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News from the Helmholtz Association



Gantry Radiation Therapy: The patient lies under a radiation delivery apparatus, which is set to precise specifications by a computer controlled robot. Photo: Universitätsklinikum Heidelberg

670 Tonnes to Treat Cancer

It is 25 metres long, 13 metres wide and three storeys high: the University Hospital Heidelberg's new ion radiation control device (Gantry) at the Heidelberger Ionenstrahl-Therapiezentrum (HIT - Heidelberg Ion Radiation Therapy Centre). The combination of proton and heavy ion radiation, developed by the GSI Helmholtz Centre for Heavy Ion Research, is unique in the world and, moreover, it is the world's largest rotating particle radiation control device. For the first time ever, it allows for comparative studies that will serve to identify which kind of radiation treatment is best suited to combat the respective kinds of tumour diseases.

Although, with its 670 tonnes of weight, the huge steel construction is a colossus indeed, it is also very moveable – a real heavy weight champion when it comes to combating tumours. The gantry can be turned by 360 degrees and allows for radiation beam control that is precise to a millimetre. The ions can accelerate to three quarters of the speed of light and penetrate the patient's tissue to a depth of 30 centimetres. In future, the new gantry will be used in particular for clinical studies that focus on the treatment of tumours, which remain unaffected by traditional treatments. These studies are to demonstrate

which kind of radiation is the most successful in treating the respective kinds of tumour diseases: radiation using protons or heavy ions such as carbon, helium or oxygen ions. The HIT already treats a total of 750 patients each year, 70 per cent of those in the context of clinical studies. The development of the gantry began in 1998 and comprised numerous studies, including some that were funded by the Helmholtz Association. Now, after the setting of 70 million parameter combinations, the gantry at last takes up operation. The aim is to identify the optimal form of treatment for each individual patient. This approach is also part of the concept of the National Center for Tumor Diseases (NCT) Heidelberg, a joint institution of the German Cancer Research Center (DKFZ) and the University Hospital Heidelberg. At the NCT, patients are provided in the fastest manner possible with a diagnosis, a recommendation for treatment as well as treatment based on the latest standard, one option being ion radiation. It is precisely this combination of the DKFZ's basic research with the university hospital's clinical research that is so efficient in promoting the development of cancer treatment methods. The commissioning of the new gantry now opens up many options on the path to individual tumour treatment.

Dear Readers,



In the field of health research, the German science system has seen an internationally significant change: In future, the Max Delbrück Centre for Molecular Medicine (MDC) Berlin-Buch and the Charité – Universitätsmedizin Berlin medical school are to join forces under the roof of the newly formed Berliner Institut für Gesundheitsforschung (BIG - Berlin Institute for Health). We expect that the close cooperation between these two top-class research institutions in their newly created research facilities will yield major progress in particular in the field of translation, that is, the transfer of basic research insights into clinical application. We therefore will fund the BIG's start-up phase in 2013 and 2014 with a total of 45 million Euro. Like the Karlsruhe Institute of Technology, the new cooperation model of the BIG ideally fulfils the Helmholtz Association's goals as presented in our strategy paper "Helmholtz 2020 – Shaping the Future Through Partnership".

Wishing you enjoyable reading,

Yours faithfully, Jürgen Mlynek, President

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In Brief

Heating Performance World Record

At the fusion facility ASDEX at the Max Planck Institute for Plasma Physics in Garching, a research institute associated with the Helmholtz Association, researchers managed to heat the fusion plasma to a new record temperature. Taking into account the size of the facility, this is a heat performance world record. This was made possibly by employing an ingenious control system. It makes sure that, on the one hand, the many million degrees hot high performance plasma types are created, while, on the other, the walls of the plasma vessel are not overstrained. The aim of these experiments is the development of a fusion reactor power plant, which is to emulate the sun in generating energy from nuclear fusion.

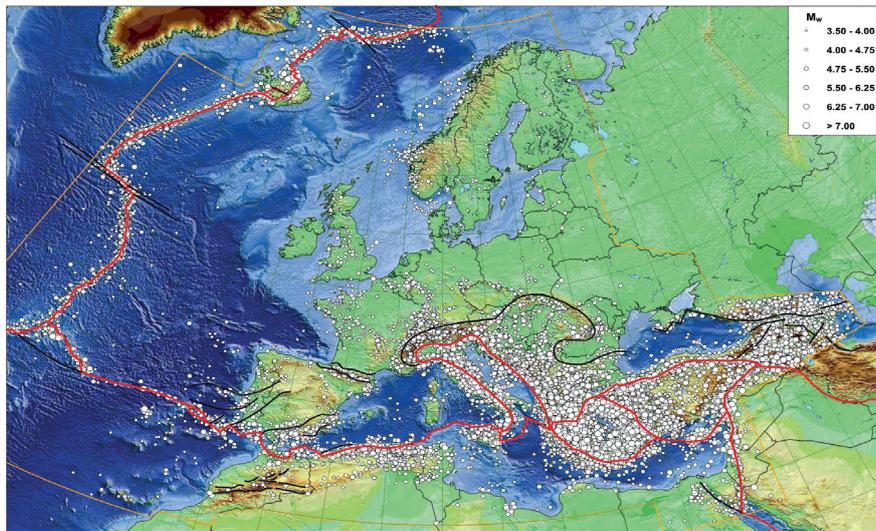
Cancer Cell Achilles Heel

Scientists at the German Cancer Research Center (DKFZ) and the University Hospital Heidelberg have identified a weak spot in cancer cells: the HDAC11 enzyme. When this enzyme is switched off, the cancer cells die, whereas normal cells survive. However, substances counteracting HDAC enzymes that are so far available inhibit also other enzymes and thereby damage healthy cells. The team around Prof. Dr Olaf Witt, head of a research department at the DKFZ and paediatrician at the University Hospital Heidelberg, now targets its research on finding specific active agents to counteract HDAC11.

Where Caffeine Hits the Brain

For the first time now, scientists from the Forschungszentrum Jülich research centre were able to demonstrate that the invigorating effect of caffeine predominantly affects the highly developed regions of the cerebrum. By way of an imaging marker and the method of positron emission tomography (PET), the researchers have shown that caffeine blocks out adenosine, a 'tired maker', from specific nerve cell receptors. This results in activation of the nerve cells and hence in triggering of cognitive processes. Knowledge about this mechanism can constitute an important step towards the prevention and treatment of both Parkinson's and Alzheimer's disease. Studies have shown that regular consumption of caffeine reduces the risk of developing these diseases.

Earthquake Research: No Forecast, but Knowledge of Threat



Map of earthquake epicentres in the European-Mediterranean Earthquake Catalogue (EMEC) including tectonic plate boundaries (red) and selected first order tectonic elements (black). Photo: GFZ

The conviction of Italian seismologists in consequence of the L'Aquila earthquake once again highlighted the fact that earthquakes cannot be predicted. Yet why should this be so, what with plate tectonics providing such an excellent and well-established concept for explaining the processes on and within our planet?

Indeed, as a result of evaluating contemporary and historic earthquakes, the major earthquake zones are well-known today. On this basis, seismologists can estimate the degree of probability of earthquakes happening in a given location and their expected magnitude. Yet even such a vague estimation of potential threat poses a challenge, because some earthquake cycles can run as long as several hundred years. Deterministic forecasting proves to be even more complex: In order to be of any use for short-term measures, the point in time would have to be known to the day, the location to an accuracy of 10 kilometres and the earthquake's intensity down to half a magnitude – a dream, which cannot be realised by today's state of knowledge. Occupying themselves in the field of earthquake research, the scientists at the Helmholtz Centre Potsdam – German Research Centre for Geosciences GFZ work on a broad range of topics: "Basic research, such as the seismic tomography of the Earth and geodynamic modelling, the global registration and evaluation of earthquakes, our tectonic plate boundary observatories, annual training courses on the seismology of and in endangered regions, the assessment of

earthquake threats in many regions worldwide and the cooperation in the development of standards for earthquake-resistant building: all these are various facets of one and the same subject matter," explains Prof. Dr Michael Weber, Director of the GFZ department "Physics of the Earth". "The geosciences play a decisive role in assessing the risk of natural threats." At the GFZ, earthquake risk research is conducted at various levels. A "Global Earthquake Threat Map" illustrates the main areas of risk in high resolution. Developed under the leadership of GFZ researcher Prof. Dr Gottfried Grünthal and translated into currently 30 languages, the European Macroseismic Scale is considered the bible of its field. Such research serves in the development of standards for earthquake-adequate building by providing engineers with information as regards threat and constantly alerts both the decision makers and the population of earthquake regions to be aware of the risk. Precaution and early warning are decisive. Early warning, but no forecast. "The warning as regards severe ground motion, which is possible after the onset of an earthquake with warning lead times of some ten seconds, can help to automatically shut down industrial facilities and traffic infrastructure," says Prof. Dr Torsten Dahm, Head of the GFZ section "Earthquake Risk and Early Warning". The best known example for early warning is the GITEWS tsunami warning system for the Indian Ocean, which can quickly and accurately assess an earthquake within a few minutes and issue a tsunami warning.

What Fathers Contribute



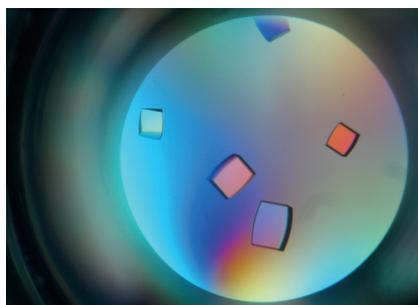
Broadnosed pipefish in an aquarium. Photo: Uli Kunz, www.kunzgalerie.de

Strengthening the immune system prior to birth no longer is a matter involving only mothers: For the first time, on the model of the broadnosed pipefish, researchers from the GEOMAR Helmholtz Centre for Ocean Research Kiel, have demonstrated that fathers, too, have an influence on the immune system of their offspring. In vertebrates, the mother passes on antibodies to its offspring via the eggs or the placenta – at least in most cases, as we now know. In the case of the broadnosed pipefish, however, the male breeds the embryos inside a bag, where the offspring is connected with the father. "It is fascinating, that the

evolution has brought forth completely independent yet similar solutions in humans and fish respectively, whereby the parents contribute towards their offspring's immune system", says Dr Olivia Roth from the GEOMAR. For their study, the scientists have investigated 18 pipefish families and have vaccinated either both partners, only the mothers, only the fathers or neither parent prior to the breeding phase. Subsequent analyses revealed that, for specific reactions of the immune system, only the father provided the crucial factor, whereas for others, the combination of paternal and maternal contributions proved effective.

Calcium Pump Booster

Using the X-ray source DORIS at the Deutsches Elektronen-Synchrotron DESY, a research team has discovered that, in the event of high levels of calcium, the calcium pumps in our body cells switch on a booster. The results have been published in the esteemed journal "Nature". Calcium is an important control signal for numerous processes within the organism. The decisive factor is the difference in its levels of concentration between the cells' interior and their environment, a difference that is regulated by calcium pumps. Using the method of X-ray crystallography on crystallised complexes of calcium pumps, the researchers now have identified two binding sites for the protein Calmodulin. When calcium binds to Calmodulin, this in turn can bind to the calcium pump and thereby switch it on. The pump is controlled by three instances: It is switched off, when no Calmo-



Crystalline calcium pump specimen extracted from thale cress. Photo: Henning Tidow/University of Aarhus

dulin is bound. When one binding site is occupied, the pump operates at a medium speed. In the event of high calcium levels, both sites are occupied and the pump switches to the newly discovered booster speed. Bioinformatics analyses now have revealed that all cells containing a nucleus – from a single cell organism to human beings – feature this booster switch.

Butterfly with Migration History

During the mass migration journeys of the butterfly commonly known as Painted Lady, hundreds of naturalists have collected a total of 60,000 observations regarding its migration behaviour. In one season, this butterfly covers up to 15,000 kilometres. However, this is not the distance covered by a single butterfly. Rather, the species uses its high rate of reproduction: The distance between West Africa and Scandinavia is covered by a succession of up to four generations, whereas it needs only two generations to travel back south. The study involved the Helmholtz Centre of Environmental Research – UFZ and its cooperation partners science4you as well as the Gesellschaft für Schmetterlingsschutz (GfS – Society for the Protection of Butterflies).

Foundation of BIG

The German Federal Minister of Education, Prof. Dr Annette Schavan, and the Mayor of Berlin, Klaus Wowereit, have announced the merger of the Max Delbrück Centre (MDC) with the Charité to form the new Berliner Institut für Gesundheitsforschung (BIG – Berlin Institute for Health). Both partners are fully legally responsible corporate bodies within the BIG, which receives 90 per cent of its funding from the federal government and 10 per cent from the government of the Federal State of Berlin. Patients in particular are to benefit from consolidating the MDC's basic research with the Charité's clinical research. The new structure allows for the faster application of research results.

First Helmholtz Day

On 20 November 2012, the 25 Helmholtz Laboratories for Schools celebrate the first Helmholtz Day, dedicated to the memory of our namesake, Hermann von Helmholtz. On this day, the pupils learn what made Helmholtz one of the most influential natural scientists of the nineteenth century and about the links to the Helmholtz Association's work. Subsequently, the groups of pupils can conduct independent experiments, thereby gaining an insight into scientific work. For this day, the GeoLab, a Laboratory for Schools at the Helmholtz Centre Potsdam, has invited a class from the Hermann-von-Helmholtz-Gymnasium grammar school in Potsdam, where Helmholtz himself went to school.

Awards

With their submarine instrument platform "ROMP", **Dr Warner Brückmann** and his team from the GEOMAR Helmholtz Centre for Ocean Research Kiel made second place in the 2012 "Ideenwettbewerb" ideas competition and received prize money totalling 3,000 Euro. The special award "Nanotechnology" went to Prof. Dr.-Ing. **Mady Elbahri** from the University of Kiel - Christian-Albrechts-Universität zu Kiel and the Helmholtz Centre Geesthacht. Elbahri and his team have developed innovative ultra thin layers made of metallic nano particles, which may be used as anti-reflectors, electric conductors or transparent layers. The awards distinguish future-oriented, seminal ideas, which can be successfully translated into applications.

At the Helmholtz-Zentrum Berlin, Dr **Christiane Becker** is establishing a new BMBF Young Investigators Group. The aim of the research work is to develop nano and micro-structure silicon building elements for applications in the fields of photovoltaics and photonics. The focus is on the production of new optical building elements made of thin layers of silicon. The German Federal Ministry of Education and Research (BMBF) funds the project with approximately 950,000 Euro over the course of the next four years.

The **Heidelberg Institute for Stem Cell Technology and Experimental Medicine** (HI-STEM) will receive funding from the Dietmar Hopp Foundation for another five years. The HI-STEM was established in October 2008 by the Foundation and the German Cancer Research Center with the aim of rendering results from stem cell research fit for application in cancer treatment medicine. Innovative diagnostics and approaches to treatment are to improve the survival rate of cancer patients. The total sum invested in the HI-STEM by the Dietmar Hopp Foundation amounts to 15 million Euro.

New Appointments



Following the wish of the supervisory board, Prof. Dr **Horst Stöcker** will continue in his term of office as Scientific Director of the GSI Helmholtz Centre for Heavy Ion Research GmbH for another five years. Stöcker occupies this post since 2007 and, amongst other things, has, in cooperation with German and

international partners, helped to create the conditions for the now approved building of the FAIR accelerator centre. Stöcker has studied physics, mathematics and chemistry at the Goethe University of Frankfurt and, after the conferral of his doctorate, has worked as a visiting scientist at the University of California in Berkeley. He is Foundation Chairman of the Executive Board and Senior Fellow of the Frankfurt Institute for Advanced Studies (FIAS) and, since 2008, Vice-President of the Helmholtz Association.

Dr **Kenneth Beyerlein** from the Deutsches Elektronen-Synchrotron DESY was awarded the Young Scientist Award by the European Powder Diffraction Conference (EPDIC). He received the award for his outstanding work in researching nano materials. Every two years, EPDIC distinguishes a young researcher for his or her special achievements in the field of applying X-ray scattering techniques to powdered materials.

The Chamber of Industry and Commerce distinguished the **Helmholtz-Zentrum Dresden-Rossendorf** (HZDR) as an exemplary enterprise in the provision of vocational education and training. Over the course of the past 20 years, the centre has provided vocational education and training for about 180 young women and men, 80 per cent of which have finished their apprenticeship with good to very good results. At present, the HZDR provides vocational education and training in eleven different fields of occupation.

Dr **Juliane Müller** from the Alfred Wegener Institute for Polar and Marine Research received the second prize of the Deutscher Studienpreis (German Study Award) for her doctoral thesis on the subject of marine ice expansion. The insights gained by her thesis

allow for the reconstruction of changes in marine ice expansion for the past 30,000 years. The total value of the Study Award, consisting of three first prizes and six second prizes, amounts to more than 100,000 Euro.

Calls for Applications

With the **Friedmund Neumann Prize**, the Schering Foundation honours young, next generation scientists with an outstanding performance record in basic research in the fields of biology, chemistry or medicine. The award is endowed with 10,000 Euro. Nominations for the Friedmund Neumann Prize 2013 may be submitted up until 01 February 2013. Direct nominations on one's own behalf will not be accepted. The selection process in determining the award winner will be completed by 15 April 2013. The award ceremony itself will take place on 23 September 2013 at the Berlin-Brandenburg Academy of Sciences and Humanities. www.helmholtz.de/neumann-prize-2013

More information in the internet:
www.helmholtz.de/hermann

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