

Foreword



As I am writing these lines, it is my ninth week at IST Austria as the new Division Head of Communications and Events. Therefore, this foreword can only reflect my first impressions against the background of my professional career in science and corporate communications so far. The first and most important observation I would like to share with you was my personal “wow effect” as I checked in on campus on September 1st. It is amazing to see how this place has developed into a true academic campus in the best sense of the word, how the “ring of buildings” around the pond is getting closer towards completion and to see this perfect combination of new and old, fancy and modest, artificially clean and pure nature. But all these contrasts remain impressions at first sight.

In order to get a true picture, interaction is required with those people having transformed this location into a vibrant place of outstanding research. It is the people in science, in the scientific service units and in administration who have created a place I would like to refer to as Future Zone. What makes me confident as a communicator is the experience I have made in my personal interactions so far. These impressions produce a perfect match with the vision and missions conveyed to the outside world. This is the best and most solid footing one can build communication strategies upon: Authenticity as an asset that makes the Institute’s narratives as robust as one can hope for. And this is exactly what makes me confident that the success story of IST Austria, which has been written and told so far, will continue.

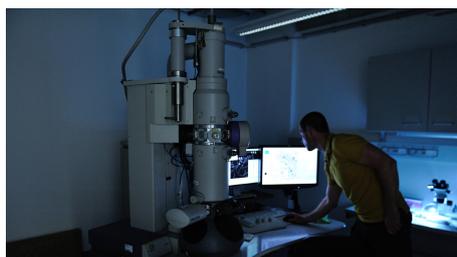
Stefan Bernhardt | Division Head Communications and Events, IST Austria



Pöttinger supports three PhD students

On October 8, IST Austria President Thomas Henzinger presented Klaus Pöttinger as another donor. The co-owner of Pöttinger Agricultural Technology (Upper Austria) will support IST Austria with EUR 200'000 over a period of three years for IST Austria’s scholarship program. The total amount of third party funding attracted by IST Austria from corporate and private donors thus now equals 17.5 million Euros.

Through the Pöttinger scholarships Feyza Nur Arslan, Matilda Peruzzo, and Priscila Pichani Hirschfeld will be funded for three years. A panel consisting of IST Austria postdocs from five different areas had been tasked with identifying particularly promising doctoral students. All graduate students’ applications were reviewed, with the statements of purpose, letters of recommendation, and academic transcripts serving as the basis for the decision. The Pöttinger Scholars have begun their studies in this year’s class of IST Austria’s graduate school which started in September.



Scientific Service Units launch website

On September 18, the Scientific Service Units (SSUs) launched a designated website to better showcase their high-quality research infrastructure. It is the SSUs at IST Austria that provide scientists with professional services and state-of-the-art equipment for performing research at an internationally competitive level. As IST Austria aims at maximizing the sharing of its high-performance infrastructure among multiple research groups in order to avoid a duplication of efforts and expenses, its SSUs are central core facilities open to all scientists of the institute.

Currently, there are seven SSUs established on campus, ranging from the bioimaging facility and the electron microscopy facility to the life sciences facility, scientific computing, the library, the MIBA Machine shop, and a clean room facility, which is still under development. The staff of these SSUs gives the IST Austria researchers the support they need to ensure their excellent findings in science. View the SSU website at <http://ist.ac.at/ssus>



Novarino to receive prestigious award

IST Austria Professor Gaia Novarino has been awarded the Boehringer Ingelheim FENS Research Award 2016. This award, donated by the pharmaceutical company Boehringer Ingelheim and announced by the Federation of European Neuroscience Societies, (FENS) is one of the most prestigious European awards in neuroscience. The prize is worth EUR 25,000 and is awarded in recognition of outstanding and innovative scientific work to European scientists under 40 years of age.

Novarino is honored for her research on the genetic and molecular mechanisms underlying human genetic disorders. Her current research program focuses on inherited forms of epilepsy, intellectual disability and autism. Often, epilepsy patients also suffer from autism or intellectual disability, comprising the neurodevelopmental disorder (NDD) spectrum. Novarino asks whether all these disorders share common molecular mechanisms, and seeks to identify the genes and the mechanisms responsible for these disorders by studying genetic forms of NDDs.



Shining light on orphan receptors

Light has been used for the first time to activate a receptor for which the compound binding and controlling it naturally is unknown, as reported in **Nature Chemical Biology** on October 12. A team of scientists including Harald Janovjak, Assistant Professor at IST Austria, Álvaro Inglés-Prieto, first author and postdoc in the Janovjak group, and Eva Reichhart, PhD student in the Janovjak group, using

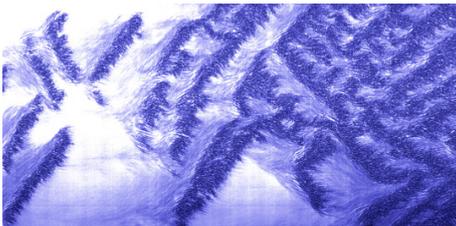
libraries and cells from the Medical University of Vienna and the CeMM, Vienna, employed their novel application of optogenetics to identify a new compound that inhibits the orphan receptor ROS1, which has been linked to several forms of cancer.

The authors demonstrate the power of a new all-optical screening method by carrying out a screen against ‘orphan’ receptors. These are receptors for which the natural ligand is currently unknown. Therefore, orphan receptors can only be activated in cells using a synthetic approach, such as the artificial light switch introduced in this study. Using the optical screening method, the researchers identify a new active compound that binds to and inhibits ROS1, an orphan receptor which plays a role in a variety of cancers. The inhibitory com-

pound AV-951, also known as Tivozanib, has already been studied in clinical trials and has the potential to treat many forms of cancer.

In their novel, “all-optical”, screening method, the researchers use light as both the activator and the read-out of cellular signaling. No assay chemicals are required, which limits the number of steps required in carrying out the screen. By using LEDs, optical activation is both cheap and highly specific.

Light activation has already revolutionized neuroscience research. This study, for the first time, used light to control a protein for which the natural mode of activation is unknown. In addition, this entirely new use for light activation expands optogenetics into the field of drug discovery.



Turbulences on the rise

Turbulence plays a central role in nature and in technology: it influences how pollutants spread in the atmosphere and limits the transport of liquids in pipelines, to give just a few examples. Researchers have been trying for over a hundred years to better understand how turbulence arises. Important progress has now been achieved by IST Austria Professor Björn Hof and his colleagues from the Max

Planck Institute for Dynamics and Self-Organization, the University Erlangen-Nürnberg as well as the University of Warwick. In the current edition of **Nature**, they describe how a fully turbulent flow arises in pipe and square duct flows.

Although turbulence can already appear at lower speeds in localized patches, a large part of the fluid remains unaffected and continues to flow in a well ordered (laminar) fashion. This changes however at larger flow rates. The fluid now possesses higher kinetic energy, thereby stabilizing the turbulent patches which now continuously grow. As a result, all laminar areas are absorbed and the entire flow is transformed into chaotic eddying motion. Fully turbulent flow is now the natural state of the system.

The scientists could observe this behavior in experiments and high-resolution computer simulations. They were able to verify with a mathematical model which state arises at which flow rates. A decisive role is played by the fronts that appear at the boundaries between laminar and turbulent patches and change their stability.

“Our findings regarding the onset of turbulence are an important starting point to eventually obtain a better understanding of highly turbulent flows,” says Hof. Due to the friction losses resulting from turbulence, pumping costs amount to billions of dollars. He states: “A transformation into a laminar flow could reduce the friction loss by more than 90% and would thus result in substantial energy savings.”



How sensorimotor intelligence may develop

It is fascinating to observe a robot exploring its physical possibilities and surroundings, and subsequently developing different self-taught behaviors without any instructions. In their paper published in **PNAS**, Professor Ralf Der from the Max Planck Institute for Mathematics in the Sciences, and Georg Martius, Postdoc and Fellow at the Insti-

tute for Science at IST Austria, demonstrate the emergence of sensorimotor intelligence in robots based on their proposed learning rule.

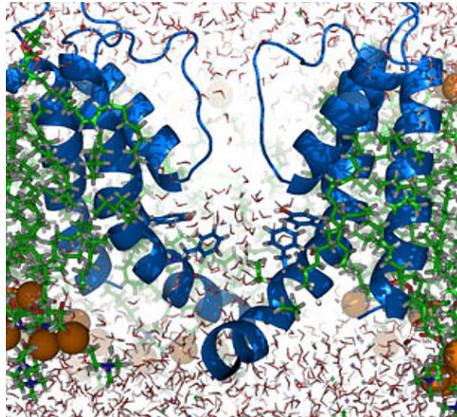
How brains or artificial neural networks develop autonomous, self-directed behavior is a fundamental challenge for both neuroscience and robotics. Traditionally, the self-organized development of behavior is explained by using concepts such as intrinsic motivation or curiosity. In their paper, Der and Martius argue however that the emergence of such behavior can be grounded directly in the synaptic plasticity of the nervous system.

To test their hypothesis, the authors use bioinspired robots consisting of a humanoid and a hexapod robot in physically realistic computer simulations. The

robots receive sensory input from their bodies but are not given any form of instruction or task. What can then be observed is a rich spectrum of rhythmic behaviors of the robots as they explore various movements. Solely because of the tight coupling of environment, body, and brain (in this case an artificial neural network), the robots can obtain feedback from their situation and adapt quickly. This, together with a simple, learned self-model, allows them to develop a form of sensorimotor intelligence. Different scenarios show how they acquire the ability to crawl, walk on changing surfaces, or even cooperate with another robot. The authors explain this phenomenon with the proposed synaptic plasticity, a coupling mechanism that allows a simple neural network to generate constructive movements for almost any given body.

Festive opening of Lab Building West

On December 1, 2015, IST Austria will celebrate the festive opening of Lab Building West. The ceremonial act in the Raiffeisen Lecture Hall will be followed by guided tours and a reception. Lab Building West is the newest laboratory building erected on campus. It will be opened after 30 months of construction to house research groups working in the fields of physics and mathematics, as well as scientific services, such as a nanofabrication facility. It will also be the interim home for administrative staff and a private company before it moves to IST Park. For information and registration view our [website](#).



MolTag official opening ceremony

IST Austria will be hosting the official opening ceremony of the 2nd period of the "Ion channels and transporters as molecular drug target" (MolTag) doctoral program on December 9, 2015.

Established by four research institutions, molTag offers a broad three-year PhD education in pharmaceutical sciences. Funded by the Austrian Science Fund (FWF), the graduate program was initially started in 2011. After a successful evaluation by an international jury, the continuation of funding for another 4-year period was secured. For information and registration go to our [website](#).

Student Open Day at IST Austria

On November 20, 2015, IST Austria welcomes you to the Student Open Day. Students who are interested in doing their doctoral studies in biology, neuroscience, computer science, mathematics, or physics await a varied program on campus, including talks, poster sessions, guided tours and a think&drink event, with scientists presenting their ongoing research. In addition, the Graduate School will provide you with information on the PhD program and internship opportunities available at IST Austria. A shuttle bus will take you to IST Austria. For information and registration see our [website](#).



COLLOQUIUM SPEAKERS

PAST SPEAKERS (September - October): Daniel Geschwind, University of California Los Angeles (Sep 7) | Steve Marschner, Cornell University (Sept 28) | Yves Barde, Cardiff University (Oct 5) | Judith Mank, University College London (Oct 12) | Julie Theriot, Stanford University (Oct 19)

FUTURE SPEAKERS (November - January): Harry Swinne, University of Texas at Austin (Nov 2) | Andrew V. Goldberg, Amazon.com Inc. (Nov 9) | Erik van Nimwegen, University of Basel (Nov 23) | Daniel Choquet, University of Bordeaux (Dec 14) | Renato Renner, ETH Zurich (Jan 18) | Eske Willerslev, University of Copenhagen (Jan 25)

SELECTED RECENT PUBLICATIONS

Bogomolov, Sergiy V, Donze, Alexandre, Frehse, Goran, Grosu, Radu, Johnson, Taylor T, Ladan, Hamed, Podelski, Andreas, Wehrle, Martin: Guided search for hybrid systems based on coarse-grained space abstractions. In: International Journal on Software Tools for Technology Transfer. Springer, 2015.

Deuchert, Andreas, Hainzl, Christian, Seiringer, Robert: Note on a family of monotone quantum relative entropies. In: Letters in Mathematical Physics. Springer, 10, 2015, 1449-1466.

Franěk, Peter, Krčál, Marek: Robust satisfiability of systems of equations. In: Journal of the ACM. ACM, 4, 2015.

PKaczmarczyk, Jan, Spalek Jozef., Wysokiński Marcin M.: Gutzwiller wave function solution for Anderson

lattice model: Emerging universal regimes of heavy quasiparticle states. In: Physical Review B. American Physical Society, 12, 2015.

Kiermaier, Eva, Sixt, Michael: Fragmented communication between immune cells: Neutrophils blaze a trail with migratory cues for T cells to follow to sites of infection. In: Science. American Association for the Advancement of Science, 6252, 2015, 1055-1056.

Klimova, Anna, Rudas, Tamás: Iterative scaling in curved exponential families. In: Scandinavian Journal of Statistics. Wiley-Blackwell, 3, 2015, 832-847.

Letts, James A., Sazanov, Leonid A: Gaining mass: The structure of respiratory complex I from bacterial towards mitochondrial versions. In: Current Opinion in Structural Biology. Elsevier, 2015, 135-145.

Marre, Olivier, Botella-Soler, Vicente, Simmons,

Kristina D, Mora, Thierry, Tkačik, Gašper, Berry, Michael J: High accuracy decoding of dynamical motion from a large retinal population. In: PLoS Computational Biology. Public Library of Science, 7, 2015.

Priklopil, Tadeas, Chatterjee, Krishnendu: Evolution of decisions in population games with sequentially searching individuals. In: Games. Multidisciplinary Digital Publishing Institute, 4, 2015, 413-437.

Ratheesh, Aparna, Belyaeva, Vera, Siekhaus, Daria E: Drosophila immune cell migration and adhesion during embryonic development and larval immune responses. In: Current Opinion in Cell Biology. Elsevier, 2015, 71-79.

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