Science & Technology in Germany

सत्यमेव जयते

Amphipod-pteropod-tandem (Photo: Charlotte Havermans)

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SCIENCE AND TECHNOLOGY WING

FORMAT OF PUBLICATION

The report is set up in a compact listing of various sections in alphabetical sequence. Every section contains one or more citations, each with the following set-up:

(i) the respective **Topic**

(ii) the publishing **Source** and bibliographical information

(iii) the **Abstract** which supplies a short summary of the contents

(iv) in case a contact address is available with the original information, it will be given under the **Contact**

In this Issue

Edited by: R. Madhan, Counsellor (S&T), Muttathu Jose (Scientific Assistant)
Compiled by: Jessy Jacob-Reitz

EDITORIAL

Dear Readers,

One of the important events during this month was the talk delivered by Professor Dr Ajay Kumar Sood, President of the Indian National Science Academy (INSA) at the Embassy of India, Berlin. The presentation on “Nature Inspired Physics: Why Do We Flock Together?” was as part of the INSA-Leopoldina Lecture series done in collaboration with the Embassy of India, Berlin. The talk on 18th September 2018 was attended by close to 100 participants. The President of Leopoldina, President of the Technical University, Berlin representatives from the Federal Ministry and other Diplomatic missions were among the eminent guests, in addition to the researchers and students who came from all over Germany. The active participation of the attendees was encouraging and an indication that such platforms are highly effective in bringing together young and experienced researchers leading to enhance the Indo-German scientific collaboration.

The Indo-German Science and Technology Centre (IGSTC) 2+2 Call for project proposals on "Clean and Green Technologies" and "Sustainable Production Technologies" have been announced with more details on www.igstc.org. This is a good opportunity for researchers to work with industry, aiming at technology demonstration & commercialization.

R. Madhan

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INDIAN SCIENTISTS VISITING GERMANY

Dr. K. Annapurna

Host Institute: ICAR-IARI, Indian Agricultural Research Institute, New Delhi

Duration: 25 October to 7 November 2018

Topic: To avail the INSA Bilateral Exchange Programme 2018

Mr. Tarun Kumar Das

Host Institute: CSIR-National Metallurgical Laboratory, Jamshedpur

Guest Institute: In Saarbrücken

Duration: 2 to 10 October 2018

Topic: To participate as a member for the activity “International Symposium on Structural Health Monitoring and Non-destructive Testing (SHM-NDT 2018)

CONFERENCE

01.11.18 – 02.11.18

"*The passion of Europe to capture coral riffs of our world: An open science colloqium*", in Bremen

Organiser: Dr. Sonia Bejarano, Leibniz-Zentrum für Marine Tropenforschung (ZMT), Fahrenheitstraße 6, 28359 Bremen

01.11.18 – 03.11.18

"*1st European Symposium on Myeloid Regulatory Cells in Health and Disease*", in Essen

Organiser: Professor Dr. Sven Brandau, Universität Duisburg-Essen, Klinik für Hals-Nasen-Ohrenheilkunde, Hufelandstraße 55, 45147 Essen, Tel.: (+49) 201/7233193

Externer Linkhttp://www.esmrc-conference.de/

04.11.18 – 07.11.18

"*ISPPP 2018 - International Symposium on the Separation of Proteins, Peptides and Polynucleotides*", in Berlin
Organiser: Professor Dr. Sonja Berensmeier, Technische Universität München (TUM), Professur für Selektive Trenntechnik, Boltzmannstraße 15, 85748 Garching, Tel.: (+49) 89/289-15750, Externer Linkhttp://www.isppp2018.net/

07.11.18 – 09.11.18

"*Observations of trace gas trends and variability in the UTLS (OCTAV-UTLS)*" in Mainz

Organiser: Professor Dr. Peter Hoor, Johannes Gutenberg-Universität Mainz, Institut für Physik der Atmosphäre, Johann-Joachim-Becherweg 21, 55128 Mainz, Tel.: (+49) 6131/3922863

08.11.18 – 09.11.18

"*Accessible Hubs - International Workshop on Universal Figures in urban Mobility Systems*" in Darmstadt
Organiser: Professor Dr.-Ing. Martin Knöll, Technische Universität Darmstadt, Fachgebiet Entwerfen und Stadtentwicklung, El-Lissitzky-Straße 1, 64287 Darmstadt, Tel.: (+49) 6151/1622167

08.11.18 – 10.11.18

"*8. Peptide Engineering Meet in Berlin (PEM8)*" in Berlin-Dahlem
Organiser: Professor Dr. Beate Koksch, Freie Universität Berlin, Abteilung Organische Chemie, Takustraße 3, 14195 Berlin, Tel.: (+49) 30/838-55344

Externer Linkhttp://www.bcp.fu-berlin.de/en/chemie/chemie/forschung/pem8/index.html

08.11.18 - 10.11.18

"*Annual meet of the German society for biomaterials*" in Braunschweig
Organiser: Professor Dr. Henning Menzel, Technische Universität Braunschweig, Institut für Technische Chemie, Hagenring 30, 38106 Braunschweig, Tel.: (+49) 531/3915361, Externer Linkhttp://www.dgbm-kongress.de/

11.11.18 – 13.11.18

"*14. German Conference on Chemistry Informatics*", in Mainz

Organiser: Professor Dr. Wolfram Koch, Gesellschaft Deutscher Chemiker e.V. (GDCh), Gesellschaft Deutscher Chemiker - Geschäftsführer -, Varrentrappstraße 40-42, 60486 Frankfurt, Tel.: (+49) 69/7917320, Externer Linkhttp://www.gdch.de/gcc2018

14.11.18 – 16.11.18

"*If robots think – An interdisciplinary view on intelligent automation*", in Münster
Organiser: Dr. Astrid Rosenthal-von der Pütten, Rheinisch-Westfälische Technische Hochschule Aachen, Human Technology Centre (HumTec), Theaterplatz 14, 52062 Aachen

15.11.18 – 16.11.18

"*Molecular Mechanisms of circadian clocks*" in Mainz

Organiser: Privatdozent Dr. Ralf Dahm, Institut für Molekulare Biologie gGmbH (IMB), Ackermannweg 4, 55128 Mainz, Tel.: (+49) 6131/39-25103 ExternerLinkhttp://www.imb.de/seminars-meetings/meetings/imb-workshop-molecular-mechanisms-of-circadian-clocks/

21.11.18 – 23.11.18

"*Sportmedicine and Sportscience im Rowing - International Conference Berlin 2018*" in Berlin

Organiser: Professor Dr. Jürgen Michael Steinacker, Universität Ulm, Sektion Sport- und Rehabilitationsmedizin,Leimgrubenweg 12-14, 89075 Ulm, Tel.: (+49) 731/50045301
Externer Linkhttp://www.rudern.de/wcc2018

22.11.18 – 24.11.18

"*42. Scientific congress- German Hochdruckliga e. V. DHL*" in Berlin
German Society for Hypertonie and Prevention

Organiser: Professor Dr. Helmut Geiger, Goethe-Universität Frankfurt am Main, Funktionsbereich Nephrologie, Theodor-Stern-Kai 7, 60596 Frankfurt, Tel.: (+49) 69/63015555, Externer Linkhttp://www.hypertonie-kongress.de

23.11.18 - 24.11.18

"*The possibilities of Organoid culture – from basic research upto clinical application*", in Heidelberg

Organiser: Professor Dr. Matthias Ebert, Ruprecht-Karls-Universität Heidelberg, II. Medizinische Klinik: Gastroenterologie, Hepatologie, Infektiologie, Theodor-Kutzer-Ufer 1-3, 68167 Mannheim, Tel.: (+49) 621/383 3284

27.11.18 - 27.11.18

"*Newly appearing and reappearing Infections: Increase of "preparedness" through Networks*" in Berlin

Organiser: Privatdozent Dr. Rainer G. Ulrich, Friedrich-Loeffler-Institut - Bundesforschungsinstitut für Tiergesundheit (FLI), Institut für Neue und Neuartige Tierseuchenerreger (INNT), Südufer 10, 17493 Greifswald, Tel.: (+49) 38351/7-1159

29.11.18 – 01.12.18

"*30th Annual Meet of German Society for Andrology e.V. (DGA)*" in Gießen

Organiser: Privatdozent Dr. Thorsten Diemer, Justus-Liebig-Universität Gießen, Klinik und Poliklinik für Urologie, Kinderurologie und Andrologie, Rudolf-Buchheim-Straße 7, 35392 Gießen

30.11.18 – 01.12.18

"*Translation in Regenerative Medicine (TIRM 2018): "Anterior Cruciate Ligament: Regeneratives Potential and new clinical suggestions*", in Regensburg

Organiser: Professor Dr. Denitsa Docheva, Universität Regensburg, Klinik und Poliklinik für Unfallchirurgie, Franz-Josef-Strauß-Allee 11, 93053 Regensburg, Tel.: (+49) 941/1605

ENVIRONMENT, ENERGY & RENEWABLE ENERGY

A NEW TWIST ON STELLAR ROTATION

Max Planck Gesellschaft Press news, 21 September 2018

Researchers use oscillations to determine how distant suns circle around their axes.

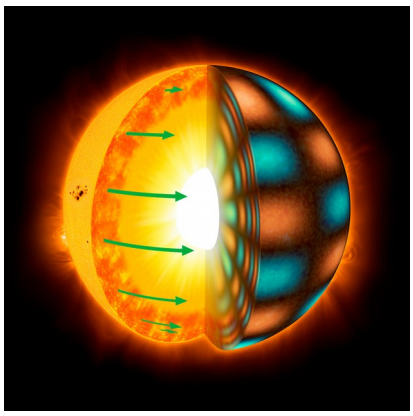
Stars, however, do not rotate like solid spheres: regions at different latitudes rotate at different rates.

A group of researchers from New York University and the Max Planck Institute for Solar System Research (MPS) in Germany has now measured the rotational patterns of a sample of Sun-like stars. They have identified 13 stars that rotate in a similar fashion as our Sun: their equators rotate faster than their mid latitudes. This rotation pattern is, however, much more pronounced than in the Sun: the stars' equators are found to rotate up to twice as quickly as their mid-latitudes. This difference in rotation speed is much larger than theories had suggested.

What do we know about distant stars aside from their brightness and colors? Is our Sun a typical star? Or does it show certain properties that make it special, or maybe even unique?

One property that is not fully understood is rotation. In its outer layers the Sun has a rotation pattern that scientists refer to as `latitudinal differential rotation'.

This means that different latitudes rotate at different rates. While at the Sun's equator one full rotation takes approximately 25 days, the higher latitudes rotate more slowly.



Different speed: Sun-like stars rotate differentially, with the equator rotating faster than the higher latitudes. The green arrows in the figure represent rotation speed in the stellar convection zone. Differential rotation is inferred from the oscillatory motions of the star seen as orange/blue shades on the right side of the picture. Differential rotation is thought to be an essential ingredient for generating magnetic activity and starspots.

© MPS / MarkGarlick.com

Near the Sun's poles, one full rotation takes approximately 31 days.

In their new work the scientists studied the rotation of 40 stars that resemble the Sun with respect to mass. Among those, the 13 stars for which differential rotation could be measured with confidence all show solar-like differential rotation: equators rotate faster than higher latitudes. In some cases, however, the difference in rotational speed between the equator and the mid-latitudes is much larger than in the Sun.

Contact: Prof. Dr. Laurent Gizon, Max Planck Institute for Solar System Research, Göttingen, Tel+49 551 384979-439

INFORMATION & COMMUNICATION TECHNOLOGY

ARTIFICIAL INTELLIGENCE CONTROLS QUANTUM COMPUTERS

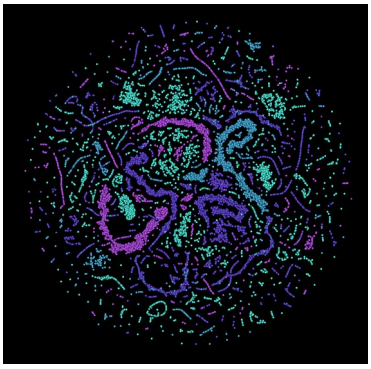
MPI for Science & Light Press news, 5 October 2018

Neural networks enable learning of error correction strategies for computers based on quantum physics.

Quantum computers could solve complex tasks that are beyond the capabilities of conventional computers. However, the quantum states are extremely sensitive to constant interference from their environment. The plan is to combat this using active protection based on quantum error correction. Florian Marquardt, Director at the Max Planck Institute for the Science of Light, and his team have now presented a quantum error correction system that is capable of learning thanks to artificial intelligence.

In 2016, the computer program AlphaGo won four out of five games of Go against the world's best human player. Given that a game of Go has more combinations of moves than there are estimated to be atoms in the universe, this required more than just sheer processing power. Rather, AlphaGo used artificial neural networks, which can recognize visual patterns and are even capable of learning. Unlike a human, the program was able to practise hundreds of thousands of games in a short time, eventually surpassing the best human player. Now, the Erlangen-based researchers are using neural networks of this kind to develop error-correction learning for a quantum computer.

Artificial neural networks are computer programs that mimic the behaviour of interconnected nerve cells (neurons) – in the case of the research in Erlangen, around two thousand artificial neurons are connected with one another.



Learning quantum error correction: the image visualizes the activity of artificial neurons in the Erlangen researchers' neural network while it is solving its task.

© Max Planck Institute for the Science of Light

Contact: Prof. Dr. Florian Marquardt, Max Planck Institute for the Science of Light, Erlangen, Tel+49 9131 7133-400

MEDICAL SCIENCES & HEALTH

PROTEIN FOR DEEPER INSIGHTS INTO THE BRAIN

MPI for Neurobiology Press news, 17 September 2018

Researchers publish building instructions to promote biomedical research.

To be able to examine the function of individual cells or structures in intact tissue, these need to be visible. This may sound trivial, but it is not. To achieve this, researchers implant fluorescent proteins into cells. These will then produce the proteins themselves, without the cell functions being disturbed: cells, structures or their activities thus become visible under the microscope. However, the proteins need to be optimized for their use in research. The required "protein engineering", in which highly sensitive and specific proteins are developed, is a dedicated research branch. Scientists from the Max Planck Institute of Neurobiology in Martinsried have now developed a method that provides for a significant improvement of protein engineering, by means of automated computer analysis and a robot-supported selection process. This has been verified by first successes achieved with a deep red protein.

The robotic arm swivels to the side with a soft humming sound. A little bit to the right, slightly forward, then it stops briefly, before a bar equipped with a little metal ball is pushed down.

"The new screening platform has already proven itself with the development of mCarmine," comments Oliver Griesbeck on his group's success. The researchers have published the code and the building instructions, to allow working groups around the world to recreate the working station at relatively low cost.

Contact: Dr. Stefanie Merker, Public Relations, Max Planck Institute of Neurobiology, Martinsried, Tel+49 89 8578-3514

INTERNATIONAL VERTEBRATE GENOMES PROJECT RELEASES NEW GENOMES

MPI for Molecular Cell Biology and Genetics Press news, 13 September, 2018

Max Planck Society supports projects for high quality reference genomes of animals.

The International Vertebrate Genomes Project (VGP) is officially launched and releases 15 new reference genomes representing all five vertebrate classes – mammals, birds, reptiles, amphibians, and fish. These 15 genomes are the most complete versions of their species to date. The mission of the VGP is to sequence and assemble high quality, nearly error-free, and complete genomes of all 66,000 vertebrate species on Earth. The VGP data is currently being produced primarily by teams at three

sequencing hubs: the Rockefeller University, USA, the Wellcome Sanger Institute, UK, and at the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden, Germany. Two of the 15 released genomes, a bat and a fish, have been sequenced and assembled in Dresden.

The common bent-wing bat (Miniopterus schreibersii) is a species of subtropical origin distributed throughout the southern Palearctic, Ethiopic, Oriental, and Australian regions.

© Dietmar Nill

Spix's disk-winged bat (Thyroptera tricolor), one of the vertebrate species whose genome scientists plan to analyze.

© S. Puechmaille

Contact: Prof. Dr. Eugene Myers, Director, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Tel: +49 351 210-1900

ENVIRONMENTALLY FRIENDLY AND EFFICIENT

Fraunhofer Research news, 3 September 2018

Heat pumps use environmental energy to provide us with heat. However, they generally require synthetic refrigerants, which contain environmentally harmful fluorinated greenhouse gases (F-gases). Fraunhofer researchers have now contributed to the development of a heat pump that uses propane instead. The pump is both more climate-friendly and more efficient.

“Heating and hot water account for around 40 percent of Germany’s final energy consumption. Burning high-quality fossil fuels such as natural gas or crude oil not only makes little sense energetically, it also harms the climate. Each unit of electrical energy required to operate a heat pump, derived often from renewable resources, generates three to five units of CO_2-neutral heat energy. This makes heat pumps an important element in implementing Germany’s transition to a sustainable energy system,” says Dr. Marek Miara, who coordinates work on heat pumps at the Fraunhofer Institute for Solar Energy Systems ISE in Freiburg.

A heat pump works in a similar fashion to a fridge. The refrigerant absorbs the heat inside the fridge and transports it outside. The difference is that heat left to escape freely from the back of a fridge is what a heat pump extracts – in this case from the ground,

groundwater, or ambient air – to heat our homes or water.

To achieve this, the heated, vaporized refrigerant is compressed, which raises its temperature and pressure. The hot refrigerant gas releases its heat into water and condenses. The warm water flows into underfloor heating systems, radiators or hot water storage tanks, while the liquid refrigerant, now cool, flows back into a so-called evaporator, where it once again absorbs heat energy. The cycle then starts again from the beginning.

For the most part, refrigerants are composed of a mixture of synthetic substances containing environmentally harmful, fluorinated greenhouse gases (F-gases). In June 2014, the European Commission announced that F-gases are to be phased out of the market. One environmentally friendly, natural alternative to synthetic refrigerants is propane, which is already gaining in popularity in air conditioning and refrigeration systems. But its use in heat pumps is still relatively new. Because even though propane has excellent thermodynamic properties, it is highly flammable, and this poses a challenge when used in a heat cycle.

Contact: Karin Schneider, Head of Press and Public Relations,Fraunhofer ISE, Heidenhofstr. 2, 79110 Freiburg, Tel +49 761 4588-5147

JOINING FORCES FOR IMMUNE RESEARCH

Helmholtz Association Press news, 13 August 2018

The initiative “Immunology & Inflammation” unifies efforts in immunological research within the Helmholtz Association. 23 working groups from five Helmholtz Centers are joining forces to address some of the most complex problems in today's immunology in ways that can only be explored in collaboration.

“What we have learned about the immune system and its role in many widespread diseases over the last ten years opens up countless perspectives for research," says Professor Martin Lohse, Scientific Director of the Max Delbrück Center for Molecular Medicine (MDC), the center that coordinates the initiative.

“Our initiative's projects combine the centers’ research topics,” says Professor Pierluigi Nicotera, Vice-President of the Helmholtz Association and Coordinator of the Field of Health Research. “They address key questions such as: How do the immune and

nervous systems interact? How does the microenvironment of tissue influence the development of immune cells and what consequences does it have for cancer? How do we use this knowledge for therapies?"

Scientists working in more than 20 projects address these and other questions. Six of those are designed as tandem projects, which are special cooperative ventures involving teams from different centers. Additionally, researchers will meet and exchange knowledge in regularly. The first "Immunology & Inflammation" Conference will take place 24th-26th February 2019 in Berlin, and will host world-leading scientists as speakers.

One of the six tandem projects, for example, brings together the teams of Professor Mathias Heikenwälder (DKFZ) and Dr. Uta Höpken (MDC) to investigate the influence of inflammatory processes and signaling molecules on the spread of blood cancer. Patients with lymphoma metastases have significantly reduced chances of survival. How and why lymphomas implant themselves in other organs such as the liver or brain is yet unknown.

Contact: Dr. Martin Ballaschk, Helmholtz Association, Tel+49 30 9406-3714

DFG PRIORITY PROGRAMME FUNDS INNOVATIVE EYE RESEARCH IN DRESDEN

CRTD - Center for Regenerative Therapies Dresden Press news, 12 October 2018

Within the Priority Programme 2127 "Gene and Cell-based Therapies to Counteract Neuroretinal Degeneration" the German Research Foundation (DFG) provides funding of more than one million Euros for three years to four research groups at the Center for Regenerative Therapies Dresden (CRTD) and the Biotechnology Center (BIOTEC), both part of the Center for Molecular and Cellular Bioengineering (CMCB) of the TU Dresden, as well as at the German Center for Neurodegenerative Diseases (DZNE) in Dresden.

The SPP2127 brings together 29 experts in vision research and clinical ophthalmology to develop gene - and cell - based therapies for the treatment of currently incurable blinding diseases in a German - wide network. The funded projects will further strengthen this research direction within the Dresden life science network including pioneering approaches in regenerative therapies utilizing human induced pluripotent stem cells (hiPSC), genome engineering and label - free sorting technologies.

Since important anatomical features of the human retina, such as the macula,

are not present in typical laboratory animals, the lab of Dr. Mike Karl, group leader for Retinal Degeneration and Regeneration at the DZNE and affiliated with the CRTD, has developed 3D retinal organ-like systems, so - called organoids, from hiPSC. He will use these organoids for human disease modelling, especially for macular degeneration. Key for future therapies is to understand the pathological processes during photoreceptor degeneration including tissue – remodelling and scar formation. In addition, these human model retinas represent potential preclinical models to translate and optimize the integration of transplanted photoreceptors into the host tissue for future vision restoration therapies by cell replacement.

Dr. Marius Ader, Professor for Cell Replacement in the Mammalian Retina at the CRTD, an expert in photoreceptor cell transplantation, receives funding for a joint research project with Dr. Jochen Guck, Professor for Cellular Machines at the BIOTEC, to extract sufficient numbers of human photoreceptors from 3D organoids.

Contact: CRTD,Center for Regenerative Therapies, Fetscherstraße 105, 01307 Dresden

DECODING THE REGULATION OF CELL SURVIVAL – A MAJOR STEP TOWARDS PREVENTING NEURONS FROM DYING

Technical University Dresden Press news, 5 October 2018

An interdisciplinary and international research group led by Dr. Volker Busskamp from the Center for Regenerative Therapies Dresden at the TU Dresden (CRTD) has decoded the regulatory impact on neuronal survival of a small non-coding RNA molecule, so-called miRNA, at the highest resolution to date. This deciphering of gene regulation primes applications for strengthening neurons in order to protect them from neurodegenerative diseases. The extensive systems biology methods used here could become a new standard for the way miRNAs are researched.

miRNAs were first discovered 25 years ago, but understanding their impact on gene regulation of messenger RNAs (mRNAs) is still incomplete. While computer-based studies predict the maximum range of miRNA interactions, some of which can bind thousands of mRNAs, experimental studies usually provide only one or very few. The research team discovered that, contrary to previous assumptions, brain-enriched miRNA (miR-124) is unnecessary during neuronal differentiation from adult human stem

cells, but has a huge effect on neuronal survival.

The team combined both experimental and computational approaches and performed an in-depth system level analysis of miR-124. They found 98 miR-124 targeted genes that are simultaneously regulated. Many of these controlled genes had direct physiological functions, in particular protecting neurons from dying. The research group used a novel computational approach to also investigate indirect effects, namely the miR-124 targeted genes that themselves are regulators of gene expression.

Contact: Dr. Anka Kempe.Tel.: +49 351 458 82060, www.crt-dresden.de / www.tu-dresden.de/cmcb

WHY IT DOESN'T GET DARK WHEN YOU BLINK

German Primate Center Press news, 25 September 2018

Even though we constantly blink and move our head and eyes, we still see our world as a stable whole. How does the brain put together the visual information to form a conclusive image?

Every five seconds we close our eyes and blink to moisten them. During this brief moment no light falls on our retina yet it is not constantly dark and we continue to observe a stable picture of our environment. The brain seems to remember the percepts that have just happened. Caspar Schwiedrzik and Sandrin Sudmann, neuroscientists at the German Primate Center and the University Medical Center Göttingen, have in cooperation with colleagues from the United States performed studies on epilepsy patients to determine where this memory is situated in the brain and how it works. They have identified a brain area that plays a crucial role in perceptual memory. This finding enables a better understanding of the interaction of perception and memory (Current Biology).

Even though we constantly blink and move our head and eyes, we still see our world as a stable, unified whole. It must therefore be possible for the brain to retain visual information for a short period of time and then put it together to form a conclusive image without interruptions. Caspar Schwiedrzik and his team of neuroscientists suspected that a specific brain region known as the medial prefrontal cortex which plays an important role in short-term memory and decision-making may be a key player in this process.

Contact: Karin Tilch, Communication, German Primate Center, Leibniz Institute for Primate Research,Tel: +49 (0) 551 3851-335, www.dpz.eu

PANDEMIC PREVENTION AT AIRPORTS

Fraunhofer Research news, 3 September 2018

New anti-infection strategies for air transport.

Global air travel isn't restricted to people and goods – infectious agents, too, can make their way on board as unwelcome passengers and travel great distances within a matter of hours. In the air, the germs can spread unchecked. The HyFly joint research project aims to establish the scientific foundation for breaking chains of infection and, if possible, prevent pandemics. One way they hope to achieve this is by using a non-invasive method to identify infected individuals based on components in their breath.

Airports are hubs for pathogens from all over the world. Infectious diseases spread swiftly by air across countries and continents. According to the World Health Organization (WHO), the risk of global epidemics is increasing. New anti-infection strategies are needed. This is where the HyFly joint research project comes in, with 2.6 million in funding under the German Federal Ministry of Education and Research InfectControl 2020 initiative (see box "HyFly – project overview"). Partners from industry and research are developing strategies for disrupting the chains of infection in air transport and establishing effective countermeasures as a precaution. The project is expected to deliver concrete action plans for airport operators and airlines.

One of the ways the project is attempting to control migration paths is by detecting infections quickly and efficiently as passengers undergo screening at airports, without using molecular biological methods. Researchers at the Fraunhofer Institute for Cell Therapy and Immunology IZI are establishing a non-invasive method for this purpose, based on ion mobility spectrometry (IMS).

Contact: Jens Augustin, Head of Press and Public Affairs, Fraunhofer-Institute for Cell Therapy and Immunology, Perlickstraße 1, 04103 Leipzig, Tel +49 341 35536-9320

NEW VIRUS CONTROL MECHANISM DECIPHERED WITHIN THE BRAIN

Helmholtz Centre for Infection Research (HZI) Press news, 5 October 2018

A new strategy for the treatment of viral encephalitis.

Our brain is one of the most protected organs of the body. The blood-brain barrier, a barricade made of specialized cells, allows only selected substances to pass from the bloodstream into the central nervous system. It also shields our brain from pathogens, toxins and other

messenger substances.

Nevertheless, like any other security system, the brain also has vulnerabilities. Olfactory sensory neurons, also known as odorant neurons, are among such vulnerable sites. These neurons are located in the nasal epithelium, they are connected with the brain, and they are essential for our odorant sense. Viruses such as influenza virus, tick born encephalitis virus, Dengue virus and herpes viruses can exploit the odorant system to enter the brain. Upon entry of viruses into the brain via this route, the brain becomes inflamed and life-threatening encephalitis can develop as a consequence. Scientists at TWINCORE have uncovered a specific immune response in the brain which is based on completely different mechanisms than the defense against pathogens in the rest of the body. Recently, they published their discovery in the Journal Cell Reports.

Contact: Dr Jo Schilling at the following telephone number: +49 511 220027-114 or Prof Dr Ulrich Kalinke at: +49 511 220027-111,www.twincore.de

THE BRAIN'S TINY THRILL-SEEKERS

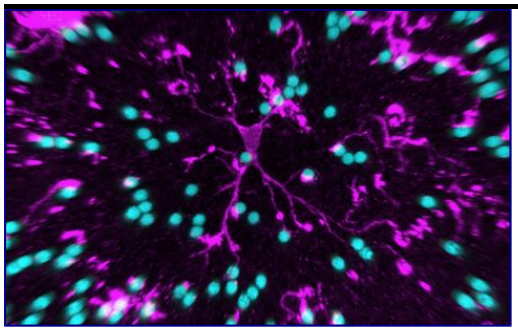
Max Delbrück Center for Molecular Medicine Press news, 4 September 2018

Microglia, the immune cells of the central nervous system, differ in male and female mice. MDC researchers report on the sex specific features in Cell Reports. Their findings could change how we treat neurological diseases.

Microglia watch over the brain's health around the clock, much like a battalion of tiny soldiers. When the cells sense pathogens or an injury through their movable projections, they rush to the trouble spot – and try to save that which is still salvageable.

But they do so quite differently depending on the animal's sex. "We were really surprised to find so many differences between the microglia of male and female mice," says Dr. Susanne Wolf, senior author of the study published in the journal *Cell Reports*, and researcher in the Cellular Neurosciences Lab at the Max Delbrück Center for Molecular Medicine (MDC) in Berlin.

Together with colleagues at Charité – Universitätsmedizin Berlin and a group of researchers from Warsaw, Wolf conducted a study on the structure and function of microglia, using brain slices and isolated cells. "It turns out that the brains of male mice have more microglia," says Wolf. And, according to the researcher, that's not the only difference: the cell bodies of male brain immune cells are larger than their female counterparts.



Microglia (pink) are a sort of garbage disposal for the brain. They quickly engulf small protein-coated latex balls and digest them.

© Susanne Wolf, MDC

Contact: Dr. Susanne Wolf, Scientist, Kettenmann lab "Cellular Neurosciences", Max Delbrück Center for Molecular Medicine in the Helmholtz Association (MDC), Tel+49 30 450 554054

PIONEERING BIOLOGISTS CREATE A NEW CROP THROUGH GENOME EDITING

University of Münster Press news, 4 October 2018

From wild plant to crop: CRISPR-Cas9 revolutionizes breeding / New tomato contains more valuable antioxidants.

Crops such as wheat and maize have undergone a breeding process lasting thousands of years, in the course of which mankind has gradually modified the properties of the wild plants in order to adapt them to his needs. One motive was, and still is, higher yields. One "side effect" of this breeding has been a reduction in genetic diversity and the loss of useful properties. varieties. Now, for the first time, researchers from Brazil, the USA and Germany have created a new crop from a wild plant within a single generation

This is shown, among others, by an increased susceptibility to diseases, a lack of taste or a reduced vitamin and nutrient content in modern using CRISPR-Cas9, a modern genome editing process. Starting with a "wild tomato" they have, at the same time, introduced a variety of crop features without losing the valuable genetic properties of the wild plant. The results have been published in the current issue of "Nature Biotechnology".

"This new method allows us to start from scratch and begin a new domestication process all over again," says biologist Prof. Jörg Kudla from the University of Münster, whose team is involved in the study. "In doing so, we can use all the knowledge on plant genetics and plant domestication which researchers have accumulated over the past decades.

The new cultivated tomato (right) has a variety of domestication features which distinguish it from the wild plant (left). The details (clockwise): It produces more flowers and therefore bears more fruit, the fruit is larger and oval in shape instead of round. The cultivated tomato contains more lycopene, which is noticeable through a deeper red colouring of the juice, and the plant has a more compact growth.

© Agustin Zsögön/Nature Biotechnology

We can preserve the genetic potential and the particularly valuable properties of wild plants and, at the same time, produce the desired features of modern crops in a very short time." Altogether, the researchers spent about three years working on their studies.

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NATURAL SCIENCES

AN EXCURSION TO THE VARIED WORLD OF PLANT LIFE

University of Freiburg Press news, 11 October 2018

Experience a green oasis in the winter cold at the Botanical Gardens.

What do you need to know about plants in the coming winter? Which winter-flowering plants can you plant to make your own garden more attractive? And which exotic plants from other climate zones can be found in Freiburg? Visitors to the University of Freiburg Botanical Gardens can find out the answers to this and many more questions during five Saturday walking tours. The lecture series begins on 20 October 2018, when Dr. Simon Poppinga presents autumn highlights in the Botanical Gardens.

Contact: Professor Dr. Hanns-Heinz Kassemeyer, Faculty of Biology, University of Freiburg, Tel: 0761/40165-1407

THE INTERACTIONS OF CHEMICAL MIRROR IMAGES

Ruhr University Bochum Press news, 12 October 2018

Chemical molecules that behave like images and mirror images interact differently with other molecules. A new project is set to reveal more about their differences.

Bochum-based chemists are hoping to find out how strongly mirror-image chemical molecules interact with their interaction partners. They are concentrating on halogen bonds that molecules with a bromine or iodine atom can form. These interactions are currently being investigated in many areas of chemistry as design elements for functional molecules, such as modern catalysts and new materials or pharmaceutically active compounds. The work of the researchers led by Dr. Christian Merten from the Department of Organic Chemistry II is being funded by the Boehringer Ingelheim Foundation as part of the “Plus 3” programme with around 760,000 euros for three years. The project starts in November 2018.

Chemical mirror images can have very different effects.

Many molecules, such as amino acids and sugars, exist in two mirror-imaged

spatial arrangements, but usually only one of them occurs in nature. “Biologically, the effect can be very different,” says Christian Merten, a member of the Cluster of Excellence Ruhr Explores Solvation, Resolv for short. “This is mainly due to the fact that the mirror-image forms interact with biomolecules such as enzymes in different ways.”

Chemists are therefore pursuing the goal of specifically producing one of the mirror-image forms and being able to precisely understand and predict its interactions with other molecules. The project by the Bochum-based researchers is mainly dedicated to the second aspect, the strength of the interaction.

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BLUE PHOSPHORUS- MAPPED AND MEASURED FOR THE FIRST TIME

Helmholtz Centre Berlin for Materials and Energy Press news, 16 October 2018

Until recently, the existence of "blue" phosphorus was pure theory: Now an HZB team was able to examine samples of blue phosphorus at BESSY II for the first time and confirm via mapping of their electronic band structure that this is actually this exotic phosphorus modification. Blue phosphorus is an interesting candidate for new optoelectronic devices. The results have been published in Nano Letters.

The element phosphorus can exist in various allotropes and changes its properties with each new form. So far, red, violet, white and black phosphorus have been known. While some phosphorus compounds are essential for life, white phosphorus is poisonous and inflammable and black phosphorus - on the contrary - particularly robust. Now, another allotrope has been identified: In 2014, a team from Michigan State University, USA, performed model calculations to predict that "blue phosphorus" should be also stable. In this form, the phosphorus atoms arrange in a honeycomb structure similar to graphene, however, not completely flat but regularly "buckled". Model calculations showed that blue phosphorus is not a narrow gap semiconductor like black phosphorus in the bulk but possesses the properties of a semiconductor with a rather large band gap of 2 electron volts. This large gap, which is seven times larger than in bulk black phosphorus, is important for optoelectronic applications.

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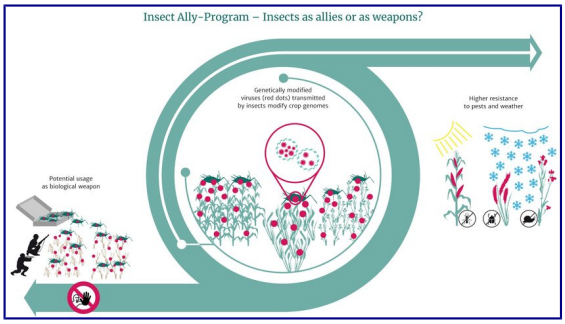
A PROJECT BY A RESEARCH AGENCY OF THE US DEPARTMENT OF DEFENSE COULD EASILY BE MISUSED FOR DEVELOPING BIOLOGICAL WEAPONS

MPI for Evolutionary Biology Press news, 4 October 2018

Genome Editing (Crispr) Jurisprudence.

Owing to present-day armed conflicts, the general public is well aware of the terrifying effects of chemical weapons. Meanwhile, the effects of biological weapons have largely disappeared from public awareness. A project funded by a research agency of the US Department of Defense is now giving rise to concerns about being possibly misused for the purpose of biological warfare. The programme called 'Insect Allies' intends for insects to be used for dispersing genetically modified viruses to agricultural plants in fields. These viruses would be engineered so they can alter the chromosomes of plants through 'genome editing'. This would allow for genetic modifications to be implemented quickly and at a large scale on crops that are already growing in fields, such as corn. In the journal Science, scientists from the Max Planck Institute for Evolutionary Biology in Plön and the Institut des Sciences de l'Evolution de Montpellier along with legal scholars from the University of Freiburg point out that this type of system could be more easily developed for use as a biological weapon than for the proposed agricultural purpose.



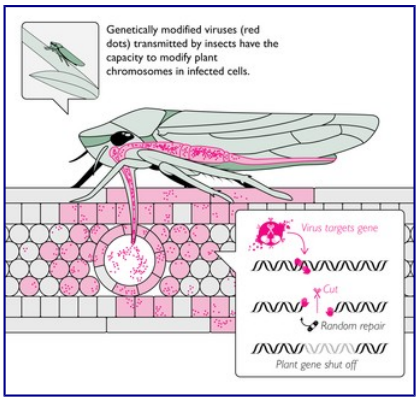
Research program with potential for dual use: scientists fear that the Insect Ally program by the US could encourage other states to increase their own research activities in the field of biological warfare.
© MPG/ D. Duneka

It is argued by the programs funders, that genome editing using synthetic viruses will open up unprecedented possibilities for changing the properties of crop plants already growing in fields. Plants could, for example, be genetically altered to nearly instantly become less susceptible to pests or droughts. Until now, genetic engineering of commercial seeds always occurred in laboratories. With farmers planting seeds, needing to anticipate what environmental conditions will likely arise during a growing season. This means that, in the case of an unexpected drought, only farmers who had already planted drought-resistant seeds would gain a benefit. However, the originators of this project claim that genetic engineering in fields would offer

farmers the possibility to alter the genetic properties of their crops at any time. Use of this technology would represent a radical break with many existing farming practices, potentially jeopardizing their coexistence.

At the end of 2016, DARPA (Defense Advanced Research Projects Agency) put out a call for tenders for a 4-year research work plan. This program has distributed a total of 27 million US dollars, aiming to develop genetically modified viruses that can genetically edit crops in fields. The first of three consortia, drawn from 14 American research facilities, announced their participation in mid-2017. Maize and tomato plants are reportedly being used in current experiments, while dispersal insect species mentioned include leafhoppers, whiteflies, and aphids. The DARPA work plan will culminate in large-scale greenhouse demonstrations of the fully functional system including insect-dispersed viruses.

In public statements, DARPA asserts that developments resulting from the Insect Allies Program are intended for routine agricultural use, for example for protecting crops against droughts, frost, flooding, pesticides or diseases. However, most countries using such technology would require comprehensive changes to approval processes for genetically modified organisms.



The program aims to develop virus-transmitting insects that infest crops. With teh help of the genome editing tool Crispr-Cas the viruses can modify the plants' genomes.

© D. Caetano-Anolles

Farmers, seed producers and not least the general public would also be massively affected by a use of such methods. “There is hardly any public debate about the far-reaching consequences of proposing the development of this technology. The Insect Allies programme is largely unknown, even in expert circles,” says Guy Reeves of the Max Planck Institute for Evolutionary Biology in Plön.

However, scientists and legal scholars from Plön, Freiburg and Montpellier believe that a broad social, scientific and legal debate of the issue is urgently required.

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SELF-MEDICATING LEMURS

German Primate Center – Leibniz Institute for Primate Research Press news, 8 September 2018

Researchers observe that red-fronted lemurs may chew on millipedes to rid themselves of intestinal parasites. They eat the millipedes because they secrete benzoquinone, a substance that is also known to repel mosquitoes.

Madagascar's red-fronted lemurs may have a secret weapon from nature's medicine cabinet: millipedes. This is according to a study led by Louise Peckre of the German Primate Center at the Leibniz Institute for Primate Research in Germany. Peckre and her colleagues believe that lemurs chew on millipedes to treat and prevent conditions such as itching or weight loss which are caused by parasites that might live in and around their guts. The research is published in the Springer-imprint journal Primates, which is the official journal of the Japan Monkey Centre.

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KIDNAPPING IN THE ANTARCTIC ANIMAL WORLD ?

AWI Press news, 10 September 2018

A puzzling relationship between amphipods and pteropods.

Pteropods or sea snails, also called sea angels, produce chemical deterrents to ward off predators, and some species of amphipods take advantage of this by carrying pteropods piggyback to gain protection from their voracious predators. There is no recognisable benefit for the pteropod. On the contrary they starve: captured between the amphipod's legs they are unable to feed. Biologists working with Dr Charlotte Havermans at the Alfred Wegener Institute have investigated this phenomenon as part of a cooperation project with the University of Bremen. In an article in the journal Marine Biodiversity, they talk about kidnapping and explain the potential advantages of this association for both the host and its passenger.

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LASER TECHNOLOGY & APPLICATIONS

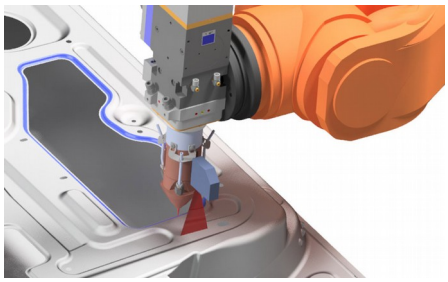
THE ROBOT EYE WITH AN ALL-AROUND FIELD OF VIEW

Fraunhofer Research news, 1 October 2018

Robots can move – but not see – in all directions. The patented laser sensor SensePRO developed by the Fraunhofer Research Institution for Additive Manufacturing Technologies IAPT provides a solution to this problem.

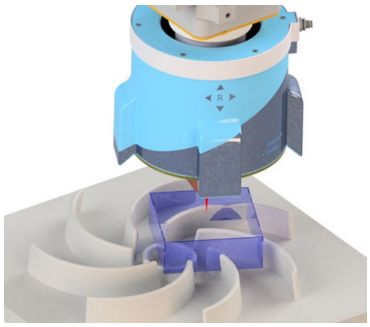
Where am I? Like humans, robots also need to answer that question, while they tirelessly glue, weld or apply seals to workpieces. After all, the production of precision products depends on robot control systems knowing the location of the adhesive bonding head or welding head to the nearest millimeter at all times. This means the robot needs some sort of eye. In the automotive industry and many other sectors, specialized sensors perform this function, most of which operate on the principle of laser triangulation. A laser diode projects a line of red light onto the workpiece, from which the light is reflected at a specific angle before being detected by a camera. From the position of the light striking the camera chip, the position and distance of the sensor with respect to the workpiece within the coordinate system can be calculated.

However, there is a problem with such systems: “Shadowing effect limits the flexibility of existing sensors. They also restrict the freedom of movement of the robot systems and integrating them is very labor-intensive,” says Mauritz Möller, head of the additive manufacturing systems department at the Fraunhofer Research Institution for Additive Manufacturing Technologies IAPT in Hamburg. The only way to measure height with conventional sensors is to mount them along the direction of processing. With these sensors, however, the robot is blind when it changes its direction of movement. Having to predefine the processing direction significantly limits the flexibility of the handling systems.



Conventional sensors limit the directional flexibility of robots

© Fraunhofer IAPT



The innovative SensePRO sensor provides a 360° all-round field of view for process control and quality assurance.

© Fraunhofer IAPT

The only alternatives are to use several sensors or additional axes – either of which, given today’s state-of-the-art technology, can sometimes cost more than the robot itself.

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"QUANTUM BOILING" REVEALS RELATIVITY IN ATOMS

DESY Press news, 11 October 2018

X-ray experiments show impact on atomic structure.

In a way of "quantum boiling" with intense X-ray flashes, scientists have stripped xenon atoms of most of their electrons. The experiments reveal the impact of Albert Einstein's theory of Special Relativity on the quantum structure of atoms. The international team around Sang-Kil Son and Robin Santra from the Center for Free-Electron Laser Science at DESY and Daniel Rolles and Artem Rudenko from Kansas State University report their study in the journal Nature Communications.

"Understanding atomic structure is fundamentally important," explains Son. "Quantum mechanics tells us how electrons are placed in different atomic shells." The atomic shell structure is the base for Mendeleev's periodic table and determines chemical properties of atomic elements. "Electrons in the outermost atomic shells typically move already at about one percent of the speed of light," adds Santra. "The electrons in inner atomic shells, however, move even faster, particularly in heavier atoms. Then, quantum mechanics must be complemented by the theory of special relativity to accurately describe the atomic structure."

Strong X-ray light can evaporate electrons from atoms in a process that is similar to the boiling of water: The X-rays only knock out a small number of electrons directly, dislodging them from the inner shells. The holes left by the missing electrons quickly "bubble up" towards the outer shells, transferring energy to other electrons, ultimately kicking them out of the atom, too. "When boiling water, the collisions between molecules play a central role, and in analogy the collisions of electrons play the central role in quantum boiling of atoms," explains Son.

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NOVEL CORKSCREW-LASER TECHNIQUE CAN SEND MOLECULES SPINNING RAPIDLY ABOUT A SELECTED AXIS

DESY Press news, 15 October 2018

Modified optical centrifuge has potential to open up new ways for the study of superrotors.

Using corkscrew-shaped laser pulses, scientists at DESY have devised a sophisticated optical centrifuge that can make molecules rotate rapidly about a desired molecular axis. The innovative method opens up new ways to control and study super fast

spinning molecules, called superrotors. Until now, optical centrifuges can make molecules rotate about one specific axis only. The new scheme lets scientists select between two axes. Alec Owens, Andrey Yachmenev and Jochen Küpper from the Controlled Molecule Imaging (CMI) Group at the Center for Free-Electron Laser Science (CFEL) report their theoretical concept in *The Journal of Physical Chemistry Letters*.

Optical centrifuges, built from rotating laser pulses, can make molecules spin faster than ten trillion times per second. These molecular superrotors have revealed unexpected behaviours and are interesting quantities for studies of scattering, spectroscopy, and dynamics. Superrotors can bring in significant energy into collisions and, at the same time, behave like tiny little gyroscopes that are more resistant to collisions and reorientation.

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MATERIAL SCIENCES & COMPONENTS

SOLID MATERIAL, MOBILE PARTICLES

Leibniz Institute for New Materials Press news, 25 September 2018

A newly developed material can “answer” temperature changes or, in the future, the presence of chemical substances and toxins with a color change.

Inside most materials, little is moving. But a new “active nanocomposite” is teeming with motion: small particles connect or separate, thus changing the color of the entire material. It was made by scientists of the Leibniz Institute for New Materials in Saarbrücken in an attempt to lend materials more dynamics. The transparent material can “answer” temperature changes or, in the future, the presence of chemical substances and toxins with a color change. The researchers want to create packaging films that change their color when food spoils, for example.

How does one get solid particles to move inside a solid material? „You rarely want this to happen in steel, concrete, or plastics, because free motion usually implies a weak spot in the material. In our active nanocomposites, particles are decoupled from the main material inside small compartments, while the rest remains stable,” says Tobias Kraus, Head of the Structure Formation Group at INM.

The research team used a trick: like raisins in a pudding, they distributed small liquid droplets in a polymer. The

droplets contained gold nanoparticles that move freely inside each droplet, something they could not do in the solid: “The particles are now free to either agglomerate or freely move in the entire droplet. The nanocomposite’s color depends on how far the nanoparticles are from each other, it changes from ruby red to grey-violet in our example. The particles can separate again, and the color change is fully reversible,” explains Professor Kraus.

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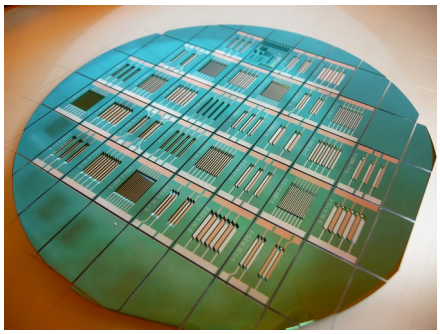
MICRO & NANOTECHNOLOGY

PLIABLE MICRO-BATTERIES FOR WEARABLES

Fraunhofer Research news, 1 October 2018

Wireless power supply: There is a new technology gripping the markets of the future – technology to wear. Wearables, as they are known, are portable systems that contain sensors to collect measurement data from our bodies. Powering these sensors without wires calls for pliable batteries that can adapt to the specific material and deliver the power the system requires. Micro-batteries developed by the Fraunhofer Institute for Reliability and Microintegration IZM provide the technical foundation for this new technology trend.



Fabrication of micro batteries with side-by side electrodes on silicon wafer

© Fraunhofer IZM

In medicine, wearables are used to collect data without disturbing patients as they go about their daily business – to record long-term ECGs, for instance. Since the sensors are light, flexible and concealed in clothing, this is a convenient way to monitor a patient’s heartbeat. The technology also has more everyday applications – fitness bands, for instance, that measure joggers’ pulses while out running. There is huge growth potential in the wearables sector, which is expected to reach a market value of 72 billion euros by 2020.

How to power these smart accessories poses a significant technical challenge. There are the technical considerations – durability and energy density – but also material requirements such as weight, flexibility and size, and these must be successfully combined. This is where Fraunhofer IZM comes in:experts at the institute have developed a prototype for a smart wristband that,

quite literally, collects data first hand. The silicone band's technical piece de resistance is its three gleaming green batteries. Boasting a capacity of 300 milliampere hours, these batteries are what supply the wristband with power. They can store energy of 1.1 watt hours and lose less than three percent of their charging capacity per year. With these parameters the new prototype has a much higher capacity than smart bands available at the market so far, enabling it to supply even demanding portable electronics with energy. The available capacity is actually sufficient to empower a conventional smart watch at no runtime loss. With these sorts of stats, the prototype beats established products such as smart watches, in which the battery is only built into the watch casing and not in the strap.

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OCEANOGRAPHY & MARINE TECHNOLOGY

HOW ARCTIC LAKES ARE ACCELERATING CLIMATE CHANGE

AWI Press news, 20 August 2018

Thawing permafrost's contribution to global warming could double by 2050. In the future, climate change could abruptly increase the amount of methane released by lakes in the permafrost regions of the Arctic. The explanation: because of thawing permafrost, these lakes are expanding, and below them the water is gnawing away deeper and deeper into the previously frozen soil where microbes now can produce methane. An international research team, including experts from the Alfred Wegener Institute, has now determined that the rapid thaw under lakes has been neglected in models so far and that bacterial decomposition of organic matter in the thawed sediments may strongly increase the emissions of the greenhouse gas methane.

Arctic lakes (Photo: Josefine Lenz)
Copyright: AWI

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SEARCHING FOR CLUES ON EXTREME CLIMATE CHANGE

GFZ Press news, 18 September 2018

The remains of a buried pine forest at the foot of Mont Saint Genis in Southern France yield insightful information on a drastic climate change event. The pine tree stand initiated around 12,900 years ago during the relatively warm “Allerød” period, and continued growing into the cold snap of the "Younger Dryas" period. Researchers at the GFZ German Research Centre for Geosciences in Potsdam, together with international colleagues, have for the first time combined classic tree-ring width measurements with chemical (stable isotope) analyses of carbon and oxygen in tree-rings to reconstruct climate variables. Thus, they were able to calculate local soil water composition (precipitation) and relative humidity at annual time resolution. This resulted in novel insights into the hydrological variability and atmospheric circulation changes during an abrupt climate change event. The team reports about its findings in the journal Scientific Reports.

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SEARCH FOR GROUNDWATER IN THE OCEAN

GEOMAR Press news, 25 September 2018/Kiel/Valetta.

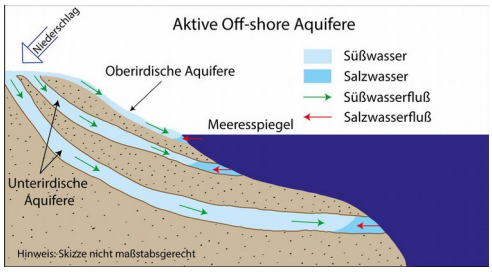
New German-Maltese Research Project started. Scientists from GEOMAR Helmholtz Centre for Ocean Research Kiel and the University of Malta (UM) will be joining forces to carry out a new research project on the sustainable management of offshore groundwater resources (SMART), and to set up an international centre for offshore groundwater research. The project will initially run for three years and receives funding in the order of 750,000 Euros from the Helmholtz Association.

Groundwater resources in the Maltese Islands and the Mediterranean Sea are facing enormous stress caused by population growth, increased pollution, and climate change. Offshore aquifers (OAs), which are freshwater bodies below the seabed, have been proposed as an alternative source of freshwater to relieve water scarcity in coastal regions. However, there are a number of issues that need to be addressed before OAs may be used sustainably. These include a lack of understanding of the location, geometry and evolution of OAs, and their connectivity with onshore aquifers.

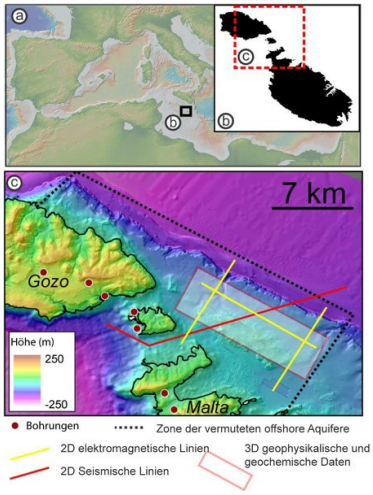
Recent studies have estimated theglobal volume of OAs is in the order of $5 \times 10^5 km^3$. This estimate is two orders of magnitude greater than what has been extracted globally from

continental aquifers since 1900 (4.5 x 10^3km^3).

Since submarine groundwater can be exploited with technology from the oil and gas industry and onshore groundwater exploitation, and because the costs seem to be economically competitive with desalination,



Schematic of submarine aquifers. Graphics: B. Weymer, GEOMAR.



Study area off the coast of Malta. Graphics: B. Weymer, GEOMAR.

OAs have the potential to become an important resource that can relieve water scarcity and mitigate the adverse effects of groundwater depletion in densely populated coastal regions.

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COASTAL EROSION IN THE ARCTIC INTENSIFIES GLOBAL WARMING

AWI Press news, 10 September 2018

Sea level rise in the past led to the release of greenhouse gases from permafrost.

The loss of arctic permafrost deposits by coastal erosion could amplify climate warming via the greenhouse effect. A study using sediment samples from the Sea of Okhotsk on the eastern coast of Russia led by AWI researchers revealed that the loss of Arctic permafrost at the end of the last glacial period led to repeated sudden increases in the carbon dioxide concentration in the atmosphere.

Today, the exact magnitude of the future increase in greenhouse gas concentrations remains unknown. This is partly due to the fact that carbon dioxide is not only produced by humans burning gas, coal and oil; it can also find its way into the atmosphere as a result of natural environmental processes. The positive feedback between warming and the release of ever increasing amounts of carbon dioxide from natural sources is a particular threat. In order to enable a better assessment of whether, and how, such developments are possible, climate researchers study records from

the past to find evidence of these events.

Researchers from the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI) together with colleagues from Copenhagen and Zurich have now found evidence of this phenomenon for the Arctic permafrost regions.

AWI permafrost scientists investigate the eroding coastline at the Siberian island Sobo-Sise, Eastern Lena delta. (Photo: Guido Grosse)

As the authors report in the journal Nature Communications, through their investigations along the coast of the Sea of Okhotsk in eastern Russia, they were able to show that several thousand years ago large quantities of carbon dioxide were released from Arctic permafrost – due to a rapid rise of sea level. Permafrost is ground that remains frozen year round down to depths of up to several hundred metres, some since the last glacial period 20,000 years ago or even longer. Like a giant freezer, permafrost soils preserve huge quantities of dead biomass, mainly plant remains. When the permafrost thaws, bacteria start degrading the ancient biomass, and their metabolisms release the greenhouses gases carbon dioxide and methane.

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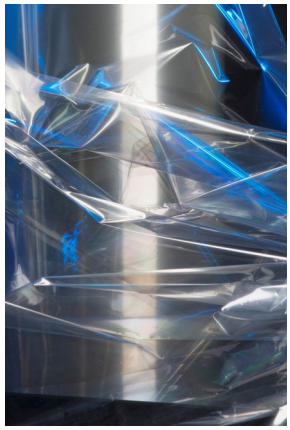
PRODUCTION TECHNOLOGY

THE BEGINNING OF A REVOLUTION IN PACKAGING

Fraunhofer Research news, 3 September 2018

Compostable polymer films: Humankind has already produced more than eight billion tons of plastic. Every year, we add another 80 million tons of plastic packaging to the total, only half of which is recycled.



bioORMOCER® foils are biodegradable and compostable.

© Fraunhofer ISC

The rest ends up in a garbage incinerator or as trash that pollutes forests, meadows, lakes and oceans. Dr. Sabine Amberg-Schwab from the Fraunhofer Institute for Silicate Research ISC in Wurzburg is on to

something that could solve the problem – a new class of material called bioORMOCER®s.

Contact: Marie-Luise Righi, Fraunhofer Institute for Silicate Research, Neunerplatz 2, 97082 Würzburg, Tel +49 931 4100-150

NEW WOOD-METAL HYBRID FOR LIGHTWEIGHT CONSTRUCTION

Fraunhofer Research news, 3 September 2018

Wood foam and metal sponge – can they be combined? That was the question that experts at the Fraunhofer Institute for Wood Research, Wilhelm-Klauditz-Institut WKI delved into in a project entitled “HoMe Foam” – with HoMe being a German acronym for wood-metal – together with scientists from the Fraunhofer Institute for Machine Tools and Forming Technology IWU and the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM. As a result, the contrasting materials come together in perfect harmony. The innovative new material mix boasts excellent insulating properties and has a low bending strength.

Now-a-days, sustainability is a key aspect when developing new materials, where the main focus is on ensuring the input materials used come from renewable sources and that the product is recyclable at the end of its service life.

From an ecological standpoint, wood foams are ideal for a whole range of applications.

© Fraunhofer WKI

Researchers at the Fraunhofer Institute for Wood Research, WKI are developing wood foams made entirely of wood. The natural adhesive properties of wood make synthetic adhesives superfluous. From an ecological standpoint, this makes wood foams ideal for a whole range of applications, for example as a core material for lightweight construction and sandwich panels, as packaging material, or for thermal insulation or soundproofing.

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CONSTRUCTION USING CONCRETE REINFORCED WITH RENEWABLE MATERIALS

Fraunhofer Research news, 1 October 2018

2019 BAU trade fair: A concrete bridge supported with natural fibers.

Tomorrow’s building material is here today. Textile-reinforced concrete (TRC) is durable, formable in diverse shapes

and suitable for lightweight construction. As the name suggests, conventional TRC is reinforced with carbon or glass-fiber fabrics rather than steel. A research team at the Fraunhofer Institute for Wood Research, Wilhelm-Klauditz-Institut WKI is now replacing these fabrics with eco-friendly natural fibers. These alternatives rival conventional concrete's performance, but leave a smaller carbon footprint, and cost less to make. Researchers will present a prototype of a natural fiber-reinforced concrete bridge at the BAU 2019 trade fair in Munich on January 14 to 19, 2019.

Germany's bridges are in sad shape. TÜV Rheinland says that one in every two is decaying. Reinforced concrete corrodes easily. Oxidation takes a toll on the reinforcing steel well before any telltale sign of damage is visible. Now the industry is looking to relegate cracks in concrete, and rusting steel, to history. Engineers and architects are opting for textile-reinforced concrete, a noncorroding building material with a long service life and the same structural properties as reinforced concrete. Components made of this material can be as thin as a few centimeters. It may be cast to make delicate, lightweight structures with reinforcing textiles that bend into practically any shape. Alongside bridges, the material is also suitable for facades and ceilings. Designers use it for seating furniture and sculptures.

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SPACE SCIENCE & AVIATION

THE INVISIBLE MADE VISIBLE

Leibniz Institute for Astrophysics Potsdam Press news, 27 July 2018

Observations with X-ray satellites open a window to regions of the Universe that are invisible to human eyes. The first catalogue of X-ray sources in overlapping observations has now been published.

Members of the X-ray astronomy working group at the Leibniz Institute for Astrophysics (AIP) and an international team have published the first catalogue of X-ray sources in multiply observed sky regions. The catalogue comprises almost 72,000 objects, partly of exotic nature, which were observed with the space-based X-ray telescope XMM-Newton. It provides information on the physical properties of the sources and enables astronomers to identify brightness variations on time scales of several years - and includes several thousand

new detections.

"The more images are superimposed the more details become visible" .

Since its launch end of 1999, the European X-ray satellite XMM-Newton has observed many patches of the sky repeatedly. Members of the X-ray astronomy group have developed new software to search for astrophysical objects in overlapping observations and used it to compile the first catalogue. By combining multiple observations of the same region of sky, higher accuracy is reached and faint sources are found that are not detectable in the individual observations. "Our method is similar to combining several transparencies showing the same subject: The more images are superimposed the more details become visible," explains Dr. Iris Traulsen, the project scientist at the AIP.

The new catalogue comprises 71,951 X-ray sources in 1,789 XMM-Newton observations and lists a wealth of information on their physical properties. Several thousand of these sources are newly discovered, many of them very faint and difficult to detect. The catalogue can be used to trace brightness changes of X-ray sources over time scales of up to 14.5 years. Dr. Axel Schwope, team leader at the AIP, says: "Variations of the X-ray brightness are a essential criteria used to search for exotic Celestial objects. To decipher their nature, we also employ the Large Binocular Telescope (LBT) in Arizona." The AIP is one of the LBT partners and contributes to its instrumentation and software.

Scientists all over the world have been using the XMM-Newton Source Catalogues to get new information about their research objects and to search for rare and as yet unknown sources of X-rays.

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NEPTUNE'S CLOUDS

Leibniz-Institut for Astrophysics Potsdam
Press news, 19 July 2018

The atmosphere impairs the astronomical images. A technology used for the first time suppresses the blurred effects of the atmosphere and produces very sharp images of the universe.

Astronomers from the Leibniz-Institute for Astrophysics Potsdam (AIP) tested as part of an international team a new observation mode with the MUSE instrument at the Very Large Telescope (VLT) in Chile in June 2018. The technology used for the first time suppresses the blurred effects of the atmosphere even better and produces very sharp images of planets, stars and

galaxies – among others of Neptune, which was once discovered at the predecessor institute of the AIP.

When observing the Universe from Earth, the atmosphere impairs the astronomical images. Therefore, astronomers have been trying to suppress this turbulence for a long time. One possibility is to observe from outside the Earth's atmosphere: The Hubble Space Telescope, for example, is so powerful because it does not have to consider the atmospheric effects.

With the help of adaptive optics (AO), astronomers can also eliminate these atmospheric effects in ground-based telescopes such as the VLT: In the ESO VLT facility on Mount Paranal, artificial stars at 80 km height, made using four lasers, are used to determine the difference between the model and the observed blurred images and correct the atmospheric turbulence. This powerful adaptive optics, for the first time, has now been tested with the MUSE 3D spectrograph in its so-called narrow-field mode with laser tomography. This corrects almost all atmospheric turbulence. Although the wide-field mode used so far enables observations in a larger field of view, it does not correct the blurring as well and produces a lower resolution images than the new narrow-field mode.

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SPACE-BORNE QUANTUM SOURCE TO SECURE COMMUNICATION

Fraunhofer Research news, 1 October 2018

Quantum communications: Soon, powerful quantum computers will be able to easily crack conventional mathematically encrypted codes. Entangled photons generated by a space-borne quantum source could enable hack-proof key exchange for ultra high security applications. A Fraunhofer research team has developed a high performance quantum source robust enough for deployment in space. They aim to launch the first European quantum satellite in some four years’ time.

The quantum source generates entangled photons and transmits them to Earth from a satellite, where they serve to distribute secure keys for encrypting data.

Gold and futuristic looking, but no larger than a bread box, this device has really been put through its paces – enduring vast leaps in temperatures from minus 40 to plus 60 degrees celsius, exposure to cold and heat in

vacuum, and jarring rodeo rides on a triple-axis vibrating platform. Throughout this excruciating campaign, the device had to demonstrate its unwavering robustness and high performance. When this quantum source passed the last of a grueling battery of stress tests conducted to the European Space Agency's stringent standards, it was deemed space-worthy. Clearly, this rugged little box would survive a rocket launch and hold up under harsh off-planet conditions.

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FAIR NEWS

CONTRACT SIGNED

FAIR News, 18 September 2018

The course for development and construction of the Collector Ring (CR), an important part of the future FAIR accelerator center, has been completely set. During the visit of a delegation of representatives of the Budker Institute for Nuclear Physics (BINP) to the FAIR and GSI campus, the contract for the remaining part of the CR was signed together with the management of FAIR and GSI. Prior to this, two contracts concerning the responsibility for the CR project realization and the dipole magnets construction for the CR had already been concluded.

The CR is designed for fast precooling of hot secondary ions coming from the antiproton separator and the Superconducting Fragment Separator (Super-FRS). The fast cooling will be done by means of the RF debuncher and stochastic cooling systems, which are developed by GSI. The CR is going to be used for mass measurements of short-lived secondary rare isotope beams from the Super-FRS in a special CR optical mode as well.

A large part of the CR is being developed under the direction of the Budker Institute as a Russian in-kind contribution to FAIR. The Budker Institute also bears the main responsibility for the Collector Ring. The signed contracts provides that BINP manufactures dipole, quadrupole and sextupole magnets, a vacuum system, power supplies for all magnets, beam diagnostic components and injection/extraction system. The most challenging components are 26 dipole magnets weighing almost 60 tons each. The BINP is responsible for assembly and commissioning of all CR components at FAIR site. With the contract now signed, all decisive prerequisites for the technological demanding Collector Ring are in place.

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