with its new flagship Airbus A320 ATRA (unique in Europe) already fly to prove the operability of new satellite supported systems.

Adding to this there have been the specialists of GAUSS (Galileo Centre for Security-relevant Applications, Certifications and Services). Their concepts and technical trials concentrate on ensuring that with the help of the new European satellite system Galileo, every technical move made at any place in the world is happening with the same degree of safety and dependability.

GAUSS in Braunschweig will certify the necessary appliances, software and operation procedures so that these can be used

worldwide. It will also ensure that, through the use of equipment certified by Galileo, substantial costs that still occur through essential aviation infrastructure facilities can be saved long-term.

The technical platform "Car 2 Car Communication" that is overseen by the ITS Lower Saxony is a source of hope for safer road traffic. The DLR, the TU Braunschweig and besides Volkswagen all other German automobile producers are involved in the development of this intelligent, automatic data communication between adjacent vehicles on the road. The aims of these driver assistance systems are the avoidance of accidents, the equalisation of traffic jams and an optimal user friendliness for the cars of tomorrow. The ITS Niedersachsen in Braunschweig also deals with the current topic eCall which will introduce an onboard automatic/manual emergency call for vehicles.

These examples show that the Research Airport is indispensable as a driving force for the economy in this region. In times where a lack of specialists is becoming more and more of a problem the Research Airport will become even more important. It will be crucial to gain "High Potentials" and "Creative Class People" for the Research Airport, to tie them to this location and by doing so to help strengthen the innovation potential of this region.

The expansion of the Avionik Clusters includes, besides the lengthening of the take off and landing strip, a further extension of the commercial areas to approx. 136,000 sqm. These commercial buildings are tendered for companies in the fields of aerospace as well as aviation technology. This will ensure a target-oriented development of the Research Airport.

Currently the Research Airport secures more than 2,000 highly qualified jobs and more than 4,000 in the surrounding area. The number of employees at the Research Airport has risen from 1,600 to 2,000 in the years 2004 to 2010 and the success story continues. ●



Photo: Braunschweig Stadtmarketing GmbH / Okerlandarchiv

Contact

**Forschungsflughafen
Braunschweig GmbH**
 Carola Meyer, Lilienthalplatz 5
 38108 Braunschweig
 Tel: +49 (0)531/362 60-101
 Email: info@researchairport.com
www.researchairport.com



Photo: Braunschweig-Stadtmaking GmbH / oberland archiv

Transport Competency Cluster Research Airport

All around the runway of the research airport Braunschweig, a large number of future-oriented institutions have teamed up in a high-technology cluster of international standing. A close-knit network has developed in which science, federal authorities and businesses cooperate successfully. More than 2,000 employees are working in the growing sector of air and road safety. The qualification of the European satellite system Galileo for safety critical applications is a key concern within the European competition.

Modelled on Nature

Biotechnology and Systems Biology

Modelling instead of experimenting

At the "Centre for Systems Biology", Braunschweig's research institutions have joined forces to try and model biological processes.

Trying out a just designed aircraft to see if it can actually fly? No engineer would dream of doing that. "Modelling instead of experimenting" – this trend not only applies for engineers, but also to biology. It is over 100 years ago since mathematical methods have been first used to describe the principles of physics and chemistry and make processes predictable.

» Braunschweig is the one location in Germany, where **all necessary areas of expertise converge.** «

Dieter Jahn, Technical University (TU)

This knowledge forms the foundation of modern engineering. Now it is biology's turn. With the aid of computer simulations, systems biology is trying to predict crucial details of the infinitely complex biological processes happening in a cell: thousands of proteins metabolise nutrients, regulate growth and protect the cell against heat or stress. "With our experiments and models, we want to try and understand the essential principles of life", Dieter Jahn, head of microbiology at the Technical University of Braunschweig, defines the objective. Braunschweig's research institutions have joined forces in order to be able to compete in this innovative area. Their project: to predict what is going to happen when a bacterium infects a cell.

"Braunschweig is the one location in Germany, where all necessary areas of expertise converge", Dieter Jahn is convinced of this. The Technical University (TU) brings in its tradition of engineering education, the expertise of computer scientists, mathematicians,

biologists, chemists and physicists. The Helmholtz-Centre for Infection Research (HZI) contributes with its knowledge on pathogenic bacteria and the human immune system. With the German Collection of Microorganisms and Cell Cultures (DSMZ), Braunschweig has the worldwide largest selection of microbial life on hand. Securely sealed, over 17,000 bacteria cultures are archived here as lyophilized cultures or stored in liquid nitrogen. Using systems biology methods, one work group is investigating how viruses in turn infect and kill bacteria. "Maybe we can learn something from these viruses to help us combat pathogenic bacteria", hopes Sabine Gronow, microbiologist at the DSMZ.

Explaining regulatory principles inside human cells is the business of Biobase. Founded in 1997 by scientists of the Gesellschaft für Biotechnologische Forschung (GBF), the name of the HZI at the time, the Wolfenbüttel-based provider of scientific services was soon amongst the fastest growing technology companies worldwide. Meanwhile, 130 experts in Germany, the USA, India and Japan are working for Biobase. "But we will never abandon the 'Made in Germany' label", promises co-founder Holger Karas.

Biobase also distributes the data base "Brenda", in which Dietmar Schomburg, head of bioinformatics at the TU collects all noteworthy information on enzymes. These proteins regulate and catalyse metabolism, and with that consequently also everything from utilisation, to nutrients, to the formation of growth factors. "Brenda is an intelligent data system", explains the bioinformatics engineer. The user displays a chemical structure on the computer screen and Brenda knows which enzyme can metabolise this substance. The Biobase founder Edgar Wingender is con-

vinced that "the future lies in providing data bases together with user interfaces to solve the problem". From here it is only a few steps to the simulation of processes. Thus, it is, for instance, predictable how cancer cells grow and, with the aid of a model, possible to seek the best moment to intervene. "We biologists", says Dieter Jahn, "are leaving behind the times of accumulating and describing scientific evidence. We are now beginning to comprehend". ■

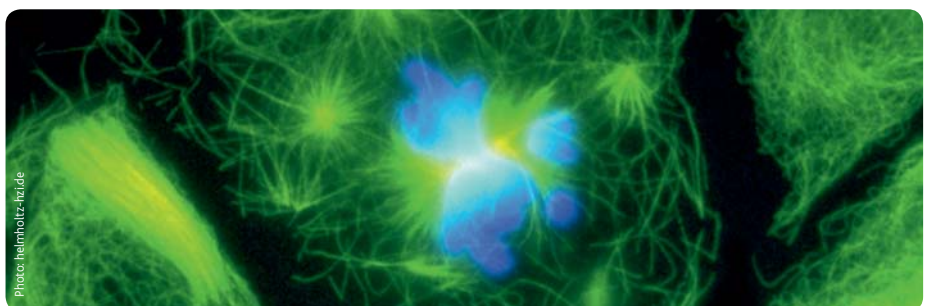
Contact

BIOBASE GmbH, Prof. Dr. Edgar Wingender, Hauptsitz: Halchtersche Straße 33, 38304 Wolfenbüttel
Phone: + 49 (0)5331/85 84-0, Email: info@biobase-international.com
www.biobase-international.de

Deutsche Sammlung für Mikroorganismen und Zellkulturen (DSMZ), Milena Wozniczka, Inhoffenstraße 7 B, 38124 Braunschweig
Phone: + 49 (0)531/26 16-3 00, Email: milena.wozniczka@dsmz.de
www.dsmz.de

Helmholtz-Zentrum für Infektionsforschung (HZI), Manfred Braun, Inhoffenstraße 7, 38124 Braunschweig
Phone: + 49 (0)531/61 81-14 00, Email: manfred.braun@helmholtz-hzi.de, www.helmholtz-hzi.de

TU Braunschweig, Dr. Elisabeth Hoffmann, Pockelsstraße 14, 38106 Braunschweig, Phone: + 49 (0)531/391-41 22, Email: e.hoffmann@tu-bs.de
www.tu-braunschweig.de





Thriller Scene: Cropping Soil

Braunschweig's researchers keep guard on the safety in agriculture

The truth lies in the soil. You literally have to rifle through soil, if you want to understand how tens of thousands of different bacteria, fungi and protozoa are working together interdependently to degrade fertiliser and pesticides, produce compost, and fight against pathogens in the rhizosphere of plants. Only through the analysis of DNA has it become possible to track them down. "It's like in a TV-thriller, we are detecting individual genes which lead us to the identity of the microorganisms", says Dr. Christoph Tebbe, team leader of the department for Microbiology and Molecular Ecology at the Johann Heinrich von Thünen-Institute (vTI). Braunschweig's researchers at the vTI, HZI, and JKI were amongst the first worldwide, who were capable of purifying soil DNA of impurities, such as humic acids in particular, and using fingerprinting techniques to study soil microorganisms", states Dr. Kornelia Smalla of the Julius Kühn-Institute (JKI).

With the aid of these methods Dr. Kornelia Smalla can track down antibiotic resistant genes in soil microorganisms. Over a period of seventy years in which antibiotic use was unrestricted, bacteria which were naturally resistant to antibiotics had a clear survival advantage. Since bacteria are able to pass DNA from one bacterium to another, they can pass on their defence mechanism through horizontal gene transfer. Now Dr. Smalla has proven that this kind of gene exchange booms in soils fertilised with liquid manure containing antibiotics.

The team of Dr. Christoph Tebbe analyses soils on which genetically manipulated maize was cultivated. Transgenic maize produces Bt toxins, an agent against crop pests. After the harvest, part of the agent remains in the field, first contained in crop roots later on in the soil. "By using highly sensitive detection methods we can detect traces even in the nanogram range



Photo: Braunschweig, Stadtmarketing, GmbH/Hoteland-archiv

(0.000 000 001 g), amounts far below any biologically effective dose." These data are important in the safety assessment of genetically engineered plants, before farmers cultivate such plants. Dr. Tebbe gives reassurance: "Bt-maize has a lower negative environmental impact than conventional pesticides." Sometimes one has to rifle through.

The in 2008 newly established Federal Research Centres JKI and vTI have their origins in two institutions that have a long tradition in Braunschweig: the Federal Biological Research Centre for Agriculture and Forestry (BBA) and the Federal Agricultural Research Centre (FAL). ■

Contact

Julius Kühn-Institut (JKI) – Bundesforschungsinstitut für Kulturpflanzen, Dr. Gerlinde Nachtigall, Messeweg 11 38104 Braunschweig, Phone: + 49 (0)531/299-32 04, Email: gerlinde.nachtigall@jki.bund.de, www.jki.bund.de

Johann Heinrich von Thünen-Institut (vTI) – Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei Dr. Michael Welling, Bundesallee 50 38116 Braunschweig, Phone: + 49 (0)531/596-10 16, Email: michael.welling@vti.bund.de, www.vti.bund.de

Braunschweig

Integrated Centre for Systems Biology (BRICS)

The huge technological and methodical progress made over the past years has opened up entirely new opportunities and chances to investigate and understand biological systems in their entirety. Research is mainly focused on studying the dynamics of biological systems, their components and architecture. By linking experimental biological functional analysis (genomic research) and computer-aided bioinformatics analyses (bioinformatics), the development of drugs and therapies can be approached from an entirely new angle. By developing suitable mathematical models it becomes possible to model biological processes and simulate changes in these processes, to discover new purposes for therapeutics and vaccines and develop these further for medical use and application within the biotechnological industry.

For this reason, the Helmholtz-Centre for Infection Research and the Technical University of Braunschweig are planning to establish a joint centre for systems biology, the BRICS (Braunschweig Integrated Centre for Systems Biology) within the framework of TRAIN (Translation Alliance Lower Saxony). The aim of this centre is to explore the dynamics and regulatory processes within complex biological systems. The centre is to be closely linked with the research activities of experimental biology and chemistry, as well as engineering sciences (cybernetics, institute for scientific computing, informatics). The new BRICS-complex does therefore primarily serve the purpose of bringing together research teams from different scientific disciplines like life scientists, computer scientists, mathematicians and engineers. The centre will make use of cutting edge technologies for genome analysis and bioinformatics in order to ensure internationally visible research.

For the first time, university and non-university research institutions are pooling their expertise and infrastructure within TRAIN in order to push forward the development of active substances and vaccines. To ensure efficient management of the translation process from basic research to clinical trial, close collaboration between partners is indispensable in such a highly interdisciplinary approach. Three infrastructure projects are therefore realised first, namely the Centre for Systems Biology (BRICS), an R&D Centre



The TRAIN partners
The Translation Alliance Lower Saxony (Translationalallianz Niedersachsen, TRAIN) is an association of following partners:

- Helmholtz-Centre for Infection Research (HZI)
- Leibniz University of Hanover (LUH)
- University of Veterinary Medicine Hanover (TiHo)
- Technical University of Braunschweig
- Fraunhofer Institute for Toxicology and Experimental Medicine in Hanover
- Hanover Medical School (MHH)

Contact

Helmholtz-Zentrum für Infektionsforschung (HZI), Manfred Braun
Inhoffenstraße 7, 38124 Braunschweig
Phone: + 49 (0)531/61 81-14 00,
Email: manfred.braun@helmholtz-hzi.de, www.helmholtz-hzi.de

for active substances and a clinical research centre (HCTM), which will enable interdisciplinary research at the interfaces of research areas and translation phases. They represent integral elements of the TRAIN concept and complete strategically and operationally the existing research landscape with the help of the complementarity of their expertise and research approaches. ■

Contact

TU Braunschweig
Dr. Elisabeth Hoffmann
Pockelsstraße 14, 38106 Braunschweig
Phone: +49 (0)531/391-41 22
Email: e.hoffmann@tu-braunschweig.de, www.tu-braunschweig.de



Virus Hunters

At the Helmholtz Centre for Infection Research scientists study mechanisms of infectious diseases and defence mechanisms against infections. Understanding these mechanisms will contribute essentially to combating infectious diseases with the aid of new drugs and vaccines.

Precision on the Smallest Scale

Optical Technologies, Microsystems Technology and Surface Technology

The research region Braunschweig "illuminates" the future

While aircraft engineering and aerospace technology are in charge of "the big stuff", other institutions in the region bring research back "to the surface". Microstructures must be measured to be, for instance, ready for use in the latest computer technology. And whoever hears the term "measuring" in Braunschweig will immediately think of the Physikalisch-Technische Bundesanstalt, PTB (National Metrology Institute).

Makes the scale bar ever smaller: The National Metrology Institute, PTB

Described as the "guardian of units", the institute is not only in charge of the exact determination and transmission of legal time, but also different kinds of measurements, including measurement of surfaces with the aid of light. Measuring experts apply the technique of optical form measurement for flat, non-structured surfaces. Even on irregular lenses such as the ones used in mobile phone cameras or spectacle lenses, surface roughness in the sub-nanometre range can be quantified by using specific measuring methods – this is the equivalent to measuring the curvature of the earth on the surface of a muesli bowl!

» A novel atomic force microscope measures even millimeter-sized areas at nanometer resolution making PTB a worldwide leader in this field. «

Dr. Hans-Ulrich Danzebrink, PTB

Things are getting more complicated whenever the structures on surfaces – for example on modern computer chips – are getting so small that light waves are too large for the small interspaces. With wavelengths between 400 and 700 nm, visible light is too coarse for the much smaller conductive paths of the latest generations and therefore practically useless. So-called scanning probe microscopes

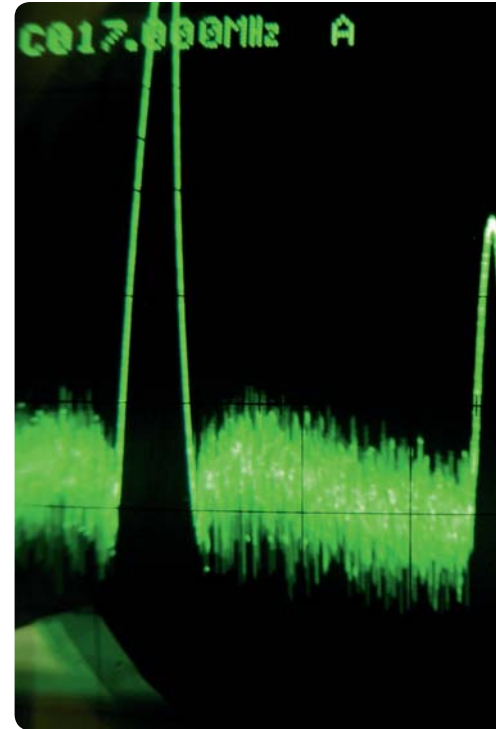
are needed for this purpose which scan the surface with tiny sensors (ideally of atomic size). These "sensed" data can then be used to calculate the exact image of the surface. Not only the semiconductor industry but also, for instance, the chemical industry use such microscopes to make the development of innovative lacquers possible, which can produce different colours depending on the type of light used. They can be used for troubleshooting in microproduction and even the cosmetics industry applies such microscopes. At the end of the day, what manufacturers actually want to know is just how well their new anti-wrinkle cream can really reduce the appearance of wrinkles ...

"A novel atomic force microscope measures even millimeter-sized areas at nanometer resolution making PTB a worldwide leader in this field", explains Dr. Hans-Ulrich Danzebrink, head of the working group Quantitative Scanning Probe Microscopy, who also likes to exercise his artistic talent and in 2007 received the award Best "Nano-film" for his short film "Dimensionen".

Film classics with a twist: Braunschweig and the computer of tomorrow

Also in the field of data storage, one of the most important innovations, the so-called MRAM (Magnetic Random Access Memory) comes from the PTB. The measuring experts developed this new technology which, in contrast to the currently used types of memory, records digital data through magnetic storage by aligning specific magnetic cells. This technology would allow data to be preserved even if the power supply was interrupted and the time-consuming boot process to restart the computer could thus be omitted. At the moment, intense efforts are made to optimise the concept of the MRAM in order to realise this concept as soon as possible.

In the field of quantum optics the PTB works on the development of single-photon light sources. Taking advantage of the quantal nature of light, information can be transmitted which is tap-proof due to the fact that any "eaves dropping" will leave visible marks at the receiving end.



"In the future if the viewer doesn't want Ben Hur to die at the end of the feature film, he can simply choose one of several endings which are transmitted simultaneously, providing there is enough bandwidth available. Optical technology provides the opportunities necessary for this as well as for future optical computers with their expected increase in speed. Just like the 20th century has been the century of the electron, without which, for instance, computers would not exist, the 21st century will be the century of the photon. And at the PTB, we have the necessary measuring technology available which is required for high-energy lasers as well as for testing the newest generation of light sources", says Dr. Fritz Riehle, head of the department of optics, pointing out the significant role of the federal institute.

Future made in Lower Saxony: Innovations of the Technical University Braunschweig

Among future light sources are the so-called organic light emitting diodes (OLEDs), studied and developed at the Technical University of Braunschweig. OLEDs consist of organic,

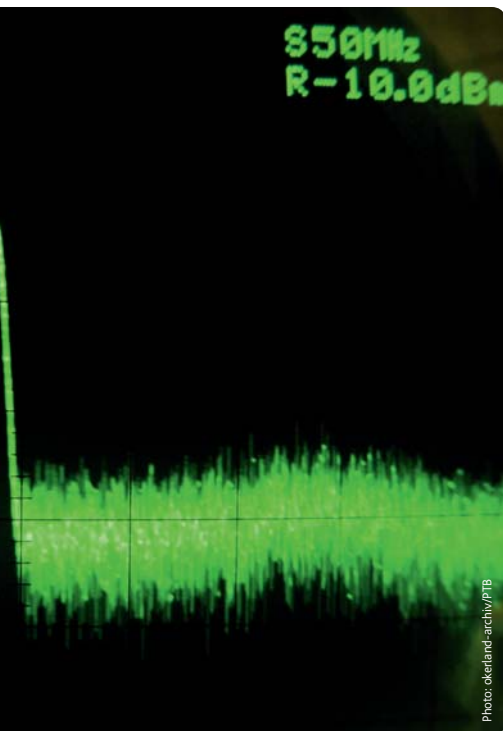


Photo: okerland-archiv/PTB

semiconductive materials which can be attached to practically any surface. In contrast to conventional LED screens OLEDs do not require a backlight to function and can be produced cost-effectively. Mobile phone batteries could operate a lot longer on the same charge since without backlight OLEDs use far less energy. After finishing a presentation, the speaker would simply have to roll up his screen and tuck it under his arm. During the journey home, as if by magic, a traffic jam alert would appear on the inside of the windscreen ...

Application possibilities of OLEDs for current and future display technologies are already very versatile. Moreover, how would you like it, if a film consisting of countless luminous dots would regulate the lightning according to your mood? Cold light for work, and warm red light to relax in your leisure-time – the light release of the OLEDs could be varied as required. This new form of illumination may well be replacing the conventional light bulb within the next few years, wherein the research region Braunschweig will play a decisive role. ■



Contact

Physikalisch-Technische Bundesanstalt (PTB), Dr. Dr. Jens Simon
 Bundesallee 100, 38116 Braunschweig
 Phone: + 49 (0)531/592-30 05, Email:
jens.simon@ptb.de, www.ptb.de

TU Braunschweig, Dr. Elisabeth Hoffmann, Pockelsstraße 14, 38106 Braunschweig, Phone: + 49 (0)531/ 391-41 22, Email: e.hoffmann@tu-braunschweig.de, www.tu-braunschweig.de



Photo: okerland-archiv/PTB

A Game of Nano-Billiard for the Industry: A worldwide unique tool at the Fraunhofer Institute for Surface Engineering and Thin Films

The Fraunhofer-Institut für Schicht- und Oberflächentechnik, IST (Fraunhofer Institute for Surface Engineering and Thin Films) is involved in the development of techniques for the production and encapsulation of new illumination and display technologies. This "stronghold of plasma technology" plays a leading role in the field of surface coating. How can flexible, extremely thin coatings be applied onto all kinds of surfaces? Experts of the IST pool their expertise in the field of plasma technology in a worldwide unique way to provide customised solutions for specific problems concerning coatings at subatomic level. A process referred to by engineers as "sputtering" allows the detachment of individual atoms with the aid of plasma. Like in the opening move of a game of billiard, the atoms of solid state bodies are physically knocked loose in order to be reassembled under vacuum conditions. For example, for a silver coating of 12 nm thickness researchers stack approximately 30 atoms on top of each other. If these atoms are then recombined in different ways while new components are added, new characteristics will ensue. This way it is possible to apply scratch-resistant coatings to the paint of a car, put very slender displays in position or attach thin insulating films to window glass. The IST is also one of the first ports of call in the field of complex multilayers. The integration of tiny sensors into the thinnest possible surface allows, for instance, the production of an "intelligent work bench", which can measure temperature, pressure or rotation speed electrically

and initiate measures accordingly so that tools and machines can be utilized more efficiently than before. High competence in the field of microsystems technology thereby facilitates the manufacturing and processing of extremely small components which have to be inserted into the "skin of a machine".

The head of the IST, Prof. Dr. Günter Bräuer is also the head of the Institute of Surface Technology at the TU, and due to this dual role basic research and teaching can be better coordinated across the field of coating technology and plasma-based production.

When individual particles come together and become an entity: Combined strengths and a central port of call

An increased collaboration between the TU Braunschweig and the PTB has brought the Joint Optical Metrology Center (JOMC), a joint research centre, into being. The purpose of the joint project is to improve and elaborate measuring techniques and equipment primarily in the visible and infrared range.

"At the TU alone there are countless institutes working in this field, and the PTB, in its role as national measuring institute, is naturally also strongly represented in this sector. Thus the JOMC was created to pool existing potential and promote knowledge transfer, joint projects and productive exchange. The combination of TU and PTB provides unique possibilities. Above all, amongst the large number of addresses, it provides a first port of call to the industry, making excellent use of the advantages all these facilities have to offer", says Prof. Dr. Wolfgang Kowalsky, spokes-

man of the JOMC and Head of the Institute for High-Frequency Technology at the TU. In 2005, the Centre for Microproduction (ZeM-Pro e.V.) based in Braunschweig was founded linking different activities in the field of microsystems technology in a similar way. University institutions, research institutes and companies from Lower Saxony and further afield work together on fundamental research, on the production and the use of ultra modern micro technologies, like the silicon-bulk-micro-mechanics, surface treatment, micro-assembly and the connection and build-up-process.

This way, individual research institutions increasingly come together to form an entity which, like an OLED, sheds new, future-oriented light on Braunschweig's individual research institutes illuminating even the "smallest details"... ■

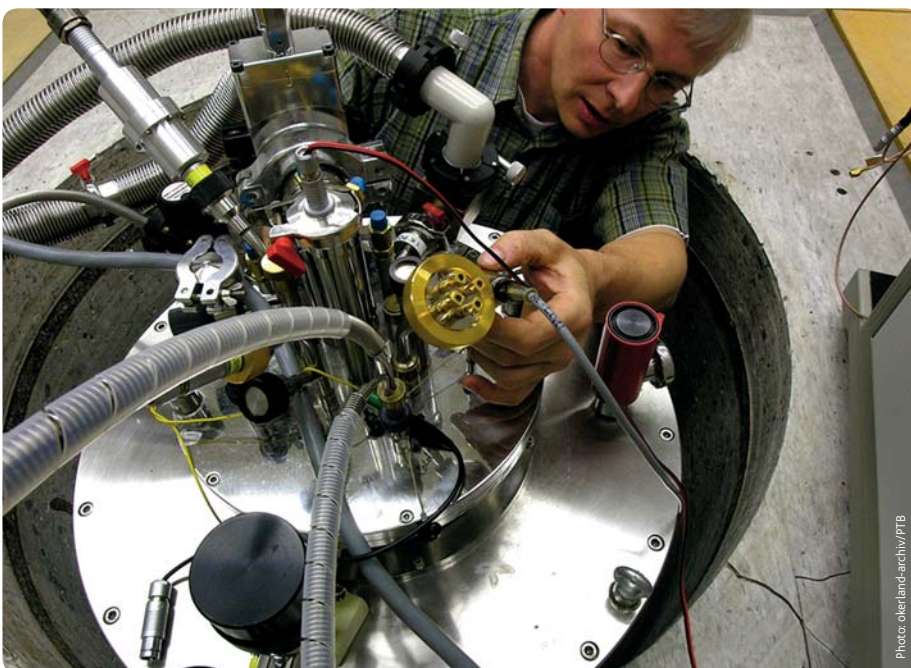
Contact

Fraunhofer-Institut für Schicht- und Oberflächentechnik (IST)

Dr. Simone Kondruweit, Bienroder Weg 54 E, 38108 Braunschweig
Phone: + 49 (0)531/21 55-5 35
Email: simone.kondruweit@ist.fraunhofer.de, www.ist.fraunhofer.de

JOMC, c/o Technische Universität Braunschweig, Fakultät für Elektrotechnik und Informationstechnik Hans-Sommer-Straße 66, 38106 Braunschweig, Phone: + 49 (0)531/ 391-77 96 Email: fk5@tu-bs.de www.tu-braunschweig.de/eitp/jomc

Zentrum für Mikroproduktion e.V.
Dr.-Ing. Monika Leester-Schädel
c/o TU Braunschweig, Institut für Mikrotechnik, Alte Salzdahlumer Str. 203, 38124 Braunschweig, Phone: + 49 (0)531/391-97 81, Email: m.leester@tu-bs.de, www.zempro.de



On the Same Wavelength

Information and Communication Technologies

The information and communication sector of the region is looking optimistically into the future. Business and science are working closely together when it comes to pushing technical developments in telecommunication – from big corporations like Intel to small and medium-sized businesses to universities. They are no bigger than a thumbnail. A silver artwork adorned with very fine lines. And yet: these tiny structures – the so-called chips – ensure that we can nowadays store and handle millions of data on our computers without giving it another thought. The chip production is part of the daily business of Intel: The worldwide largest manufacturer in the semiconductor development sector produces thousands of these modules. “The cost to develop such microchips nowadays can run to several 100

million dollars”, explains Nikolaus Lange, Engineering Director of Intel, Germany.

The market pressure is enormous – even a global player like Intel is feeling the effect of this. Companies in this sector are meanwhile operating from quarter to quarter. Intel invests almost six million dollars in research and development every year, and has continued to expand its site at Braunschweig since the year 2000 in order to cope with the ever shorter development times of innovations. Today, this site is one of Intel's largest chip research centres in Europe. Its research is focused on multi-core processor architectures. Instead of one or two cores, these processors possess even more than one hundred cores. “Multi-core processors will enable us to achieve the so-called terascale computing”, predicts Niko-

laus Lange. Better processing power in the future will be particularly interesting for the computer games industry and high performance computers. “Terascale computing

» We are heading in the right direction in the region. «

Nikolaus Lange, Intel Germany

allows completely new applications, for example, in the graphics sector”, says Lange. “By increasing the performance tenfold or hundredfold significantly more detailed and realistic graphics can be achieved”. In addition, Intel cultivates its future experts



Photo: cleveland-archiv/TU BS



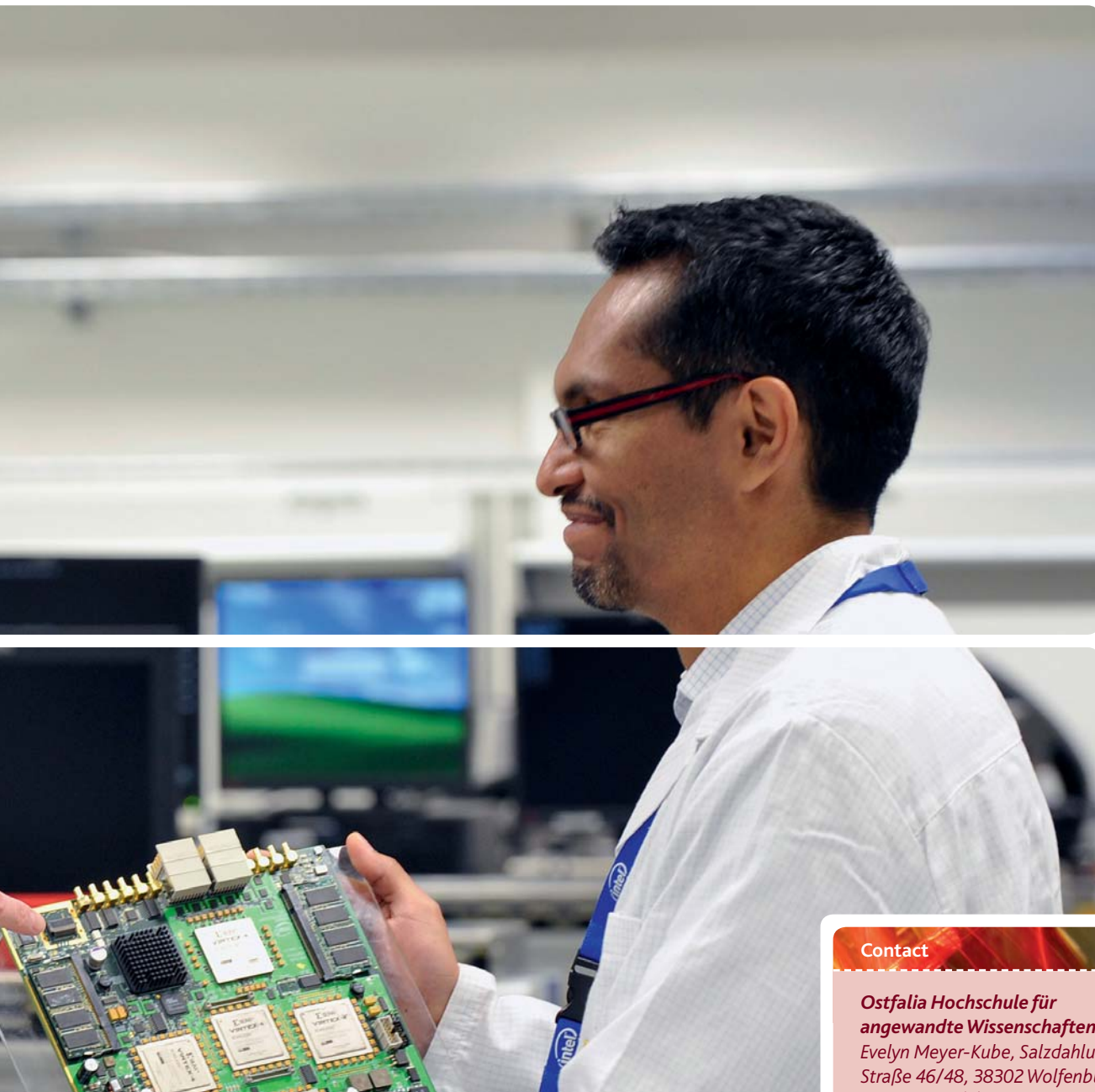
at the Technical University of Braunschweig. Since 2004 the degree programme “Advanced VLSI Design”, which is tailored to the particular needs of the semiconductor industry, is sponsored by Intel. “Both sides can benefit from this”, explains Nikolaus Lange: it allows Intel to counteract the imminent shortage of specialists while the highly practical orientation of the course makes it easier for graduates to embark on a professional career later on. “We are heading in the right direction in this region”, is Nikolaus Lange positive verdict on the potential. The Intel® Leibniz Challenge has been set up by Intel Braunschweig in collaboration with the Leibniz University Hanover and is aimed at pupils in year 9 to 13 at high schools, vocational high schools as well as comprehensive schools. The contest seeks to convey a better understanding of the job profile of an engineer and wants

to raise pupils’ interest in heading towards a career in the technical sector. The American company is also currently working together with Volkswagen AG in the field of car communication.

Emerging from the shadow of the automobile industry

Not only a giant like Intel, but also Professor Dr. Diederich Wermser from the Ostfalia University of Applied Sciences has an optimistic view on regional developments in the information and communication technology sector. The 56-year-old is spokesman of TELIAISON. This association was founded in 2004 and includes two universities, six companies and a competence network – all of which are well-positioned in the field of

telecommunication. “The name TELIAISON might sound a little bit bulky”, admits Prof. Diederich Wermser, “yet the word ‘liaison’ suggests what the association wants to be: an exciting business relationship.” TELIAISON was born on board of a plane. While travelling regularly between Munich and Braunschweig, Wermser frequently got into conversation with representatives of small and medium-sized businesses and came to the conclusion that “the sector needs to be led out of the shadow of the powerful regional car industry.” Wermser: “Information and communication technologies play an enormous role worldwide, and also in the Braunschweig region”. In order to strengthen market recognition, produce synergetic effects, and achieve better perception through a joint market presence, TELIAISON was founded six years ago by its members. According to its spokes-



man "Not from a position of weakness, but from a position of strength: with an annual turnover of approximately 182 mill. EUR between them, the companies are doing very well financially".

Currently the companies Auerswald, BCC, Brunel, eck*cellent IT, the Institute for Applied Radio Systems Technology (IAF), Netzlink as well as the ITS Lower Saxony, the Technical University Braunschweig and the Ostfalia University of Applied Sciences are participating in the consortium.

From November 2009 onwards, TELIAISON has taken over the responsibilities of the ikn2020-cluster manager for Braunschweig and the region. The Lower Saxony initiative ikn2020 is a nationwide network of institutions with similar interests in the informa-

tion and communication sector. With the help of 8 regional locations cooperation and similar interests between companies are developed. This is important as the information and communication technology is a crucial element for the efficiency of the economy. TELIAISON is committed to the leading issue of "next generation networks".

What about promoting young talents? "TELIAISON specifically wants to promote graduates", stresses Wermser. "Qualified people have excellent career opportunities in the IT sector, but women in particular are still hesitant to study for a degree in this field". The joint presence of the TELIAISON partners on the market also serves to emphasise the attractiveness of the sector. ■

Contact

Ostfalia Hochschule für angewandte Wissenschaften

Evelyn Meyer-Kube, Salzdahlumer Straße 46/48, 38302 Wolfenbüttel
Phone: + 49 (0)5331/939-1 01 50
Email: info@ostfalia.de
www.ostfalia.de

Intel, Nikolaus Lange (Entwicklungsleiter), Theodor-Heuss-Str. 7, 38122 Braunschweig, Phone: + 49 (0)531/866-61 01, Email: nikolaus.lange@intel.com, www.intel.com

TELIAISON, Prof. Dr.-Ing. Diederich Wermser, Theodor-Heuss-Straße 2, 38122 Braunschweig, Phone: + 49 (0)531/707-34 55 Email: info@teliaison.de, www.teliaison.de

TU Braunschweig, Dr. Elisabeth Hoffmann, Pockelsstraße 14 38106 Braunschweig, Phone: + 49 (0)531/391-41 22, Email: e.hoffmann@tu-bs.de, www.tu-braunschweig.de



Photo: Rüdiger Möller



Joint Optical Metrology Center (JOMC) – unique nationwide

The JOMC is a joint research centre of the Technical University of Braunschweig and the National Metrology Institute (PTB) in Braunschweig. Under the umbrella of JOMC, professors of electrical engineering of the TU Braunschweig and the Optics Department of the PTB are working together on the research and development of optical measuring technology.

Using Green Energies

Agriculture and Renewable Resources



A pipeline is leading the way

Braunschweiger Wissenschaftler forschen nicht nur an alternativen Energien, sie nutzen sie auch. Die Physikalisch-Technische Bundesanstalt (PTB) und das Johann Heinrich von Thünen-Institut (vTI) werden mit Strom und Wärme, gewonnen aus nachwachsenden Rohstoffen, versorgt. Das Einzigartige daran: Die Öko-Energie Biome- than wird durch Deutschlands erste Biogas- Pipeline über 20 Kilometer in ein Blockheiz- kraftwerk transportiert.

Das Biogas-Pilotprojekt des Braunschweiger Energieversorgers BS|Energy und des Abwasserverbandes Braunschweig besitzt Vorbildcharakter, da es eine Brücke zwischen ländlicher Biogaserzeugung und städtischer Biogasnutzung schlägt. Der große Gewinn: Die Wärmeenergie wird dort produziert, wo sie auch Abnehmer findet. Sie geht nicht verloren. BS|Energy plant, weitere Land- wirte an die Gasleitung anzubinden – und in wenigen Jahren ein komplettes Biogas-Netz zu betreiben. ■

Biomass as a Source of Energy

The problem with renewable energies is that they are depended on weather conditions (e.g. wind, photovoltaic and solar thermal systems). Biomass, however, can be stored and therefore be used continuously. But as cultivated areas are limited, the provision of large amounts of biological material is a task for the future.

In the past three years several projects were in progress at the CUTEC Institute to make agricultural by-projects and waste available for the use of energy. An exem- plary by-product was wheat straw that accrues in large amounts in Lower Saxony and Saxony-Anhalt. The aim of this devel- opment was to chaff wheat straw that was delivered in bales, to pneumatically convey

it and to enter it into a gas generator to produce high-calorific syngas. Mono gas- ification of chaffed wheat in a circulating fluidized bed that is robust and principally suitable for a large range of fuels was dem- onstrated successfully – for the first time worldwide – in a continuous operation of over 250 hours. In the course of this devel- opment several problems had to be over- come: the development team had to get to grips with the enormous power that is built up by chaffed wheat in ton sizes, the error messages in the sensors caused by single stalks had to be eliminated and the trans- port of the straw into the gas generator by gastropods had to be improved upon.

A by-product of this enterprise, that was financed by the Volkswagen AG and die NBank of Lower Saxony, was the use of algae that are a world-wide problem at inhabited sea shores. These are moist, contain a lot of salt and consist of totally different types of algae. In Clausthal they managed to produce syngas from these dried and chopped algae. Unfortunately, the energy efficiency was insufficient. They discovered that despite substantial sieving the structure of some algae types (probably diatoms) consists out of thermally stable SiO₂ (raw material of sand) so that 40-50 percents of the biomass leave the reactor as ash. The salt, however, does not impede the process. Should it be possible in the future to collect the algae in such a way that the diatoms can be left out, this waste product could be very at- tractive for thermal recycling. ■

Contact

Johann Heinrich von Thünen- Institut (vTI), Dr. Michael Welling
Bundesallee 50, 38116 Braunschweig
Phone: + 49 (0)531/596-10 16, Email: michael.welling@vti.bundl.de, www.vti.bund.de

Physikalisch-Technische Bundes- anstalt (PTB), Dr. Dr. Jens Simon
Bundesallee 100, 38116 Braunschweig,
Phone: + 49 (0)531/592-30 05
Email: jens.simon@ptb.de, www.ptb.de



Contact

CUTEC
Dr. Thomas Heere, Leibnizstraße 21 +
23, 38678 Clausthal-Zellerfeld
Email: thomas.heere@cutec.de
www.cutec.de

Little Helpers on a big Mission

It has a certain charm that the smallest of all come to the rescue to tackle the big problems in the world. Researchers of the Johann Heinrich von Thünen Institute (vTI) in Braunschweig have realised the importance of those tiny helpers, and the vTI Institute of Agricultural Technology and Biosystems Engineering is guarding their valuable microorganisms day and night. "We put in a huge amount of effort to ensure that bacteria do their job", says Professor Klaus-Dieter Vorlop, director of the institute. The mission of these little helpers is as tricky as it is important; Their job is: to keep up the recycling of nutrients from renewable resources, to vitalise white biotechnology, and to spur on change within the chemical industry. Welcome to

take thousands of soil samples before we finally found them", says Klaus-Dieter Vorlop. But this perseverance has paid off. "Our bacteria are clearly superior to the ones, which have been known up to now". Additional support comes from the industry: the pilot plant at the Mechanical Engineering Institute in Braunschweig is to isolate 1,3-propanediol from the murky fermentation broth.

"Away from oil and towards renewable resources – that is our objective", says Dr. Stefan Friebe, Vice Head of Division for Surface Technology at the Fraunhofer-Institute for Wood Research, Wilhelm-Klauditz-Institute Braunschweig (WKI). Like the vTI, the WKI is one of the project partners sponsored by the Fed-

eral Ministry of Education and Research and industrial firms. The research work attracts much interest since time is running short. Stefan Friebe: "Germany urgently needs alternatives to petrochemical resources in order to reduce its level of dependence on oil-exporting countries". And also to contain climate change. "The production process for one kilogram of plastic from crude oil generates approximately one to three kilograms of carbon dioxide", points out Stefan Friebe.

Braunschweig's researchers share the workload: while polymer chemists of the vTI are focussing on the synthesis of cast resins and fibre composites, the WKI is primarily engaged in developing modern surface coat resins for

»» Away from oil, and
towards renewable resources – that
is our objective. ««

Dr. Stefan Friebe, Fraunhofer-Institute
for Wood Research WKI, Braunschweig

the world of high-performance fermenters, chromatography, and mass spectroscopy: sophisticated, multi-million euro technology and a team of 25 scientists at the vTI laboratories ensure that bacteria and fungi get everything they need and can evolve into high-performance microorganisms. Bacteria are some of the most important allies of the international biotechnology programme IG-Biotech. Together, the vTI, the Fraunhofer-WKI and a multitude of other research and industry partners want to develop surface coating resins and cast resins as well as fibre-reinforced composites from renewable resources, while, at the same time, paving the way for environmentally-friendly production technologies.

Researchers are particularly interested in glycerin. Large amounts of this liquid are generated as a by-product of the biodiesel production – and the microorganisms of the vTI are able to convert glycerin under anaerobic conditions into 1,3-propanediol. 1,3-propanediol is one of the more promising renewable resources; the dihydric alcohol can, for example, be used as component for polymers which can also form surface coat resins. The search for more and more effective microorganisms is a cumbersome task. "We had to



Photo: CUTEC

wood coating. Institutes of the TU Braunschweig and the Ostfalia University of Applied Sciences undertake basic research.

Lacquers from renewable resources protect not only the environment – the utilisation of glycerine is also of benefit for biodiesel producers by giving them a new source of income. There is an enormous market for wood lacquer finish. “In Germany, more lacquer is produced for use in wood than for use in automobiles”, says Dr. Guido Hora, Head of the Department Surface Technology at the WKI. The German industry has been appreciating the synthesis capacity of nature already for some time. About ten percent, approximately three million tons,

of the overall raw material charge in the chemical industry are renewable resources. The vTI and WKI want to ensure that this share will increase. Research projects cover all levels of the value-added chain – from the bioconversion of glycerine into 1,3-propanediol, to further processing into surface coating resins and thermoplastic resins.

The properties of lacquers and plastics from renewable resources are equal to those of petroleum-based products. The biotechnological process for upgrading raw materials to plastics presents a great scientific challenge. It is one of the most difficult tasks to establish the economic efficiency of the production chain – since glycerine utilis-

ation should be profitable for the agriculture sector as well as the chemical industry. The development at the vTI is even further advanced where the conversion of sugars into detergents containing gold nanoparticle catalysts is concerned; here, the sugar industry is already operating a pilot plant.

The production of itaconic acid, which can be isolated from sugar, also opens up new future prospects for farmers: researchers at the vTI have succeeded in increasing the yield of itaconic acid, which can be converted to polyesters in a biotechnological process, in which mould fungi are useful helpers. The vTI will leave nothing undone to further improve the bioconversion processes carried out by these fungi strains. We have already come a long way: researchers have succeeded in synthesising materials from itaconic acid and 1,3-propanediol which consists entirely of renewable resources. Currently, the researchers at the WKI work on new paint resins that among other things contain itaconic acid. With those they can produce environmentally friendly, water-soluble dispersions that can be hardened through UV light. Guido Hora: “The two components are a crucial development towards the production of lacquers made entirely from renewable resources.” ■



Photo: misokaco/fotolia

Contact

Johann Heinrich von Thünen-Institut (vTI), Dr. Michael Welling
Bundesallee 50, 38116 Braunschweig
Phone: + 49 (0)531/596-10 16
Email: michael.welling@vti.bundl.de
www.vti.bund.de

Fraunhofer-Institut für Holzforschung, Wilhelm-Klauditz-Institut (WKI), Simone Peist, Bienroder
Weg 54 E, 38108 Braunschweig
Phone: + 49 (0)531/21 55-2 08,
Email: simone.peist@wki.fraunhofer.de
www.wki.fraunhofer.de

Establishing Business Relations, Promoting Dialogue

Culture and Communication

In the cultural network

Braunschweig is a place which creates knowledge. However, it is not enough to gather new knowledge, in order to gain the right to exist this knowledge also needs to be propagated and refined. And to prevent it from being lost, it needs to be conserved. This applies to natural sciences and engineering sciences as well as to the art and culture sector. Here, both fields are closely linked in a network and work together: university research meets cultural institutions.

The State Museum of Braunschweig was founded in 1891 and is one of the largest historical museums in Germany due to its large collection housed in four buildings. In the main building at the Burgplatz, visitors can encounter innumerable objects from the areas of history, culture, science, technology, art, folklore, and social history – from with the 8th century right up to the present day. Numerous events, conferences, and presentations make the museum a vital cultural centre where the regional history of Braunschweig is conserved and studied. It represents a hub for

culture and science in the heart of the city and has cooperations with many other research institutions. Braunschweig has also a lot to offer where art is concerned. The spectrum ranges from contemporary art, where the Braunschweig University of Art (HBK) is playing a pioneering role in Germany, to the internationally renowned Herzog Anton Ulrich-Museum (HAUM). The HAUM is one of the oldest museums in Europe and has enriched the lives of generations of people since its opening in 1754. Overall, approximately 170,000 works of art covering a period of almost 3,000 years are facilitating a sensuous experience and comprehension of art. “We are a universal art museum. We show not only paintings but also graphic, sculptures, furniture, majolica, and East Asiatica – to name only a few. Our picture gallery of Old Masters includes works of Rubens, Rembrandt and Vermeer, and is one of the most important galleries in Germany. The ‘Kupferstich-abinnett’ (collection of prints) with its 120,000 works of art is among the most important graphic collections in Europe”, explains Prof. Dr. Jochen Luckhardt, director of the museum. The museum is currently being refur-

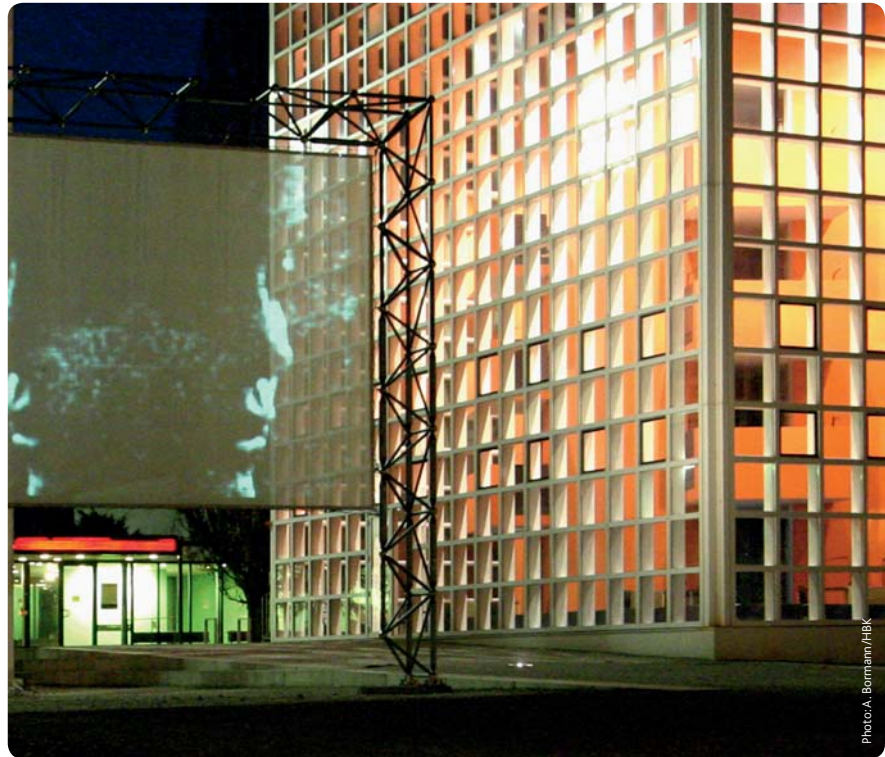
bished, but nobody will have to miss out on the enjoyment of art – the HAUM will show a selection of highlights of its collections in the “Epochal” exhibition in Dankwarderode Castle at Burgplatz until the museum’s reopening. Administration wise, the HAUM is tied

» Since its opening in 1754
the HAUM has enriched
the lives of generations
of people. «

Prof. Dr. Jochen Luckhardt,
Herzog Anton Ulrich-Museum

in with the State Museum of Braunschweig and the State Natural History Museum. The three museums form the Lower Saxony State Museums Braunschweig. With three of the six state museums of Lower Saxony based at Braunschweig, the city is an important location for culture – which is, above all, broadly





diversified. Alongside art and history, natural history is also very well represented: The State Natural History Museum of Braunschweig is Germany's oldest natural history museum and houses large and valuable collections. In the fields of systematic zoology and palaeontology, the diversity of animal species worldwide are studied and classified here. New findings are obtained with the aid of modern molecular biological methods – in close collaboration with the Technical University of Braunschweig. Topics like dinosaurs and snakes are covered by research, as well as by attractive special exhibitions.

300 years ago, the Herzog August Library was already celebrated as the eighth wonder of the world. In 1666, at the time of Herzog August's death, it was one of the most famous baronial book collections and, in view of the number of prints, arguably the largest library worldwide; the collection of medieval manuscripts was amongst the most important ones in Europe. Today, the Herzog August Library is one of the oldest, preserved libraries still intact and the cultural memory in the field of research of European cultural history of the mediaeval times and early modern history. "One thing that is so special about our library is that it is full of activity, it is being used", points out Dr. Helwig Schmidt-Glintzer, director of the Herzog August Library. The Wolfenbüttel library provides the setting for a number of scientific events, in addition to a divers culture programme, which includes a series of events such as "Politik im Gespräch" (politics in talk), or, in collaboration with the "Friedrich-Ebert-Stiftung" (Friedrich Ebert Foundation), the "Wolfenbütteler Gespräche" (talks of Wolfenbüttel) on issues of religions in civil society. This also includes conferences, work-

shop discussions and guest seminars on a wide range of topics. "The promotion of young researchers is important to us", says Prof. Dr. Helwig Schmidt-Glintzer.

With the aid of grants, which are internationally announced, numerous young researchers from all over the world come to Wolfenbüttel in order to study the sources of their research interests. Special exhibitions make the comprehensive stock of books, which has a lot of treasures on offer including the Gospels of Henry the Lion, accessible to a wide audience. Since 2007, the Herzog August Library, together with the Herzog Anton Ulrich-Museum, is in the process of establishing a virtual "Kupferstichkabinett" (collection of prints) which already contains the images of 25,000 graphics from the 15th to the 19th century and makes the valuable drawings and prints digitally accessible anywhere in the world. The Herzog August Library already represented the epitome of sciences and the mirror of the academic universe for Leibniz, who, like Lessing, worked as a librarian in Wolfenbüttel. Lessing's drama "Nathan the Wise", postulating religious tolerance and humanity, was written during his time in Wolfenbüttel.

The Georg-Eckert-Institut für internationale Schulbuchforschung, GEI (Georg Eckert Institute for International Educational Me-

dia Research) is also working on the issue of tolerance and intercultural understanding. It analysis the role of school relevant educational media under the influence of globalisation as well as the conflict potential which is associated with this. Educational books can become weapons, for instance, because they convey ideas which develop

» We are a **nationally and internationally unique centre of expertise** for comparative educational media research. «

Verena Radkau, Georg Eckert Institute for International Educational Media Research

into a mindset and persist for a long time. Central fields of activities are "Muslim societies and Europe", "Educational Media in Times of Globalisation", "Images of Europe", and "Textbook and Conflicts". The GEI brings together researchers of different disciplines, as well as experts of teaching and textbook practice in order to encourage a reflective way in dealing with cultural diversities. Cooperations with the Council of Europe and the UNESCO as well as the acceptance into the renowned Leibniz Soci-



ety speak for the GEI's high reputation. "We are a nationally and internationally unique centre of expertise for comparative educational media research. In the future we will also increasingly focus our attention on the analysis of other school-relevant media and become the (virtual) hub within the international network of education media research. This is a very interesting field of research, due to the fact that textbooks always convey the spirit of time and reflect the self-conception", concludes Verena Radkau, the spokeswoman of GEI. Connections to the TU Braunschweig exist within the scope of a cooperation contract agreed in 2005. The director of the GEI, Prof. Simone Lässig, was jointly appointed and, in addition to her activities at the institute, she teaches at the history seminar of the university.

Interdisciplinary young scientists are educated in Braunschweig in order to continue cross-cultural work. The aim of the master's

programme "Kultur der technisch-wissenschaftlichen Welt" (culture of the technical-scientific world) at the TU Braunschweig is to give students a spiritual home in both, arts and natural sciences, since well-founded knowledge of the other culture can only be beneficial to the professional life. For this purpose institutes are working closely together: English studies, German studies, history, and philosophy meet sciences like engineering, pharmacy, physics, and psychology. The course is aimed at interested students who already have a first academic degree – in whatever scientific culture. And while culture is already being mentioned here, in Braunschweig you are bound to come across the Hochschule für Bildende Künste, HBK (Braunschweig University of Art), sooner or later. It is the second-largest university of art in Germany and the epicentre, so to speak, of contemporary art in Braunschweig. Intensive research and teaching is undertaken here in the fields of art, design and media

science. Degree courses – whether Fine Arts, Art Mediation, Performing Arts, Art and Media Science, Industrial Design and Communication Design – all live on the interdisciplinary interpenetration and the close proximity to artistic work. This is not primarily about creating new works of art, instead this is about developing new insights, new research findings and new media and industrial products. Because whether it is art, design or science, all are working according to the same principles: research, observation, and perception.

The next generation of artists is working and being raised at the HBK, designers are shaping the world of tomorrow, and scientists are contributing their part to scientific groundwork. The close interdisciplinary work creates a fertile ground for numerous collaborations. For instance, within the frame of the Transportation Design degree course major companies of the mobility sector such as Volks-wagen, BMW and others are partici-



Photo: Braunschweig Stadtmarketing GmbH / Sascha Kimmann



Photo: TU-ClaraThal

pating in co-operations to find solutions to the questions of the 21st century. Depending on the type of degree course the HBK works closely with several research and mediating institutions like the Museum of Art in Wolfsburg, the TU Braunschweig, the Ostfalia University of Applied Sciences and further international universities. Many of the ideas produced in Braunschweig are consequently originating from the studios, workshops, laboratories and lecture rooms of the HBK. As Lower Saxony's University of Art, the HBK, is therefore of importance far beyond the national borders. In June 2009, the Kunstzeitung wrote: "The Braunschweig University of Art is one of the most vital universities, if not the most exciting one in Germany."

Another partner of the HBK: the State Theatre of Braunschweig. Opened as early as 1690 by Herzog Anton Ulrich, it can today look back on a large number of success-

ful productions. Amongst others, the debut performance of Lessing's Emilia Galotti and Goethe's Faust I took place at this theatre. Some 750 shows are performed at the four venues each season, including around 35 premieres and numerous concerts. The cooperation with the Research Airport Braunschweig facilitated the German premier of the helicopter-string quartet of Karlheinz Stockhausen within the event "Festliche Tage neuer Musik" (festive days of modern music). And for anyone who does not want to spend all his time browsing in history, enjoying the pleasures of art or getting spellbound by music, a visit to Germany's unique science centre, the phäno, in Wolfsburg, can be warmly recommended. Technology and art form an exemplary symbiosis in this place. ■

Contact

Braunschweigisches Landesmuseum, Herzog Anton Ulrich-Museum
 Silke Röhring, Museumstraße 1,
 38100 Braunschweig
 Phone: + 49 (0)531/12 25-0
 Email: silke.roehling@haum.niedersachsen.de
www.museum-braunschweig.de

Georg-Eckert-Institut für internationale Schulbuchforschung
 Verena Radkau, Celler Straße 3,
 38114 Braunschweig,
 Phone: + 49 (0)531/590-99 47
 Email: radkau@gei.de, www.gei.de

Herzog August Bibliothek
 Antje Dauer, Lessingplatz 1
 38304 Wolfenbüttel, Phone:
 + 49 (0)5331/80 82 13, Email:
dauer@hab.de, www.hab.de

Hochschule für Bildende Künste Braunschweig, Jesco Heyl
 Johannes-Selenka-Platz 1,
 38118 Braunschweig, Phone:
 + 49 (0)531/391-91 23 Email:
j.heyl@hbk-bs.de, www.hbk-bs.de

Staatliches Naturhistorisches Museum, Prof. Dr. Ulrich Joger
 Pockelsstraße 10, 38106
 Braunschweig, Phone:
 + 49 (0)531/288 -92 0, Email:
ulrich.joger@snhm.niedersachsen.de
www.naturhistorisches-museum.de

Try out, get involved and join in the discussion

A house as a meeting point for science, trade and industry, culture and the community

Since it opened its doors in May 2009 the Haus der Wissenschaft (House of Science) as a place for learning and experiencing has offered a variety of interesting and demanding events for different target groups. There are scientific exhibitions where you can actively participate, discussion rounds and age appropriate tours as well as workshops and readings that are meant to particularly encourage a young audience to get to know science. As a platform for science as well as trade and industry the Haus der Wissenschaft supports networking and offers several areas for cooperation. Here every participant has the opportunity to see and experience science in a different way. Citizens are to be involved in the discussion about scientific subjects. Because: research and science of today define our lives in the future!

During series of events like "Tatsachen? Forschung unter der Lupe" ("Facts? Research under the microscope") views on explosive topics can be discussed in a pleasant atmosphere. Together with the Helmholtz-Centre for Infection Research HZI, the Haus der Wissenschaft presents leading experts that offer discussions on subjects like genetic engineering, stem cell research and mobility of the future. Changing formats of events allow plenty of interaction with the speakers and give the audience a strong voice. Thus the Braunschweig Energy Café supported by BS|ENERGY addresses the subject of energy and wants to put emphasis on the importance of energy research and the social challenges involved in this. During those exciting discussions the audience is asked to discuss issues among themselves and to declare their point of view.

One of the most important aims of the Haus der Wissenschaft is to promote science among the next generation. With events like the school holiday programme "KIWI – Research Days for the Curious" the Haus der Wissenschaft wants to get kids and youngsters interested in science and research. Besides theoretical knowledge transfer in the form of seminars and lectures this diverse programme also includes practical applications like experiments in laboratories, guided tours and artistic projects.

Already firmly established in the Haus der Wissenschaft is the so called "Science Slam". Regularly more than 400 curious guests fol-

low the participants' short lectures. Each speaker in this competition has a maximum of 10 minutes to introduce his current research topic in a popular scientific way and to win the hearts of the audience. This concept is already being copied in many other cities. The first German Championship – the German Slam – took place in Braunschweig in June 2010 and more than 1,000 visitors in the Haus der Wissenschaft witnessed Martin Buchholz from the TU Braunschweig becoming the first German Champion.

In addition to hosting its own events, the Haus der Wissenschaft can also be hired as a venue for lectures, seminars or conferences. Besides reliable, modern conference equipment, it has attentive service personnel looking after conference participants and offers a

professional catering service. The restaurant "La Cupola" on the sixth floor is a meeting place ideally suited for informal talks over a freshly prepared Italian meal. The bistro "Allegetto" on the ground floor offers Italian coffee specialities and delicious snacks inside as well as in the outdoor area. ■

Contact

**Haus der Wissenschaft
Braunschweig GmbH**

Pockelsstraße 11, 38106 Braunschweig

Phone: + 49 (0)531/3 91 41 14

Email: info@hausderwissenschaft.org

www.hausderwissenschaft.org



Photo: Haus der Wissenschaft Braunschweig GmbH



Photo: Klinikum Braunschweig/Schelle

An experimental science centre to marvel at

The phæno in Wolfsburg is Germany's unique experimental science centre where visitors can discover the world with over 350 experiments on an action packed area of over 9,000 square metres: touching, trying out, being amazed, playing, discovering and above all: to decipher the often puzzling scientific phenomena of every day life on their own initiative. "The phæno is all about having fun, getting curious and deepening your knowledge. In the phæno we consciously do not mark out any paths through the centre. Each visitor finds his/her own path through this experimental centre and finds his/her own highlights", phæno director Dr. Wolfgang Guthardt describes the concept.

To be amazed in the phæno means for example: to admire Europe's largest fire tornado with a height of over six metres, to move a sphere purely by relaxation, to have your senses confused in the witch's cottage, to stand at an angle in the crazy saloon and still not fall over, to make sounds visible, to analyze DNA, to move

the magnetic levitation train, to experience the weightlessness of objects or to lie comfortably on a bed of nails like a fakir.

The interactive stations were specially built for the phæno in nine different countries, some of them can only be seen in the phæno and nowhere else. Joe Ansel, one of the figure heads of the American Science Centre movement worked as a curator for the phæno, put some of the exhibits together and even designed some of them himself.

Two laboratories for visitors, the science theatre and the forum of ideas offer the visitor even more opportunities to see, hear, taste, smell and touch. A varied event programme consisting of workshops and discovery tours conveys contents leading to networked thinking and acting.

The architecture of the phæno is equally impressive. The London architect, Zaha Hadid who was awarded the Pritzker Price designed the building in Wolfsburg that

gives the impression of being a walk-on sculpture. This impressive building rests on cone feet and floats above the city directly opposite the ICE train station. Inside this building in seven metres height you find a constructional adventure area consisting of craters, caves, terraces and plateaus. This avant-garde building demanded new building materials like self-compacting concrete that had never before been used in such large quantities in Germany. ■

Contact

phæno gGmbH
Willy-Brandt-Platz 1
38440 Wolfsburg
phæno Service-Center
Phone: + 49 (0)180 / 10 60 600
Email: entdecke@phaeno.de
www.phaeno.de



Photo: Lars Landmann

With the kind support of:

- Aerodata AG
- AICON 3D Systems GmbH
- Braunschweig Zukunft GmbH
- Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH
- Forschungsflughafen Braunschweig GmbH
- Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH
- Haus der Wissenschaft Braunschweig GmbH
- Helmholtz-Zentrum für Infektionsforschung GmbH
- Hochschule für Bildende Künste Braunschweig
- Industrie- und Handelskammer Braunschweig
- Physikalisch-Technische Bundesanstalt
- Salzgitter Mannesmann Forschung GmbH
- Siemens AG
- Solvis GmbH & Co. KG
- Städtisches Klinikum Braunschweig gGmbH
- Technische Universität Braunschweig
- Technische Universität Clausthal

Publisher:

Braunschweig Stadtmarketing GmbH
Schild 4
38100 Braunschweig
Phone: +49 (0) 531/4 70 21 04
Fax: +49 (0) 531/4 70 44 45
www.braunschweig.de/wissenschaft
Email: stadtmarketing@braunschweig.de
V.i.S.d.P. Geschäftsführer Gerold Leppa

Concept:

Braunschweig Stadtmarketing GmbH

Design:

Steffen und Bach GmbH | www.steffenundbach.de

Status: Februar 2011

Errors and omissions excepted. All information is subject to change without notice. The contents of this brochure are protected by copyright. If you wish to reprint or reproduce the content, please contact the publisher.