



SCIENCE AND RESEARCH

IN HAMBURG



Hamburg



The research center DESY in the west of Hamburg | © DESY 2015



Evening atmosphere in historic warehouse district | © www.mediaserver.hamburg.de / Andreas Vallbracht



Hamburg's Science and Research System

Hamburg's diverse science and research system has been exceptionally dynamic in recent years. This strong drive is set to continue, especially in the research areas of natural science, technology, engineering and mathematics.

Hamburg currently has 19 public and state-certified universities. 98,953 students, over 10,000 of them from abroad, and approx. 9,500 researchers help make the city's university sector highly attractive. 15 non-university research institutions and collaborations also make a fundamental contribution to research in this city state. The total expenditure of the Ministry of Science, Research and Equalities of Hamburg in 2016 was approx. 1.1 bill. euros. The departmental authority employs a workforce of 120.

In the following, a selection of highlights from the wide range of research activities in Hamburg will be presented.

Scientific Structural Research at the Bahrenfeld Research Campus

This Research Campus is home to a structural research centre that is unparalleled throughout the world. The centre is a collaboration between a large number of partners from both inside and outside the university sector. Based on a longstanding collaboration between the University of Hamburg and DESY (the German Electron Synchrotron), the campus offers research infrastructures with a wide-ranging, world-leading combination of radiation facilities. The free-electron lasers FLASH and FLASH II provide high-intensity ultrafast flashes of light in the vacuum ultraviolet and soft X-ray ranges, and PETRA III is currently the most brilliant storage-ring-based X-ray

facility in the world. The Hamburg area will soon boast another research facility of superlatives: The European XFEL, which will be available for scientific experiments from 2017 on, will generate ultrashort X-ray flashes – 27.000 times per second and with a brilliance that is a billion times higher than that of the best conventional X-ray radiation sources.

The Max Planck Institute for the Structure and Dynamics of Matter (MPSD), founded in 2012, conducts research into dynamic phenomena in matter at the electronic, atomic and molecular levels. The City of Hamburg provided 37 mill. euros to fund a building for this new institute. The MPSD is an offshoot of the Center for Free-Electron Laser Science (CFEL), which as part of a collaboration between DESY, the Max Planck Society and the University of Hamburg carries out research into new ways of using radiation sources to investigate structural changes in atoms, molecules, condensed matter, molten substances and biological systems. A new building to house the CFEL was constructed on the Research Campus at a cost of 50 mill. euros.



1. HAMBURG: STRUCTURAL INDICATORS

Indicator	Year	Value
Area	2015	755.29 km ²
Population	2014	1.76 mill.
Gross domestic product (GDP)	2015	109.3 bill. euros
GDP growth rate (nominal increase over previous year)	2015	3.9%
Export ratio	2015	51.5%

The Centre for Structural Systems Biology (CSSB) brings together the cutting-edge research fields of structural biology and systems biology with a focus on infectious diseases. It makes use of DESY's large-scale research equipment to carry out life sciences research.

The combination of the disciplines of physics, chemistry, biology and medicine, alongside the planned collaboration between members of the Helmholtz and Leibniz associations as well as universities and university hospitals from northern Germany, is unique in the field of fundamental biomedical research. The €52 million research building is jointly funded by the German federal government and the states of Hamburg, Lower Saxony and Schleswig-Holstein.

The new Center for Hybrid Nanostructures (CHYN) is also an integral part of the campus's research landscape. A new building was constructed to house the centre at a cost of approx. 60 million euros.

In 2012, the University of Hamburg, in collaboration with partners including DESY, launched a highly successful project under the auspices of the Excellence Initiative: the Hamburg Center for Ultrafast Imaging (CUI). The centre has since been joined by the European XFEL and the MPSD. The CUI partners, in collaboration with the University Medical Center Hamburg-Eppendorf (UKE), the newly founded research institutions mentioned above and the innovative research infrastructures, are exceptionally well positioned for the Germany-wide Excellence Strategy, the successor to the Excellence Initiative, which begins in 2017.

2. HAMBURG: INNOVATION INDICATORS

Indicator	Year	Value
R&D spending as proportion of GDP	2014	2.33%
Academic publications per million inhabitants	2013	2,735
Patent applications per 100,000 inhabitants	2015	46
University income from third-party sources (per professorial post, in thousand euros)	2013	167.5

Climate Research at “KlimaCampus Hamburg”

The University of Hamburg, the Max Planck Institute for Meteorology, the German Climate Computing Centre (DKRZ) and the Helmholtz-Zentrum Geesthacht (HZG) work together in a pioneering climate research association, with the Integrated Climate System Analysis and Prediction (CliSAP) excellence cluster playing a central role. Specialist climate, climate impact and climate adaptation research is also carried out at HafenCity University Hamburg, the Technical University of Hamburg, the Climate Service Center Germany (GERICS) and at federal institutions such as the Federal Maritime and Hydrographic Agency (BSH), the German Sea Weather Office (DWD Seewetteramt) and the Federal Waterways Engineering and Research Institute (BWB). These institutions have pooled their expertise as equal partners in the “Klima-Campus Hamburg” network.

This interdisciplinary collaboration within the CliSAP excellence cluster has resulted in two new research centres being founded at the University of Hamburg: the Center for Earth System Research and Sustainability and the Center for Globalisation and Governance.

Extensive funding has been provided to expand Klima-Campus Hamburg: for example, the excellence cluster CliSAP is receiving 24.5 mill. euros of funding from the

Excellence Initiative until the end of 2017, while the City of Hamburg has announced an additional 19 mill. euros up until 2022 to secure the cluster’s long-term prospects. The first stage of work on a new supercomputer at the German Climate Computing Centre began in 2015. The expansion project is jointly funded by the federal government and a number of state governments. In order to provide top-quality facilities for climate research, a new building complex with a total floor area of 21,000 m² is being built at the University of Hamburg. The buildings will be used for climate research and geosciences.

Medicine at the Eppendorf Campus – A Leading Centre for Teaching and Research

Another key focus of Hamburg’s science and research policy has been to develop the University Medical Center Hamburg-Eppendorf (UKE) into one of Germany’s leading centres for university medicine.

The UKE’s strategic development is being implemented in the centre’s teaching, research and clinical activities across a series of stages. Major construction highlights as part of the development have included a new medical centre (at a



Research at UKE | © UKE



CAMPUS FORSCHUNG (research) at UKE | © UKE

cost of 194 mill. euros) and two new campuses for research and teaching respectively (at a cost of 52

mill. euros). A new psychiatry and psychotherapy clinic has also been built (at a cost of 18 mill. euros) while a new children’s clinic is currently under construction (at a cost of approx. 70 mill. euros). The new children’s clinic is set to be a centre of expertise specialising in university-level medical care for children and young people.

The university medical centre has focused and structured its research and targets, with five corresponding research centres. Recently, the UKE secured extra funding until 2019 for two collaborative research centres (CRC) from the German Research Foundation (DFG): the CRC Immune-mediated glomerular diseases and the CRC Multi-site communication in the brain.

The UKE, the Bernhard Nocht Institute and the Heinrich Pette Institute have taken



CAMPUS LEHRE (teaching) at UKE | © UKE

an important step with the support of the German Centre for Infection Research (DZIF), securing funding for trans-

national research worth approx. eight million euros. The UKE is also contributing to the development of the German Centre for Cardiovascular Research (DZHK), with a project volume of 3.4 mill. euros, and is participating in the long-term population study “Nationale Kohorte (NAKO)”. The Hamburg City Health Study, which began in 2015, is the world’s largest local health study, covering 45,000 Hamburg residents. The study is a UKE initiative.



Hamburg University

Humanities at the Eimsbüttel Campus

Research and teaching in the humanities is one of the University of Hamburg’s strengths. One example of this is the collaborative research centre Manuscript cultures in Asia, Africa and Europe, which has raised additional financial means (approx. 24 mill. euros) from the European Research Council (ERC) and the German Research Foundation (DFG) since 2011. This successful interdisciplinary collaboration brings together 11 Asian, African and European experts in philology, history of art and historical

musicology, informatics and materials science in order to conduct joint research into diverse manuscript cultures from historical and comparative perspectives.

Another aspect that makes the University of Hamburg stand out is the diverse range of “fringe” subjects. Alongside LMU Munich and FU Berlin, the University of Hamburg offers more such subjects (32) than nearly any other university in Germany.

The German Institute of Global and Area Studies (GIGA), the Institute for Peace Research and Security Policy (IFSH) and the interdisciplinary Carl Friedrich von Weizsäcker Centre for Science and Peace Research (ZNF) Hamburg possess internationally recognised expertise in regional, globalisation and peace research, arms control and security policy, with university and non-university researchers working closely together. This expertise is supplemented by two state institutions based in the city, the Hamburg Research Centre for Contemporary History (FZH) and the Institute for the History of German Jews (IGDJ).

In 2010, the Academy of World Religions was founded at the University of Hamburg. The academy carries out theology-based research into world religions (specialising in Islam, Judaism, Buddhism and Alevism) and acts as a centre for interreligious dialogue.

3. HAMBURG: SCIENCE AND RESEARCH INDICATORS

Indicator	Year	Value
Number of public universities	2015	6
Number of state-certified private universities	2015	13
Number of students	winter semester 2014/15	98,953
Number of professors (primary occupation)	2015	1,614
Number of research assistants (primary occupation)	2015	7,860
Non-university research institutions and collaborations	2015	20
Total expenditure of the Ministry of Science, Research and Equalities Hamburg	2016	1.1 bill. euros
Number of staff employed by the Ministry of Science, Research and Equalities Hamburg	2016	120

Hamburg's Fraunhofer Strategy

Another key milestone in Hamburg's science and research policy and promotion of technology came on 1 January 2015, when the city joined the Fraunhofer Society. It has since established several Fraunhofer institutions.

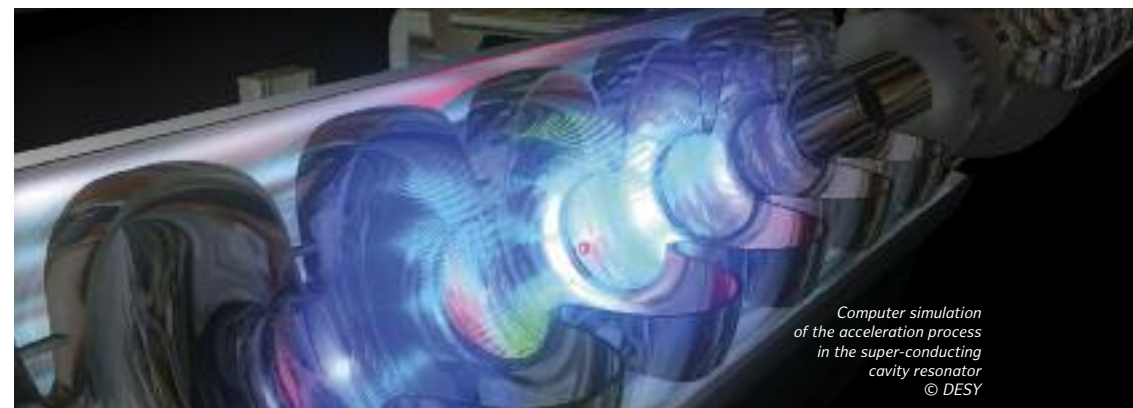
The Fraunhofer Center for Maritime Logistics and Services at the Technical University of Hamburg is set to be gradually upgraded into an independent Fraunhofer institute. The European ScreeningPort, a high-performing transfer institution in the field of biotechnical and pharmaceutical drug discovery, has been part of the Fraunhofer Institute for Molecular Biology and Applied Ecology in Aachen since 2014. In order to further expand the city's renewable energy expertise, a third Fraunhofer centre was established at Hamburg University of Applied Sciences: the "Power Electronics for Regenerative Energy Systems" application centre as part of the Fraunhofer Institute for Microelectronics and Microsystems Technology in Itzehoe, Schleswig-Holstein.

The Senate of the Free and Hanseatic City of Hamburg is planning to further expand Fraunhofer activities in the city. Potential fields for future expansion include nanotechnology and the innovative concept of 3D printing.

Innovation Policy in Hamburg to Promote Technology, New Companies and Networks

The Senate's innovation policy is based on the "Innovation Alliance Hamburg (InnovationsAllianz Hamburg)", a joint initiative between Hamburg's political, business and research sectors. The aim of this initiative is to improve conditions for innovation and to help Hamburg and its Metropolitan Region to develop into one of Europe's leading innovation regions by 2020. The Innovation Alliance is developing, directing and implementing Hamburg's Regional Innovation Strategy 2020 in partnership with innovation stakeholders.

One focus of the strategy is to develop Hamburg as an innovation hub across five key strategic areas: marketing (innovation climate), education and training, networking



*Computer simulation
of the acceleration process
in the super-conducting
cavity resonator
© DESY*

and knowledge transfer, infrastructure and systems for promoting innovation.

The strategy is based on the Hamburg clusters. Each cluster focuses on a different sector: life sciences, logistics, aviation, media and IT, renewable energy, the health-care industry, the creative industry, the maritime industry and the financial industry. Within the Innovation Alliance, the clusters function as strategic specialisation fields as part of a smart specialisation strategy.

One key success for Hamburg came when it was selected by the European Commission as one of six model regions



Aerial view of Elbphilharmonie and Hamburg historic city
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showcasing modern cluster policies. Hamburg's goal is to systematically develop cluster bridges (cross-clustering), with the aim of making better use in future of the potential for innovation and value creation in the areas of overlap between the clusters.

Under the auspices of the Innovation Alliance Hamburg, an initiative has been founded to create and promote technology centres. The initiative aims to gradually establish a network of research and innovation (R&I) parks focusing on selected areas of specialisation. R&I parks comprise facilities and working spaces for technology and knowledge transfer where businesses and researchers can carry out research and development activities with a focus on practical applications. Recent examples include the EnergieCampus Bergedorf Technology Centre, the Innovationszentrum Bahrenfeld business incubator and the Innovations-Campus for Green Technologies Harburg.

Furthermore, there are plans for a platform to support start-up companies. The platform will help stimulate the founding of new university spin-offs. This requires a support concept to be developed on the basis of existing structures that addresses various issues linked to founding new companies, such as entrepreneurial motivation, technology and idea scouting, networking and funding options.

The following measures have also been put in place to promote innovation:

- IFB Hamburg, which was founded on 1 August 2013, serves as the city's central investment and promotional bank. IFB Hamburg's aims include further reinforcing Hamburg's business-friendly climate, providing support to new and established companies and promoting the city to them as a key long-term centre for business and innovation.
- IFB Hamburg's innovation programme PROFI supports industrial research and experimental development projects with up to 500,000 euros of funding per project. The aim of the funding is to enable companies to develop a greater number of business-oriented product and process innovations, and to do so faster. It also aims to strengthen R&D networks both between companies and between companies and research institutions.
- Innovationsstarter Fonds Hamburg is an investment fund that provides young, innovative and capital-intensive companies in the start-up phase with funding of up to one million euros per investment. The fund aims to ensure that promising, innovative companies have the equity capital they urgently need during the early phases.



- To supplement the investment fund, the funding programme InnoRampUp was launched in 2013. The programme provides innovative start-ups and young companies in the pre-seed and seed phases with funding of up to 150,000 euros per project.
- IKS Hamburg is the first undertaking to be implemented on the basis of the Innovation Alliance guidelines. IKS is an institution that facilitates contact between Hamburg businesses and the university and science/research sectors by working closely with other Hamburg-based transfer institutions.

International Collaboration (including EU)

Hamburg's key strategic goals include developing institutions with an international focus and systematically expanding international science and research collaborations. Within the broad spectrum of international collaboration, two key areas of focus can be identified in Hamburg:

- Regionally focused expansion and intensification of collaboration between Hamburg, northern Germany and northern Europe, with a focus on the Baltic Sea region



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- International collaboration on the basis of Hamburg's unique research infrastructure, which provides a key foundation for existing and future regional and international research associations

The Baltic Sea region is now one of the world's most competitive knowledge regions, with an outstanding university and research infrastructure in direct geographical proximity to the Hamburg Metropolitan Region. The Fehmarn Belt Fixed Link will help to further consolidate the Baltic region over the next decade.

Capitalising on its advantageous location, Hamburg has launched the three-year



INTERREG project Baltic Science Network (BSN) as the project's lead partner and helped secure three million euros of funding. The network has over 20 partners: science ministries from from all Baltic Sea States (Germany, including the federal states of Hamburg and Schleswig-

Holstein, Denmark, Estonia, Latvia, Lithuania, Sweden, Finland, Poland and Russia), other science and research policy organisations and the Council of the Baltic Sea States.

The network aims to intensify transnational scientific collaboration through improved coordination and the



Connecting modules in the European XFEL linear accelerator
© Heiner Müller-Elsner / European XFEL

development of joint research and innovation strategies in the Baltic region.

In the area of research infrastructure, the European XFEL (X-ray free-electron laser) is the largest European research infrastructure project currently under construction on the ESFRI list. It is due to go into operation in 2017. The €1 billion+ project currently has partners from 11 countries.

With BER II, PETRA III, BESSY, FLASH and MaxLab I–III, based in Hamburg, Berlin and Lund, the northern Euro-

pean science and research sector is already able to draw on a combination of large-scale research infrastructures for research with photon and synchrotron radiation that is unrivalled anywhere else in the world. Another state-of-the-art photon radiation facility, MaxLab IV, is being built in Lund, and valuable transregional scientific collaborations are being established throughout the region.

Hamburg's universities and research institutions are highly successful in receiving EU-research funding. The science region Hamburg for example hosts 15 ERC-grantees with an approx. project-volume of 20 mill. euros.

Other information online:

Hamburg Science and Research Portal:
<http://wissenschaft.hamburg.de>

The Hamburg Centre for
Ultrafast Imaging (CUI) excellence cluster:
www.cui.uni-hamburg.de

Integrated Climate System
Analysis and Prediction (CliSAP) excellence cluster:
www.clisap.de/de



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