

## Foreword



Campus Services was established in September 2011, with the goal of combining the operation of such infrastructural services as guesthouse rooms, apartments, cafeteria, pub, kindergarten, shuttle bus, and sports facilities in one unit. As my educational background is in the fields of tourism and hospitality management, I was overcome with joy when IST Austria wanted me to lead the Campus Services team.

Almost five years later, I still feel enthusiastic: at the beginning of May we have opened a new cafeteria on campus. It has a capacity of 230 seats inside plus 154 seats on the terrace. The new cafeteria is operated by SV (Österreich) GmbH, a company that currently manages more than 250 restaurants in Austria, Germany, and Switzerland. They have introduced a new lunch concept with freshly cooked food made of local, seasonal, and well-balanced ingredients and a free-flow system at the buffet. Their additional focus on ethnic food reflects the diversity of the people and nationalities on campus.

Looking ahead, I am filled with excitement for the 90 new apartments to be built on campus. The construction works are scheduled to be kicked off this June. Once they are completed by the end of next year, Campus Services will run a total of 121 apartments and 38 guesthouse rooms. As excellent staff always forms the basis for successful operations, I consider myself lucky having a highly motivated and dedicated team that supports our scientists and employees in the best possible way.

Wolfgang Erhart | Unit Head Campus Services, IST Austria



### ERC Advanced Grants for IST Austria

Three IST Austria Professors are to receive the prestigious Advanced Grants from the European Research Council (ERC). Neuroscientists Peter Jonas and Ryuichi Shigemoto as well as physicist Robert Seiringer secured an award each with a total value of EUR 6.65 million.

President Thomas Henzinger is delighted: "ERC Advanced Grants are signs of recognition for excellent research, and I congratulate Peter Jonas, Ryuichi Shigemoto, and Robert Seiringer. Overall, the share of ERC awardees in our faculty has now risen to over 50% with 23 ERC-funded projects."

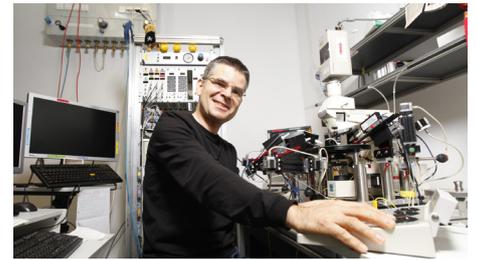
In their projects, neuroscientist Peter Jonas will address the question of how the biophysical properties of synapses shape higher brain functions up to the level of behavior, neuroscientist Ryuichi Shigemoto will investigate the structure of single channel subunit composition in situ, and physicist Robert Seiringer will delve into the mathematical analysis of many-body quantum systems.



### Martin Loose awarded HFSP grant

IST Austria Professor Martin Loose was awarded with the Young Investigator grant from the Human Frontier Science Program (HFSP). The grant is worth \$1.35 million in total for three years. Loose will join forces with Ivo Telley (Instituto Gulbenkian de Ciencia, Portugal), Sebastian Maurer (Center for Genomic Regulation, Spain), and Timothy Saunders (Mechanobiology Institute, Singapore). Their project "reconstitution of cell polarity and axis determination in a cell-free system" will start in fall 2016.

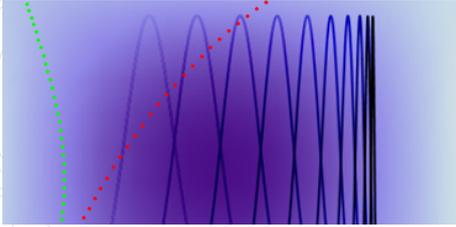
The International Human Frontier Science Program Organization (HFSP/O) exclusively funds scientific projects in life sciences that are highly innovative and risky. The funding program enjoys an excellent reputation within the scientific community because of the strict focus on pioneer research and is coveted because of the high autonomy given by the funding organization. Consequently, the funding is very competitive. With the current grant, IST Austria has already accumulated more than EUR 1.84 million of HFSP funding.



### Jonas joins Neuron's editorial board

IST Austria Professor Peter Jonas will be joining Neuron's editorial board. Neuron is one of the most influential and reputable journals in the field of neuroscience. With its editors embracing interdisciplinary strategies that integrate biophysical, cellular, developmental, and molecular approaches with a systems approach to sensory, motor, and higher-order cognitive functions, Neuron serves as one of the premier intellectual forums of the entire neuroscience community.

Peter Jonas, born in 1961, is an internationally recognized and highly distinguished neuroscientist, who is also on the board of reviewing editors for Science. In his research he focuses on synaptic signaling, investigating how synapses enable communication between neurons. With approximately 10 billion neurons communicating with each other at a billion of synapses in the brain, understanding the function of these neuronal microcircuits is one of the major challenges of the life sciences in the 21<sup>st</sup> century.



**Long-term response to selection predictable regardless of generic architecture**

In their *Proceedings of the National Academy of Sciences (PNAS)* publication postdoc Tiago Paixao and Professor Nick Barton addressed the controversial role of epistasis, where the effect of one gene is affected by the presence of other genes, in the response to selection for two extremely different

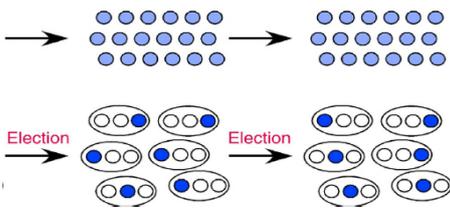
scenarios of evolutionary mechanisms. Evolutionary biologists so far argued over the role of epistasis on adaptation: while its effects on the short-term response are small, some argue that they can accumulate to produce large effects in the long-term.

By asking how much the mean of a complex genetic trait can be increased by selection, Paixao and Barton show the impact of epistasis in two different regimes. In the first scenario the dynamics of the allele frequencies are dominated by the mechanism of genetic drift, which means a purely random change in the frequency of gene variant instead of favoring the best or “fittest” variant. The long-term response in this case can be predicted in a surprisingly simple way as it depends only on the initial

components of the trait variance, regardless of the genetic architecture.

In the second scenario, allele frequencies change only due to their effect on the trait but, due to epistasis, this effect changes as the population adapts. The scientists show that epistasis can only affect the long-term response if the sign of this effect changes during the response which depends on the pattern of gene interactions. They show that the initial variance components are not predictive of these allelic reversals and of the long-term response.

Both scenarios have in common that epistasis can only increase the long-term response to selection if there is no systematic bias for the gene interactions.



**Gambling our way against climate change**

Humans have mastered the art of cooperation better than any other animal species. However, many social dilemmas remain unsolved. While we are in charge of most of our lives, in these dilemmas, representatives make decisions for us. A team of scientists including postdoc Christian Hilbe published the first experimental investigation into how repres-

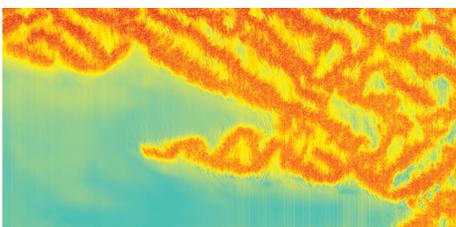
entatives behave in social dilemmas in *Nature Communications*.

To study how representatives act in dilemmas, the scientists played a game with volunteers divided into groups. Together, the groups need to raise a set sum of money by contributing from their pots. For each country, a representative decides how much money to contribute. If all countries together manage to raise the required target amount, the participants can keep the remaining money. However, if the countries fail to reach the target sum, participants lose all remaining money. Similar to real-life countries, the representatives are up for election after several rounds.

In the experiment, selfish representatives, who con-

tribute less than their country’s fair share, get preferentially re-elected. Hilbe and colleagues show that selfish representatives are extortionists, getting other representatives to compensate for what they themselves do not contribute. All countries together reach the target amount of money, but the extortionate country maximizes its own pot.

This study suggests an answer to why we keep electing representatives who do not contribute enough to reaching global goals. As representatives get preferentially re-elected if they act selfishly, they act selfishly. But at the same time, selfish representatives are extortionists, as they successfully persuade others to contribute more towards the global goal. In the end, the collective goal is reached – it is to be hoped.



**What does turbulence have in common with an epidemic?**

Fluid flows can take one of two forms: well-ordered “laminar” or highly disordered “turbulent” motion. Although everyday experience shows that laminar motion in simple shear flows gives way to turbulence as the flow speed increases, the exact nature of this transition has remained a riddle since its first study in the 19<sup>th</sup> century.

IST Austria Professor Björn Hof and his colleagues from the Max Planck Institute for Dynamics and Self-Organization in Göttingen and the Friedrich-Alexander-University Erlangen-Nürnberg have considerably contributed to answering this question in the past. In their *Nature Physics* paper they were eventually able to show that the transformation can be fully characterized as a phase transition, based on their study of the so called “Couette flow”. This kind of flow consists of a viscous fluid that is confined between two parallel walls that move in opposite directions.

Just like in pipes or channels, turbulence in Couette flow first appears in localized domains and seems to co-exist happily with laminar regions. Investigations over exceedingly long times reveal that turbu-

lent and laminar regions in reality compete and try to annihilate each other. Below a critical speed, the laminar phase wins, but yields to turbulence beyond some threshold, resulting in an ever changing co-existence pattern of laminar and turbulent domains.

A qualitatively similar behavior is known from “directed percolation”. This simple statistical physics model has three “critical exponents” that can describe the resulting fluctuating co-existence patterns. The turbulent Couette experiments could precisely confirm predicted critical exponents. Apart from finally providing an answer for the nature of the onset of turbulence, they are also one of the first experimental confirmations of the directed percolation universality class.

## Open Campus 2016

IST Austria opens its doors and cordially invites you to its Open Campus on June 5, 2016, from noon to 6:00pm. The Open Campus is our annual science festival for the entire family, with IST Austria scientists presenting their current research projects in an interactive exhibition. It gives you the unique opportunity to do hands-on experiments at research islands, explore labs and other facilities on campus tours, and learn more about basic research topics in the family lecture. Another highlight is the award ceremony for the winners of this year's school competition in the Raiffeisen Lecture Hall. In addition to food, drink, and music, there is also a children's program on campus, providing entertainment and information for kids from 3 to 12 years old. Free shuttle buses departing from Vienna and Tulln take you to the IST Austria campus on an hourly basis.

For further information on the program view our [website](#).



## On the Way to the Top: What makes a Research Institution Excellent?

On June 6, 2016, IST Austria celebrates an important milestone. Ten years before, an international committee submitted a report to the Federation of Austrian Industries. That report not only provided a concept of IST Austria but also recommended steps towards the foundation of the research institute. Today the report describes the founding principles that continue to shape IST Austria's development from vision to reality.

"On the Way to the Top: What makes a Research Institution Excellent?" brings together seven distinguished speakers from the academic world to reflect on what it takes to become a first-class research center. On the panel are Patrick Aebischer, Jonathan Dorfan, Peter Gruss, Helga Nowotny, Rolf-Dieter Heuer, Haim Harari, and Olaf Kübler. The celebratory evening starts with a cocktail reception and concludes with a get-together and buffet.

For information and registration see our [website](#).

## COLLOQUIUM SPEAKERS

**PAST SPEAKERS (March - mid-May):** David Forsyth, University of Illinois (March 7) | Naama Barkai, Weizmann Institute of Science (March 14) | Ana Maria Rey, University of Colorado (March 21) | David DiVincenzo, Aachen University (April 4) | Richard Tsien, New York University (April 11) | Stefan Wol, Università della Svizzera italiana (April 18) | Gloria Corruzi, New York University (April 25) | Aneil Agrawal, University of Toronto (May 2) | Richard Losick, Harvard University (May 9)

**FUTURE SPEAKERS (mid-May - June):** Lai-Sang Young, New York University (May 23) | Peter Schröder, California Institute of Technology (May 30) | Sandra Troian, California Institute of Technology (June 13)

## SELECTED RECENT PUBLICATIONS

Ajanki, Oskari H, Erdős, László, Krüger, Torben: Local spectral statistics of Gaussian matrices with correlated entries. In: *Journal of Statistical Physics*. Springer, 2016, Epub ahead of print-.

Avvakumov, Serhii: The classification of certain linked 3-manifolds in 6-space. In: *Moscow Mathematical Journal*. Independent University of Moscow, 1, 2016, 1-25

Bao, Zhigang, Erdős, László: Delocalization for a class of random block band matrices. In: *Probability Theory and Related Fields*. Springer, 2016, Epub ahead of print-.

Chatterjee, Krishnendu, Chmelík, Martin, Gupta, Raghav, Kanodia, Ayush: Optimal cost almost-sure reachability in POMDPs. In: *Artificial Intelligence*.

Elsevier, 2016, 26-48.

De Martino, Daniele: Genome-scale estimate of the metabolic turnover of E. Coli from the energy balance analysis. In: *Physical Biology*. IOP Publishing Ltd., 1, 2016, Article number: 016003-.

Gundert, Anna, Wagner, Uli: On topological minors in random simplicial complexes. In: *Proceedings of the American Mathematical Society*. American Mathematical Society, 4, 2016, 1815-1828.

Kazda, Alexandr: CSP for binary conservative relational structures. In: *Algebra Universalis*. Springer, 1, 2016, 75-84.

Pausinger, Florian, Steinerberger, Stefan: On the discrepancy of jittered sampling. In: *Journal of Complexity*. Academic Press, 2016, 199-216

Petrat, Sören P., Pickl, Peter: A new method and a new

scaling for deriving fermionic mean-field dynamics. In: *Mathematical Physics Analysis and Geometry*. Springer, 1, 2016, Article number: 3-.

Seiringer, Robert, Warzel, Simone: Decay of correlations and absence of superfluidity in the disordered Tonks-Girardeau gas. In: *New Journal of Physics*. IOP Publishing Ltd., 3, 2016, Article number: 035002-.

Qi, Qin, Toll-Riera, Macarena, Heilbron, Karl, Preston, Gail M, MacLean, R Craig: The genomic basis of adaptation to the fitness cost of rifampicin resistance in *Pseudomonas aeruginosa*. In: *Proceedings of the Royal Society of London Series B Biological Sciences*. Royal Society, The, 1822, 2016, Article number: 20152452-.

A full list of publications from IST Austria can be found at [publist.ist.ac.at](http://publist.ist.ac.at).

**IMPRINT** The IST Austria Newsletter is produced by the Communications team and published every three months. You can find further information about IST Austria on our [website](http://www.ist.ac.at) ([www.ist.ac.at](http://www.ist.ac.at)), on Facebook ([www.facebook.com/istaustria](http://www.facebook.com/istaustria)), and on Twitter ([www.twitter.com/istaustria](http://www.twitter.com/istaustria)).