

Foreword



As a person who has accompanied IST Austria from the very early days in 2007, first in charge of media communication and since last year as Head of Stakeholder Relations, the newly created unit responsible for establishing, nurturing and expanding IST Austria's network of supporters, I look back onto what has been achieved here in Klosterneuburg both in awe and pride, but particularly filled with motivation.

IST Austria's circle of friends and benefactors has grown over the years. Affluent individuals, but also corporations realizing the important role research and education at IST Austria may play in the economic development of Austria, if not internationally, have come to increasingly support IST Austria's ambitious goals. Until today, IST Austria has been successful in attracting over 17 million Euros in donations. Next we are establishing an endowment for funding professorial chairs and scholarships for PhD students.

A third of our federal budget depends on the successful acquisition of grants and donations. Now, after the first six years since research on campus has started, and with regular stakeholder visits to campus, I am confident that IST Austria's steady development and scientific and organizational acclaim will now more than ever before inspire private financial support. This would significantly help us to both fulfill our budgeting goals and IST Austria's mission to establish itself among the world's best higher education and research institutions.

Oliver Lehmann | Head of Stakeholder Relations, IST Austria



Novarino becomes FENS-Kavli Scholar

As announced by the FENS-Kavli Network of Excellence, Gaia Novarino was selected to join the group of FENS-Kavli Scholars. She thereby becomes a member of a prestigious network of 35 outstanding young European neuroscientists who represent the most talented researchers in their field.

Novarino's research focuses on elucidating the genetic and molecular basis of neurodevelopmental disorders. She aims to identify and study genes underlying inherited forms of epilepsy associated with intellectual disability and/or autism. Despite a lot of progress in brain research to date, the causes of epilepsy remain unknown for the majority of cases.

Supported generously by the Kavli Foundation, the Federation of European Neuroscience Societies (FENS) established a high-level multidisciplinary network of excellent early to mid-career European neuroscientists providing fora of exchange and "putting young researchers in the driver's seat" of brain research on a global scale.



Jonas receives Wittgenstein Award

Peter Jonas was awarded the Wittgenstein Prize 2016, the most important and most valuable science award in Austria. The prize includes a funding of 1.5 million Euro with a maximum degree of freedom and flexibility for carrying out his research. In accordance with the program's objective, Peter Jonas intends to use the available funds for "high risk / high gain" research projects. As one of the world's leading neuroscientists, he is particularly known for his contributions to synaptic signaling in neuronal microcircuits.

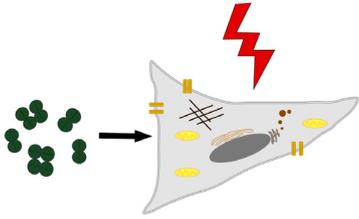
The Wittgenstein Prize funding will enable Peter Jonas to address another exciting question in neuroscience: the interrelation between structure and function of synaptic signaling. The goal is to detect the structural changes during synaptic transmission by combining optical stimulation and electron microscopic analyses. These studies will result in a precise picture on molecular, structural, and functional level of signaling at excitatory and inhibitory synapses.



Heisenberg elected as EMBO member

Carl-Philipp Heisenberg has been elected to European Molecular Biology Organization (EMBO) membership. His election by the most prestigious molecular biology network to EMBO Membership recognizes his outstanding contributions to cell and developmental biology. EMBO supports talented researchers at all stages of their careers, stimulates the exchange of scientific information, and helps build a top research network in Europe.

So far, more than 1700 of the best researchers in Europe and around the world have been elected EMBO Members and Associate Members. Each year this community convenes to elect new Members and Associate Members to life-long membership; this ensures that EMBO is represented by the most excellent researchers in the life sciences. In the annual election for 2016, a total of 58 new Members and Associate Members have been selected. Of the 30 EMBO members conducting research in Austria, four are from IST Austria: Nick Barton, Michael Sixt, Jiri Friml, and Carl-Philipp Heisenberg.



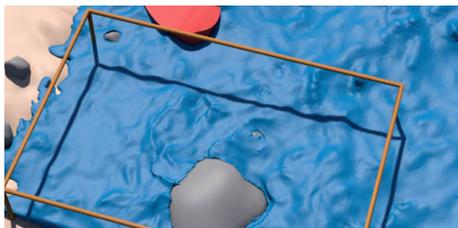
Red light controls signaling in cells

Optogenetics now enables the development of new methods that can be used like light switches to turn on and off specific processes in cells. Optogenetic methods are based on the isolation and modification of light-sensitive proteins in a first step and their subsequent incorporation into an individual target cell or an entire tissue. A paper by IST Austria researchers published in *Angewandte Chemie International Edition* describes successful red light experiments. Compared with the blue light mostly used in current approaches, red light has major benefits, particularly with respect to applications in model systems for diseases. Red light can penetrate deep tissues and can be employed without surgery in a non-invasive way; it has minimal cytotoxicity for human and animal tissues and has no effects on fluorescent proteins. Often used for various applications in research labs, fluorescent proteins tend to be activated or bleached by blue light.

For the light-sensitive protein, IST Austria Professor Harald Janovjak and his research group chose a photoreceptor which can be activated by red light. This photoreceptor was found in the cyanobacterium *Synechocystos*. In their study the authors

modified the receptor and fused it with a mammalian receptor, which has been found significant for many diseases. Later, they successfully demonstrated in experiments that the red-light activation of the fused receptor could activate a signal pathway that plays a crucial role in cell division.

As a rule, cell division is activated by so-called growth factors. They are the reason why two receptors undergo a binding and activation process, marking the start of cell division. The researchers managed to induce the binding and activation process by combining the receptors and using red light. Additionally, they showed that the fused receptor could be activated by red light even across tissue in cells which are used in model studies for diabetes.



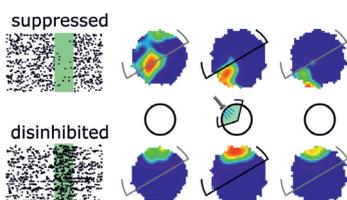
ACM SIGGRAPH Award for realistic physically-based fluid animation

During the annual top conference of the Special Interest Group for Computer Graphics (SIGGRAPH) of the Association for Computing Machinery (ACM) Professor Chris Wojtan was awarded the prestigious Significant New Researcher Award 2016. The jury based the decision on Wojtan's achievements throughout the last years using numerical methods

to simulate natural phenomena in a realistic and yet time- and cost-effective way. His research group developed fundamental new algorithms which allow a visualization of fluid dynamics or fracture of brittle material displaying fine, small-scale details in a large-scale behavior on the one hand while reducing memory usage and computing time on the other hand.

rock including changes of wave patterns in an ocean scene. In another publication, PhD student David Hahn introduces a new way for simulating brittle fracture. The selective removal of certain parts of the computation for fracture lines leads to a much faster, but still satisfying result for the animation of cracking material. The recently developed algorithms might be taken up by game developers or engineers for future applications. Additionally, Hahn contributed to a second publication presenting a new simulation method where only relevant parameters of a liquid surface are computed, which still allows a simulation of the whole liquid volume. The adaptation of the concerned equations resulted in a cost effective, yet feasible animation replacing current methods where super computers are required.

In addition to the recognition of Wojtan's achievements with the ACM Award, the ongoing success of his research group was underlined by three publications at the 43rd ACM SIGGRAPH conference. PhD student Morten Bojsen-Hansen presented a publication on a new algorithm that allows a seamless re-integration of a small simulation of local changes within a larger simulation, e.g. adding or deleting a



Activity-dependent processes govern place representation in hippocampus

Hippocampal excitatory cells fire in relation to space, and collectively these so-called place cells form an internal cognitive map of space. These hippocampal maps are thought to be updated during learning and in response to changes in the environment through activity-dependent synaptic plasticity. A research paper recently published by IST Austria

neuroscientists in the June issue of *Nature Communications* examines how changes in activity influence spatial coding in rats by using halorhodopsin-mediated, spatially-selective optogenetic silencing. As halorhodopsin is expressed in both place cells and inhibitory interneurons, optogenetic stimulation leads to light-induced suppression in many of these cells. However, some place cells were unaffected by light stimulation and some others increased their firing because they received less inhibition from the suppressed inhibitory interneurons.

former postdoc Philipp Schoenenberger, find that place fields of the unaffected subpopulation remain stable before, during, and after the optogenetic stimulation. On the other hand, place fields of suppressed place cells are unstable, showing a remapping process across sessions before and after optogenetic inhibition. Disinhibited place cells have stable maps but sustain an elevated firing rate following the stimulation. The findings produced by the IST Austria neuroscientists suggest that place representation in the hippocampus is constantly governed by activity-dependent processes in which suppressing place cell activity can cause lasting changes in their spatial coding. By contrast, increasing the excitability of these cells can cause lasting upregulation of their place-specific firing rates.

In their publication with the title "Activity-dependent plasticity of hippocampal place maps" Professor Jozsef Csicsvari and two members of his research group at IST Austria, postdoc Joseph O'Neill and

Sommercampus 2016 - kids discover research

IST Austria is organizing a one-week research camp for school children from August 22-26. The Sommercampus will give 45 talented kids the opportunity to discover science at first hand. Guided by IST Austria scientists and students of the Pädagogische Hochschule Niederösterreich (Lower Austrian College of Education), the youngsters at the age of six to ten will join one of three research groups – “Plants, animals and humans”, “Games, computers and robots” or “Observe, measure, experiment” - to find out more about basic concepts in life sciences, computer science, or physics. After studying, exploring and researching for four days, the young scientists will present the results of their experiments and discoveries at a mini conference on the fifth day. A graduation ceremony for the kids will mark the end of a research week full of fun and thrills.

For further information and registration visit the [Sommercampus website](#).

SOMMER CAMPUS



Scientific utopia - improving transparency in scholarly communication

The reproducibility of research results is, as several studies in recent years have shown, one of the biggest challenges for science. Therefore, IST Austria and Austrian Science Fund (FWF) are very proud to announce the lecture “Scientific Utopia - Improving Transparency in Scholarly Communication” by Brian Nosek on September 21st at the Albert-Schweitzer-Haus in Vienna.

Brian Nosek is the Director of the Centre for Open Science at the University of Virginia and one of the key contributors to the debate of Open Science in general and to the reproducibility of research results in particular. In his lecture, Brian Nosek will discuss how openness in research can be improved and contribute to better research results. His talk is part of the „New Trends in Scholarly Communication“ lecture series, initiated by IST Austria and the Austrian Science Fund.

For further information and registration visit the [IST Austria website](#).

COLLOQUIUM SPEAKERS

PAST SPEAKERS (May - June): Aneil Agrawal, University of Toronto (May 2) | Richard Losick, Harvard University (May 9) | Lai-Sang Young, New York University (May 23) | Peter Schröder, California Institute of Technology (May 30) | Iain Mattaj, EMBL (June 24)

FUTURE SPEAKERS (September - October): Garret Stuber, The University of North Carolina at Chapel Hill (September 5) | James Briscoe, The Francis Crick Institute (September 12) | David Nelson, Harvard University (September 26) | Kenneth S. Suslick, University of Illinois at Urbana-Champaign (October 10) | Ryohei Yasuda, Max Planck Florida Institute for Neuroscience (October 17) | Erik Jorgensen, The University of Utah (October 24)

SELECTED RECENT PUBLICATIONS

Bodová, Katarína, Tkačik, Gašper, Barton, Nicholas H: A general approximation for the dynamics of quantitative traits. In: *Genetics*. Genetics Society of America, 4, 2016, 1523-1548.

Calatrava Moreno, Maria D C, Auzinger, Thomas, Werthner, Hannes: On the uncertainty of interdisciplinary measurements due to incomplete bibliographic data. In: *Scientometrics*. Springer, 1, 2016, 213-232.

Chatterjee, Krishnendu, Goharshady, Amir, Ibsen-Jensen, Rasmus, Pavlogiannis, Andreas: Algorithms for algebraic path properties in concurrent systems of constant treewidth components. In: *ACM SIGPLAN Notices*. ACM, 1, 2016, 733-747.

Daca, Przemysław, Henzinger, Thomas A, Křetínský, Jan, Petrov, Tatjana P: Faster statistical model

checking for unbounded temporal properties. In: *Tools and Algorithms for the Construction, 9636:112-129 (LNCS)*. Springer, 2016, 112-129.

Ellis, Thomas J, Field, David L: Repeated gains in yellow and anthocyanin pigmentation in flower colour transitions in the Antirrhineae. In: *Annals of Botany*. Oxford University Press, 7, 2016, 1133-1140.

Franek, Peter, Krčál, Marek: On Computability and triviality of well groups. In: *Discrete & Computational Geometry*. Springer, 1, 2016, 126-164.

Guzman, Segundo J, Gerevich, Zoltan: P2Y receptors in synaptic transmission and plasticity: Therapeutic potential in cognitive dysfunction. In: *Neural Plasticity*. Hindawi Publishing Corporation, 2016, Article number: 1207393.

Jeschke, Stefan: Generalized diffusion curves: An

improved vector representation for smooth-shaded images. In: *Computer Graphics Forum*. Blackwell Publishing, 2, 2016, 71-79.

Lagator, Mato, Iglar, Claudia, Moreno, Anaisa B, Guet, Calin C, Bollback, Jonathan P: Epistatic interactions in the arabinose cis-regulatory element. In: *Molecular Biology and Evolution*. OUP, 3, 2016, 761-769.

Marhavý, Peter, Montesinos López, Juan C, Abuzeineh, Anas, Van Damme, Daniël, Vermeer, Joop E, Duclercq, Jérôme, Rakusová, Hana, Novakova, Petra, Friml, Jiří, Geldner, Niko, Benková, Eva: Targeted cell elimination reveals an auxin-guided biphasic mode of lateral root initiation. In: *Genes and Development*. Cold Spring Harbor Laboratory Press, 4, 2016, 471-483.

A full list of publications from IST Austria can be found at publist.ist.ac.at.

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