IST AUSTRIA

Institute of Science and Technology

FLOW

In 2013, the research directions at IST Austria expanded to include physics, studying – among other topics – fluid turbulence.
Thus ‘flow’ has been chosen as theme for the 2013 annual report.
At IST Austria the steady flow of ideas between researchers of different disciplines is stimulated by physical connections, such as the campus bridge, a meeting space between buildings. A room-length blackboard on the bridge bears witness to the continuous exchange of ideas and concepts, and inspired the design of this report.

Content

WHERE DO THEY FLOW FROM?
Have a look!

Imprint
Institute of Science and Technology Austria
Am Campus 1, 3400 Klosterneuburg
Phone: +43 (0)2243–9000
office@ist.ac.at
www.ist.ac.at

Editor
Sophie Fessl

Texts
IST Austria

Graphic design
alessandri-design.at

Photography
Lisa Cichocki
Roland Ferrigato
Patrizia Gapp
Göran Gnaudschun (Portrait Peter Fratzl)
Oliver Lehmann
Rita Newman
Paul Pölleritzer
Reiner Riedler
Hans Ringhofer
Lukas Schaller
Jürgen Skarwan
Anna Stöcher
Bernhard Wenzl
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IST Austria Scientists
(December 31, 2013)

Professors *(last appointment before IST Austria)*

1 Nick Barton *University of Edinburgh, Edinburgh, UK*
2 Eva Benková *Ghent University, Ghent, Belgium*
3 Bernd Bickel *Disney Research Zurich, Zurich, Switzerland*
4 Jonathan Bollback *University of Edinburgh, Edinburgh, UK*
5 Tobias Bollenbach *Harvard Medical School, Boston, USA*
6 Krishnendu Chatterjee *University of California, Santa Cruz, USA*
7 Sylvia Cremer *University of Regensburg, Regensburg, Germany*
8 Jozsef Csicsvari *University of Oxford, Oxford, UK*
9 Herbert Edelsbrunner *Duke University, Durham, USA*
10 László Erdős *Ludwig Maximilians University of Munich, Munich, Germany*
11 Jirí Friml *Ghent University, Ghent, Belgium*
12 Calin Guet *Harvard University, Cambridge, USA*
13 Carl-Philipp Heisenberg *Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany*
14 Thomas Henzinger *EPFL, Lausanne, Switzerland*
15 Simon Hippenmeyer *Stanford University, Palo Alto, USA*
16 Björn Hof *Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany*
17 Harald Janovjak *Ludwig Maximilians University of Munich, Munich, Germany*
18 Peter Jonas *University of Freiburg, Freiburg, Germany*
19 Vladimir Kolmogorov *University College London, London, UK*
20 Christoph Lampert *Max Planck Institute for Biological Cybernetics, Tübingen, Germany*
21 Mikhail Lemeshko *Harvard University, Cambridge, USA*
22 Gaia Novarino *University of California, San Diego, USA*
23 Krzysztof Pietrzak *Centrum Wiskunde & Informatica, Amsterdam, Netherlands*
24 Robert Seiringer *McGill University, Montreal, Canada*
25 Ryuichi Shigemoto *National Institute for Physiological Sciences (NIPS), Okazaki, Japan*
26 Daria Siekhaus *NYU Medical Center, New York, USA*
27 Michael Sixt *Max Planck Institute of Biochemistry, Martinsried, Germany*
28 Gašper Tkačik *University of Pennsylvania, Philadelphia, USA*
29 Caroline Uhler *University of Minnesota, Minneapolis, USA*
30 Uli Wagner *EPFL, Lausanne, Switzerland*
31 Chris Wojtan *Georgia Institute of Technology, Atlanta, USA*

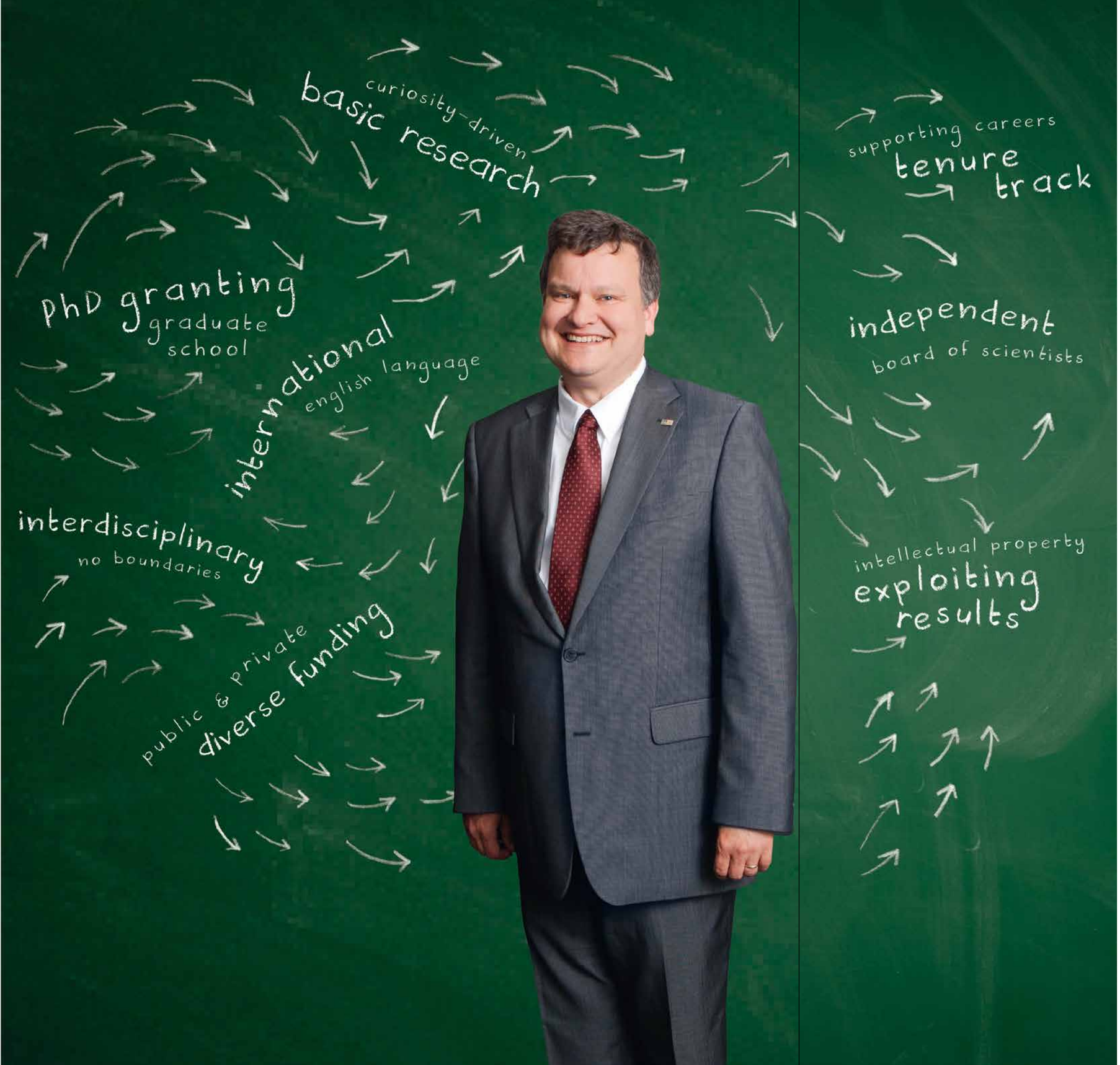
Postdocs *(institution of PhD degree)*

32 Heikki Oskari Ajanki *University of Helsinki, Helsinki, Finland*
33 Sebastian Altmeyer *Saarland University, Saarbrücken, Germany*
34 Benjamin Aminof *The Hebrew University of Jerusalem, Jerusalem, Israel*
35 Anna Andersson *University of Copenhagen, Copenhagen, Denmark*
36 Itaru Arai *University of Tokyo, Tokyo, Japan*
37 Fuste Arquè Gloria *University of Barcelona, Barcelona, Spain*
38 Péter Baracskay *Eötvös Lóránd University, Budapest, Hungary*
39 Ulrich Bauer *University of Göttingen, Göttingen, Germany*
40 Tobias Bergmiller *ETH Zurich, Zurich, Switzerland*
41 Veronika Bierbaum *Max Planck Institute of Colloids and Interfaces, Potsdam, Germany*
42 Karel Blahna *Charles University, Prague, Czech Republic*
43 Charlotte Boccara *Norwegian University of Science and Technology, Trondheim, Norway*
44 Katarina Bodova *University of Michigan, Ann Arbor, USA*
45 Vicente Botella-Soler *University of Valencia, Valencia, Spain*
46 Remy Chait *Harvard University, Cambridge, USA*
47 Xu Chen *Shanghai Institute for Biological Sciences, Shanghai, China*
48 Guillaume Chevereau *ENS de Lyon, Lyon, France*
49 Eduardo Cires Rodriguez *University of Oviedo, Oviedo, Spain*
50 Julien Compagnon University of Paris VII: Denis Diderot, Paris, France
51 Candela Cuesta Moliner *University of Oviedo, Oviedo, Spain*
52 Marjon De Vos *FOM Institute AMOLF, Amsterdam, Netherlands*
53 Desiree Dickerson *University of Otago, Dunedin, New Zealand*
54 Cezara Dragoi *University of Paris VII: Denis Diderot, Paris, France*
55 Leila El Masri *Kiel University, Kiel, Germany*
56 Rodrigo Apar Fernandes Redondo *Federal University of Minas Gerais, Belo Horizonte, Brazil*
57 David Field *University of Wollongong, Wollongong, Australia*
58 Tamar Friedlander *Israel Institute of Technology, Haifa, Israel*
59 Georg Fuchsbauer *University of Paris VII: Denis Diderot, Paris, France*
60 Jose Gallardo Ruiz *University of Malaga, Malaga, Spain*
61 Jian Gan *University of Glasgow, Glasgow, UK*
62 Peter Gaži *ETH Zurich, Zurich, Switzerland*
63 Ashutosh Gupta *Technical University of Munich, Munich, Germany*
64 Harumi Harada *University of Tsukuba, Tsukuba, Japan*
65 Miroslav Hons *University of Bern, Bern, Switzerland*
66 Hua Hu *University of Oslo, Oslo, Norway*
67 Stefan Huber *University of Salzburg, Salzburg, Austria*
68 Rasmus Ibsen-Jensen *Aarhus University, Aarhus, Denmark*
69 Álvaro Ingles Prieto *University of Granada, Granada, Spain*
70 Shreyas Vaman Jalikop *University of Manchester, Manchester, UK*
71 Stefan Jeschke *University of Rostock, Rostock, Germany*
72 Eva Kiermaier *University of Vienna, Vienna, Austria*
73 Sooyun Kim *IST Austria, Klosterneuburg, Austria*
74 Anna Klimova *University of Washington, Seattle, USA*
75 Krisztián Kovács *University of Lausanne, Lausanne, Switzerland*
76 Janina Kowalski *Albert Ludwigs University Freiburg, Freiburg, Germany*
77 Marek Krčál *Charles University in Prague, Prague, Czech Republic*
78 Gabriel Krens *University of Leiden, Leiden, Netherlands*
79 Jan Kretinský *Technical University of Munich, Munich, Germany*
80 Jakob Kühnen *Vienna University of Technology, Vienna, Austria*
81 Mato Lagator *The University of Warwick, Warwick, UK*
82 Grégoire Marie Antoine Lemoult *École Supérieure of Industrial Physics and Chemistry of the City of Paris, Paris, France*
83 Hongjiang Li *Peking University, Beijing, China*
84 Peter Marhavy *Ghent University, Ghent, Belgium*
85 Abraham Martin Del Campo Sanchez *Texas A&M University, College Station/Houston, USA*
86 José Martinez Guzman *University of Leipzig, Leipzig, Germany*
87 Eva Medvecka *Constantine the Philospher University in Nitra, Nitra, Slovakia*
88 Gabriel Mitchell *Georgia Institute of Technology, Atlanta, USA*
89 Gergely Molnar *University of Szeged, Szeged, Hungary*
90 Hitoshi Morita *National Institute for Basic Biology, Okazaki, Japan*
91 Emilie Morvant *Aix-Marseille University, Aix-en-Provence, Marseille, France*
92 Christine Moussion *Paul Sabatier University, Toulouse, France*
93 Anna Nagy-Staron *Ludwig Maximilians University of Munich, Munich, Germany*
94 Phan Thành Nam *University of Copenhagen, Copenhagen, Denmark*
95 Patrik Noren *Aalto University, Aalto, Finland*
96 Joseph O'Neill *University of Oxford, Oxford, UK*
97 Jan Otop *University of Wroclaw, Wroclaw, Poland*
98 Krisztina Ötvös *University of Szeged, Szeged, Hungary*
99 Tiago Paixao *University of Porto, Porto, Portugal*
100 Alejandro Pernia-Andrade *Venezuelan Institute for Scientific Research, Caracas, Venezuela*
101 Tatjana Petrov *ETH Zurich, Zurich, Switzerland*
102 Jitka Polechova *University of Prague, Prague, Czech Republic*
103 Maria Pia Postiglione *University of Naples Federico II, Naples, Italy*
104 Aparna Ratheesh *University of Mumbai, Mumbai, India*
105 Jan Reininghaus *Free University of Berlin, Berlin, Germany*
106 Anne Reversat *University of Paris VII: Denis Diderot, Paris, France*
107 Jimena Royo-Letelier *Versailles Saint-Quentin-en-Yvelines University, Versailles, France*
108 Sasha Rubin *University of Auckland, Auckland, New Zealand*
109 Verena Ruprecht *Johannes Kepler University Linz, Linz, Austria*
110 Keisuke Sako *Osaka University, Osaka, Japan*
111 Yuliya Salanenka *National Academy of Sciences of Belarus, Minsk, Belarus*
112 Inmaculada Sanchez Romero *University of Granada, Granada, Spain*
113 Srdjan Sarikas *University of Naples Federico II, Naples, Italy*
114 Cristina Savin *Frankfurt Institute for Advanced Studies, Frankfurt, Germany*
115 Philipp Schmalhorst *Hannover Medical School, Hannover, Germany*
116 Philipp Schönenberger *Friedrich Miescher Institute, Basel, Switzerland*
117 Mateusz Sikora *Polish Academy of Sciences, Warsaw, Poland*
118 Sibu Simon *Charles University, Prague, Czech Republic*
119 Jana Slovakova *Universidad Miguel Hernández de Elche, Alicante, Spain*
120 Michael Smutny *University of Vienna, Vienna, Austria*
121 Rustem Takhanov *Russian Academy of Sciences, Moscow, Russia*
122 Martin Tancer *Charles University in Prague, Prague, Czech Republic*
123 Julia Tischler *University of Cambridge, Cambridge, UK*
124 Hildegard Uecker *University of Vienna, Vienna, Austria*
125 Line Vej Ugelvig *University of Copenhagen, Copenhagen, Denmark*
126 Kari Vaahtomeri *University of Helsinki, Helsinki, Finland*
127 Mukund Vasudevan *Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India*
128 Nicholas Vyleta *Oregon Health and Science University, Portland, USA*
129 Daniel Weissman *Stanford University, Palo Alto, USA*
130 Shih-Ming Weng *University of Glasgow, Glasgow, UK*
131 Marcin Pawel Zagórski *Jagiellonian University, Krakow, Poland*
132 Qiang Zhu *Shanghai Institute for Biological Sciences, Shanghai, China*

PhD students *(nationality)*

133 Hamza Abusalah *Palestine*
134 Hande Acar *Turkey*
135 Maciej Adamowski *Poland*
136 Vanessa Barone *Italy*
137 Martin Behrndt *Germany*
138 Vera Belyaeva *Russia*
139 Pradeep Bhandari *Nepal*
140 Morten Bojsen-Hansen *Denmark*
141 Lena Bunatyan *Armenia*
142 Daniel Capek *Austria*
143 Matthew Julian Case *UK*
144 Barbara Casillas Perez *Mexico*
145 Sarah Anhala Cepeda Humerez *Bolivia*
146 Suzanne Chesnay *France*
147 Martin Chmelik *Czech Republic*
148 Ximena Contreras Paniagua *Mexico*
149 Przemyslaw Daca *Poland*
150 Marta Dravecka *Slovakia*
151 Alexander Eichner *Germany*
152 Thomas Ellis *UK*
153 Claudia Espinoza Martinez *Chile*
154 Mirco Giacobbe *Italy*
155 Sarit Goswami *India*
156 Igor Gridchyn *Ukraine*
157 Peter Grones *Slovakia*
158 David Hahn *Austria*
159 Katarina Hribiková *Slovakia*
160 Jan Humplik *Czech Republic*
161 Andrej Hurny *Slovakia*
162 Kristóf Huszár *Hungary*
163 Claudia Igler *Austria*
164 Mabel Iglesias-Ham *Cuba*
165 Fabienne Jesse *Netherlands*
166 Karola Käfer *Austria*
167 Sebnem Kesaf *Turkey*
168 Alexander Kolesnikov *Russia*
169 Matthias Konrad *Germany, Austria*
170 Susanne Laukoter *Austria*
171 Alexander Leithner *Austria*
172 Martin Lukacisin *Slovakia*
173 Isaac Mabillard *Switzerland*
174 Lenka Matejovicova *Slovakia*
175 Catherine Mckenzie *USA*
176 Rajiv Mishra *India*
177 Karin Mitosch *Germany*
178 Maurizio Morri *Italy*
179 Madhumitha Narasimhan *India*
180 Anton Nikitenko *Russia*
181 Sebastian Novak *Austria*
182 Petra Novakova *Slovakia*
183 Chaitanya Paranjape *India*
184 Florian Pausinger *Austria*
185 Andreas Pavlogiannis *Greece*
186 Pavel Payne *Czech Republic*
187 Anastasia Pentina *Russia*
188 Maros Pleska *Slovakia*
189 Tomas Prat *Czech Republic*
190 Roshan Prizak *India*
191 Christopher Pull *UK*
192 Arjun Radhakrishna *India*
193 Dámaris Ketinó Rangel Guerrero *Mexico*
194 Eva Reichhart *Austria*
195 Johannes Reiter *Austria*
196 Justine Renno *France*
197 Georg Rieckh *Austria*
198 Harald Ringbauer *Austria*
199 Michal Rolinek *Czech Republic*
200 Michal Rybar *Slovakia*
201 Sriram Kumar Sankaran *India*
202 Jan Schwarz *Germany*
203 Cornelia Schwayer *Austria*
204 Neel Shah *India*
205 Viktoriia Sharmanska *Ukraine*
206 Konstanze Simbriger *Austria*
207 Magdalena Steinrück *Austria*
208 Miriam Stock *Germany*
209 Dora Tarlungeanu *Romania*
210 Thorsten Tarrach *Germany*
211 Isabella Tomanek *Austria*
212 Murat Tugrul *Turkey*
213 Haibing Xu *China*
214 Alexander Zimin *Russia*

Expanding horizons



Thomas A. Henzinger *President, IST Austria*

2013 was a year of strong growth for IST Austria. Six new research groups started their work on campus, bringing the total number of groups at the Institute to 28, half of them funded by coveted ERC grants of the European Union. With the 29 new PhD students who joined the IST Graduate School at the start of the new academic year, there are now more than 200 scientists on campus. Overall, more than 370 employees from over 50 countries work at IST Austria.

The scientific scope of IST Austria also expanded in 2013. Several groups now perform research in physics: mathematical physics, biophysics, and fluid dynamics. The Institute's activities in the life sciences also expanded into plant biology. Over the course of the year, the scientists of IST Austria published more than 160 refereed journal and conference papers and acquired more than 9 million Euro in new research funds. The first assistant professor, Michael Sixt, went through a tenure evaluation by international experts and was promoted to professor. The first PhD graduate who began his studies at IST Austria, Damien Zufferey, is now a postdoc at MIT. Several IST Austria postdocs succeeded in obtaining faculty positions.

As the scope of the research activities expanded at IST Austria, also the supporting infrastructure grew accordingly. A new electron microscopy facility was established and the lab support facility expanded from biology to physics. In the name of all scientists, I thank the new managing director Georg Schneider and the entire dedicated team of scientific and administrative support personnel. They make it possible that our researchers compete successfully against the leading institutions in the world, both in extending the frontiers of human knowledge and in training future generations of scientists.

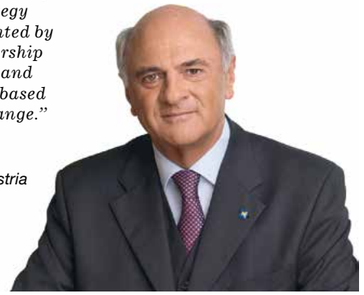
IST Austria cannot succeed without its many supporters. Six of our most promising PhD students received scholarships by our donors OMV and Steven Heinz. The IST Austria machine shop for building electronic and mechanical setups for our scientists was officially named the Miba machine shop, appreciating Miba's generous support of the Institute. I thank all supporters and friends of IST Austria, especially the former Federal Minister for Science and Research, Karlheinz Töchterle, and the Governor of Lower Austria, Erwin Pröll. IST Austria proves that ambitious projects can succeed if politics provides the necessary firm and long-term commitment.

"IST Austria is by definition an institute for basic research, which intrinsically means that the research is driven solely by the curiosity of the scientists. Nevertheless, its founding fathers in the very beginning provided the plans to enable a profitable utilization of scientific findings. In this farsighted framework the requirements of science and industry are considered equally. This equips IST Austria to pursue its strategy of excellence in a highly competitive environment."

Reinhold Mitterlehner
Federal Minister of Science, Research and Economy

"IST Austria proves that the transformation of a region can be achieved by adhering to a long-term strategy of excellence implemented by an outstanding leadership and a highly skilled and motivated work force based on a bold vision of change."

Erwin Pröll
Governor of Lower Austria



How dreams become reality

Anton Zeilinger
Vice-Chair, Board of Trustees of IST Austria
President, Austrian Academy of Sciences

In 2013 the idea of IST Austria celebrated its tenth anniversary. In March 2003, I participated at MIPIM, the International Real Estate Show in Cannes, to make a point for the Vienna region as a hub for science and technology. There, I made the first public proposal to create what eventually became IST Austria: "When you tell a taxi driver in Boston that you want to go to MIT, he is impressed. In Vienna, we need a similar institution."

From the beginning, it was clear that the new institute should be a postgraduate research institute, and that the Weizmann Institute of Science in Israel was an institution to be compared with. It was part of the concept from early on that the new institute should be dedicated to the basic sciences, performing interdisciplinary research with a focus on mathematics, physics, chemistry and biology.

Today, IST Austria shows that these dreams have become reality. This was possible by uncompromisingly following a few fundamental principles. The most important ones are: No political involvement in any academic affairs, including the selection of the president and key decision makers. Attract the most interesting professors available, solely on the basis of their qualification. Avoid filling positions in a predefined research direction. And, have clear internal policies, the most important being the limit of the size of each research group. This avoids that a senior professor becomes mainly a group's manager. Other key policies are: Strong focus on interdisciplinary research, recruitment of students on the highest international level, and getting top advice both from various committees within the Institute and from the outside. A very challenging and sometimes arduous road had to be travelled in the first few years of the fledgling idea. In the end, it was possible to convince the important decision makers that the idea is worthwhile. It is to be hoped that the success of IST Austria sets an example for other institutions in Austria and beyond. The success, as always, depends on the framework conditions, of which the financial supply to tertiary and postgraduate education at an internationally competitive level is a vital requirement. The very fact that it was possible to create IST Austria carries very high compliments for the level of political debate and for the decision making processes in this country.

IST Austria at a glance

The Institute of Science and Technology Austria (IST Austria) is a multidisciplinary research institution dedicated to cutting-edge basic research in the natural, mathematical, and computer sciences.

IST Austria is located in the city of Klosterneuburg, 18 km from the center of Vienna. As a PhD granting institution, the graduate school of IST Austria educates doctoral students from around the world. IST Austria was established jointly by the federal government of Austria and the provincial government of Lower Austria and inaugurated in 2009. In the fall of 2010, the first laboratory building, the Bertalanffy Foundation Building, was opened and the first experimental research groups started their work at the Institute. The second laboratory building, Lab Building East, was completed at the end of 2012. At the end of 2013, 28 professors and a total of 373 employees from 51 different countries worked on campus. The development plans of IST Austria allow for a growth to 90 research groups by 2026, who will conduct research in an international, state-of-the-art environment.

To foster a creative and interdisciplinary scientific atmosphere, all hierarchical and separating organizational structures, such as departments, are avoided at IST Austria. The scientists are organized into independent research groups, each headed by a professor or a tenure-track assistant professor. The decision to promote an assistant professor to professor with a permanent contract is based entirely on an evaluation of the scientific achievements of the assistant professor by international experts. Research excellence and promise are the exclusive hiring criteria for all scientists at IST Austria - from doctoral students to professors. The Institute's choice of scientific topics is based solely on the availability of outstanding individuals: a direction of research is pursued only if IST Austria can compete with the best in the world.

Diverse funding

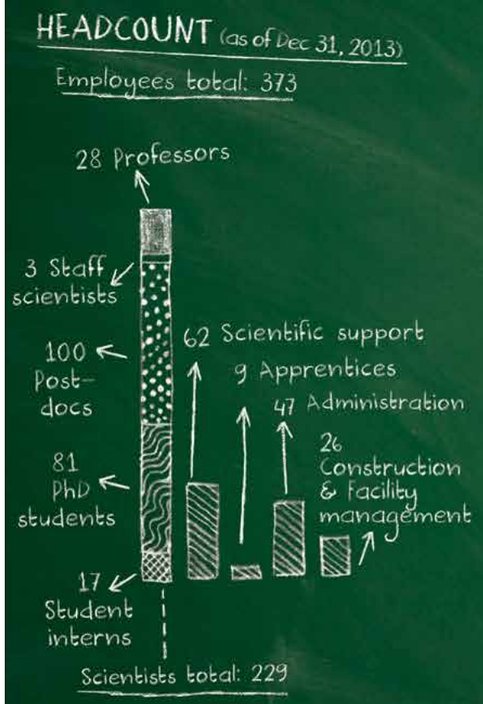
The long-term financial viability of IST Austria relies on four sources of funding: public funding, international and national research grants, technology licensing, and donations. For the period from 2007 until 2026, the federal government of Austria provides up to 1'280 million Euro in operational funds. Two thirds of this budget are guaranteed, while the remaining third is conditioned on performance-related criteria such as the raising of third-party funds.

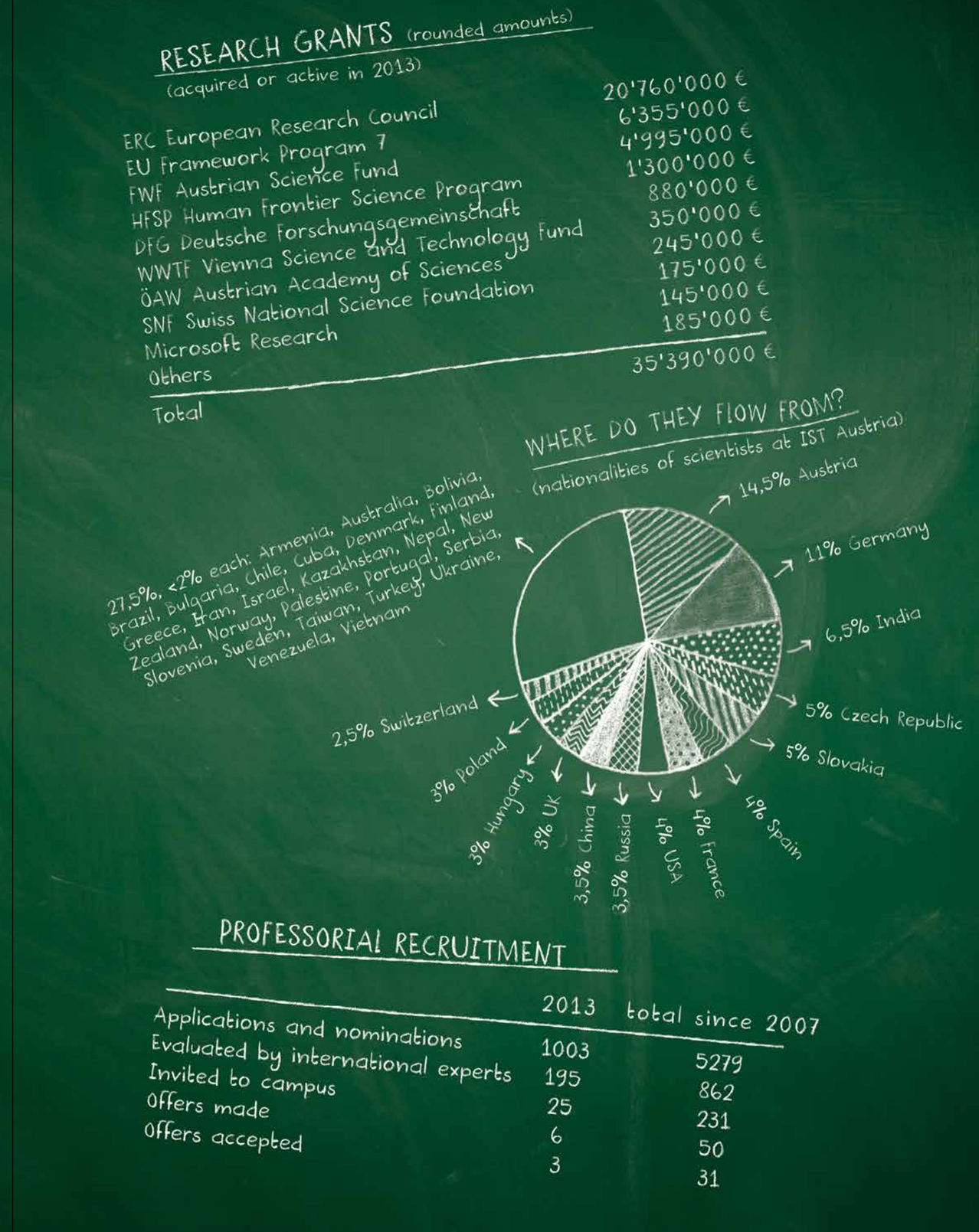
The state of Lower Austria contributes the budget for construction and campus maintenance, in a total amount of 510 million Euro from 2007 until 2026. By the end of 2013, IST Austria has obtained commitments for more than 36 million Euro in research grants, the vast majority of which originates from sources outside of Austria. The Institute holds the rights to all research results and discoveries of its scientists and is committed to promote their use through technology licensing. IST Austria is also active in fundraising and, by the end of 2013, has received more than 17 million Euro in donations.

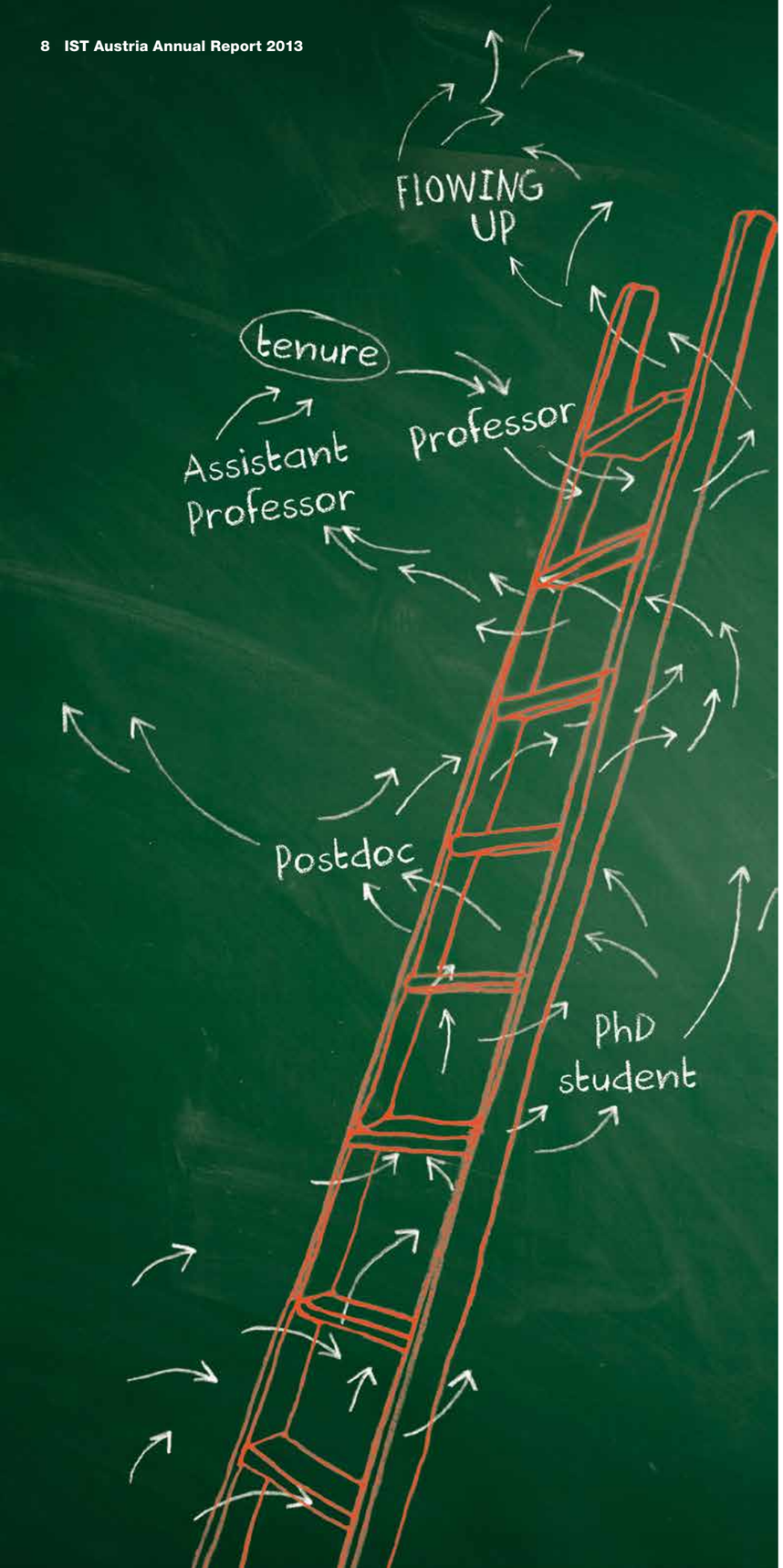
Independent leadership

The governance and management structures of IST Austria guarantee the Institute's freedom from political and commercial influences. The Institute and its scientific fields are evaluated regularly by leading international scientists and science administrators. In 2013, the seven computer science groups of IST Austria were evaluated. IST Austria is headed by the President, who is appointed by the Board of Trustees and advised by the Scientific Board. The first President of the Institute is Thomas A. Henzinger, a computer scientist and former professor of the University of California at Berkeley and the EPFL in Lausanne, Switzerland, who started his second term in 2013. The administration of IST Austria is led by the Managing Director, Georg Schneider.

Up-to-date information on IST Austria can be found at www.ist.ac.at, where it is possible to sign up for the Institute's quarterly newsletter.







Career model

Flowing up the career ladder

From PhD students to postdocs and professors, IST Austria is committed to promoting the international success of its researchers at all stages of their career.

The steps of an international scientific career are similar for young researchers all over the world. Accordingly, the scientists of IST Austria are at one of the following four stages: PhD student in the graduate school, postdoc, assistant professor (tenure track), and professor. While PhD students and postdocs leave IST Austria to pursue the next steps of their careers at other institutions, assistant professors may be promoted to professor, dependent on an evaluation of their scientific achievements. In 2013, all career transitions were accomplished by scientists of IST Austria.

More than a third of the scientists at IST Austria are doctoral students. They take advanced courses and perform research supervised by an assistant professor or professor. IST Austria puts much emphasis on the education of its graduates, as the reputation of IST Austria will depend crucially on the future success of the scientists it trains.

Damien Zufferey joined the IST Austria graduate school in September 2009, as one of the first intake of graduate students. Damien pursued research on the verification of message passing programs and successfully passed his thesis defense in August 2013. Damien moved to a postdoc position at MIT, where he now works in the Computer Science and Artificial Intelligence Laboratory.

In the next career stage, postdocs perform partly independent research, still under the supervision of a group leader. It is important for the education of a scientist that the undergraduate, doctoral, and postdoc stages happen at different institutions, so that the young researcher gets exposed to a variety of scientific approaches, methods, and cultures. After a few years of postdoc experience, the goal of a successful young scientist is to obtain a fully independent researcher position.

In 2013, **Pavol Cerny,** who had been a postdoc in the group of Thomas Henzinger since 2009, became assistant professor at the University of Colorado in Boulder.

IST Austria recruits young group leaders as assistant professors, gives them complete scientific independence during the most creative years in a researcher's career, and promises them the opportunity to be promoted to professor based solely on an independent evaluation of their scientific performance. In 2013, both steps of this tenure track model were taken at IST Austria.

Gaia Novarino, an Italian neuroscientist performing postdoctoral research at the University of California in San Diego, was hired as assistant professor at IST Austria and will move to the IST Austria campus at the beginning of 2014. Gaia Novarino's research aims to identify and study genes that underlie inherited forms of epilepsy associated with intellectual disability and/or autism.

Michael Sixt, who joined IST Austria as assistant professor in 2010, was the first to go through the tenure evaluation. During the evaluation, international experts are consulted to judge the research achievements of the assistant professor, but also performance with regards to the other duties of a successful scientist play a role, such as teaching, supervision of PhD students and postdocs, service to the Institute and to the international scientific community. Michael Sixt, a cell biologist, was promoted to professor in the fall of 2013. He aims to understand the molecular and mechanical principles of cell motility at both the cellular and tissue level.

The IST Austria Graduate School

A flow of education

The graduate school of IST Austria offers a first step into scientific careers in the life sciences, computer sciences, mathematics, physics, and any related interdisciplinary areas. Highly qualified students with a bachelor's or master's degree seeking to start their scientific career in an international environment are invited to apply for our unique multidisciplinary PhD program.

81 students from 28 countries

In 2013, its fourth year of operation, the IST Austria graduate school had its largest intake of new PhD students yet: of more than 330 applicants from 57 countries, 29 new PhD students were selected and started their doctoral studies at IST Austria in September 2013. The newest class of PhD students, among them 7 Austrians, comes from 14 different countries. Currently, 81 PhD students from 28 nations work at IST Austria. All PhD students are chosen once a year in a competitive selection process (the application deadline is always January 15). The entire IST Austria faculty evaluates the applications, as prospective students need not identify a potential supervisor when applying. All PhD students are offered employment contracts with an internationally competitive full-time salary.

A multidisciplinary PhD program

Owing to the interdisciplinary research culture at IST Austria, a single joint graduate program is offered for all PhD students. The graduate school trains a new generation of researchers who are able to approach scientific questions from different angles and are fluent in the languages of both the experimental sciences and the analytical sciences.

The PhD program is divided into two phases. During the first phase, students carry out projects with three different research groups and attend courses from the entire range of scientific fields represented at IST Austria. This phase, which typically lasts one year, offers students the opportunity to work closely with several professors, while the interdisciplinary curriculum gives students both breadth and depth to their scientific education. After successfully presenting their research proposal in a qualifying exam, students enter the second phase of the program, during which they focus on research towards a doctoral thesis. After a successful thesis defense, the student receives a PhD degree from IST Austria.

Graduate student association

The PhD students of IST Austria are organized in the Graduate Student Association (GSA), which, as an interface between graduate students, administration, and faculty, represents the students' interests and provides feedback from the students' perspective. As a platform for exchanging opinions and promoting interactions, the GSA also organizes social and work-related events. In 2013, these included a retreat for PhD students to Slovakia, a welcome BBQ for arriving students, career development workshops and seminars, as well as events with students from other universities. A day at a climbing park provided an opportunity to meet fellow students while sharing the adrenaline kick of high ropes and flying foxes. The GSA plays a vital role in bringing together students from different research groups and disciplines and creating a lively atmosphere on campus.

Scholarships

Six students who started their degree in September 2013 received a special honor at the very beginning of their scientific career: they were chosen as named scholars, meaning that two donors financially support their study. As of 2013, Steven Heinz, Austrian co-founder of the investment company Lansdowne Partners and Managing Director of Lansdowne Partners Austria GmbH, supports IST Austria's scholarship program with € 120'000. The Vienna-based oil and gas company OMV has been supporting IST Austria since 2008, and contributions to the scholarship program are part of this support. The six especially promising doctoral students were chosen by a jury consisting of IST Austria postdocs, based on their achievements as undergraduate students.

Key Features

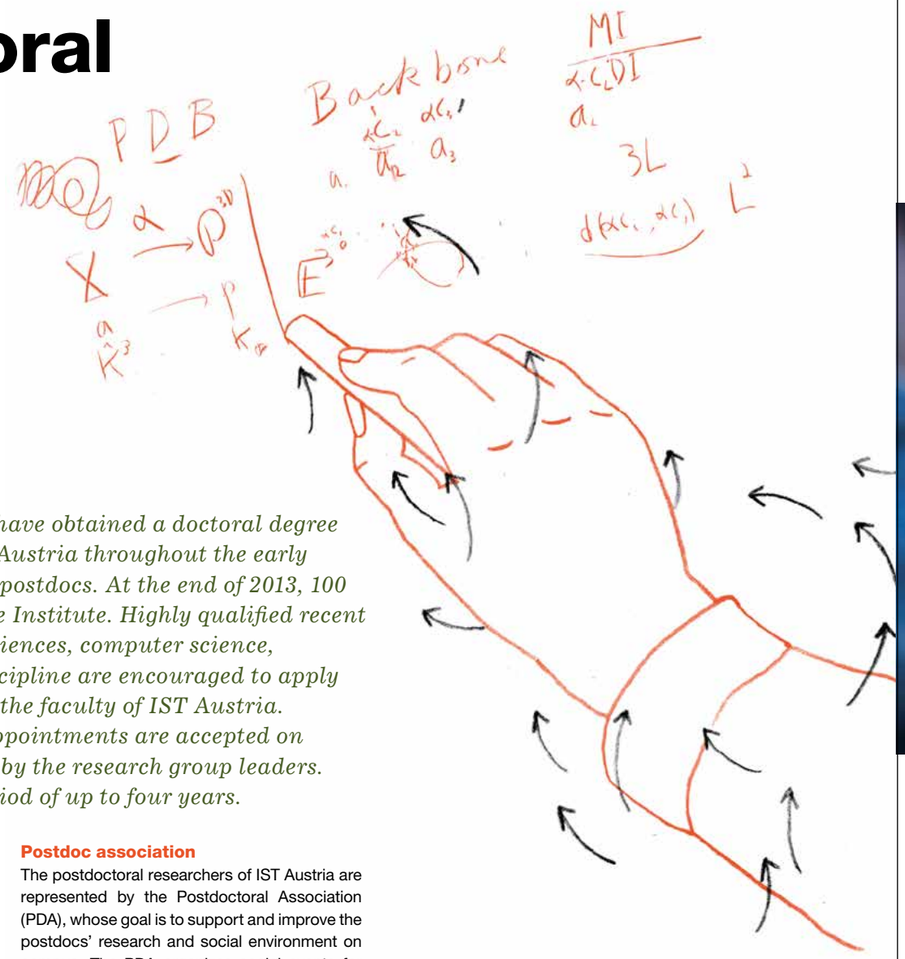
Entry with a bachelor's or master's degree
Multidisciplinary, US-style graduate school
Central admissions process once a year

Admissions

Annual call for applications starts November 15
Open day for prospective applicants in November
Application deadline January 15
Visit day for shortlisted candidates in March
PhD program starts September 15

see www.ist.ac.at for further information on PhD applications

Postdoctoral flow



Excellent young scientists who have obtained a doctoral degree elsewhere are supported at IST Austria throughout the early stage of their research career as postdocs. At the end of 2013, 100 postdocs pursued research at the Institute. Highly qualified recent PhD graduates in the natural sciences, computer science, mathematics, or any related discipline are encouraged to apply for a postdoctoral position with the faculty of IST Austria. Applications for postdoctoral appointments are accepted on a continuous basis and decided by the research group leaders. Appointments can last for a period of up to four years.

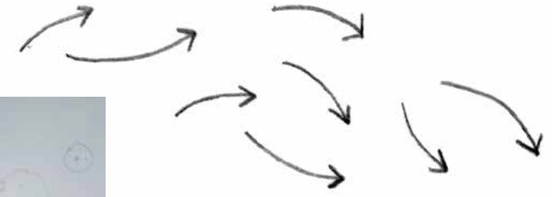
The ISTFELLOW program

In addition to postdocs accepted by individual research groups, IST Austria has set up the ISTFELLOW program for exceptional postdoctoral researchers with a higher degree of independence. ISTFELLOW is partially funded by the European Union through a Marie-Curie Action COFUND grant. Over a period of five years, ISTFELLOW will support 40 international postdoctoral fellows for two years each; a prolongation for another two years is possible through the support of an IST Austria professor. ISTFELLOW places an emphasis on cross-disciplinary scientific approaches and is open to qualified applicants from all over the world. The main selection criteria for ISTFELLOW are scientific excellence and promise. Applications for ISTFELLOW are accepted at any time, butthe selection of fellows takes place twice a year, in October and April.

www.ist.ac.at/research/postdoctoral-research/how-to-apply/

Postdoc association

The postdoctoral researchers of IST Austria are represented by the Postdoctoral Association (PDA), whose goal is to support and improve the postdocs' research and social environment on campus. The PDA organizes social events for postdocs including barbecues and regular get-togethers, as well as work-related events such as career-planning and grant-writing workshops.



First steps for young scientists

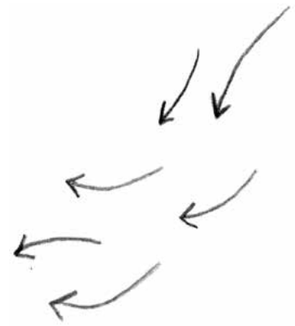
Young Scientist Symposium

Because of its overwhelming success when first introduced in 2012, a Young Scientist Symposium was organized again jointly by the postdocs and PhD students in 2013. This year's one-day symposium, on "Understanding shape: in silico and in vivo", explored the concept of shape and how to deal with it, bringing together alternative views from different areas of research, including mathematics, computer science, and the life sciences. The multidisciplinary symposium featured six world-class speakers - Ed Connor, Robert Černy, Vittorio Ferrari, Massimo Ferri, Chaim Goodman-Strauss, and Isaac Salazar-Ciudad - and attracted an interdisciplinary audience from the Vienna region. The expert talks were followed by a panel discussion and lively discussions in a relaxed atmosphere.

The ISTernship program

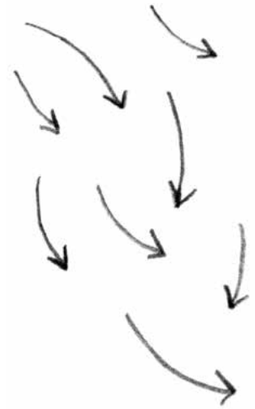
ISTernship is a new program aimed at outstanding undergraduate students who wish to spend part of the summer at IST Austria to perform basic research with one of our research groups. ISTerns work on a research project for two to three months under the close supervision of a faculty member and a lab mentor. In the summer of 2013, 16 interns took part in the ISTernship program, which culminated in a research symposium where they presented their work. The application is open to students within the final two years of a bachelor's of master's program at Austrian and international universities. The deadline for applications is February 15.

www.ist.ac.at/research/isternship/applications/



Research highlight

Computer Science at IST Austria



Shared foundational thinking and a focus on interdisciplinarity set computer science at IST Austria apart from many other computer science departments.

As different as their research areas are, all computer scientists at IST Austria pursue their research emphasizing the mathematics behind their subjects, and perform their work on a solid foundation of mathematical rigor. A driving force in their work is an interdisciplinary outlook, as they look for joint efforts both between different areas of computer science and with other disciplines of the natural sciences. The mathematics used, and the concepts explored at IST Austria span a wide spectrum, from the discrete to the continuous. Also in the range from theory to application, computer scientists at IST Austria can be found at both ends, and at many steps between.

Safe software

The groups of Krishnendu Chatterjee and Thomas Henzinger perform research on the formal verification of computer programs. This research area aims to improve the quality of software by preventing programming errors, or at least detecting them before they do harm. At the basis of formal verification is the idea of proving the safety of computer code by mathematically analyzing whether a program behaves as desired - or not. On the theoretical side, Chatterjee is interested in the study of games played on graphs. Since the behavior of software can be modeled using such graph games, mathematical methods of game theory help in the development of safe software. At the same time, the Chatterjee group applies the mathematics of game theory to questions in evolutionary and cancer biology.

The Henzinger group works to prevent and reduce programming bugs in parallel and embedded software processes, which often control physical devices and are particularly error-prone and safety-critical. To improve the reliability of such cyber-physical systems, the Henzinger group develops new theories, algorithms, and programming tools – based on mathematical logic and formal languages - for error detection in computer programs and for the error-free design of hardware and software and their interaction. Their stochastic mathematical models for capturing and analyzing the behavior of software processes that interact with each other are also used to predict the behavior of molecular and cellular processes, such as biochemical reaction networks.

Visual Computing

Vladimir Kolmogorov and Christoph Lampert employ mathematical methods to make computers understand images. Kolmogorov focuses on algorithms for inference in graphical models, which are frequently used for analyzing images. His work ranges from developing practically efficient techniques to understanding theoretical aspects of discrete optimization. Some of Kolmogorov's theoretical work can be applied immediately in practice. Algorithms and methods found by Kolmogorov are widely used by the community, and are included in commercial image segmentation tools. In 2013, Kolmogorov received an ERC grant for his research on discrete optimization in computer vision, which brings the number of computer scientists at IST Austria who are supported by the European Research Council to five.

The Lampert group builds on a different mathematical theory – machine learning - to approach questions in image understanding. In 2013, Lampert started a project that aims to give computers the ability to recognize objects in an image as well as understand what is happening in a scene. The idea behind this project is that a computer can learn continuously and, over time, build up the necessary background knowledge for understanding images, just as humans do when growing up. While the theory of continuous learning is developed in the mathematical framework of machine learning, the knowledge acquired by a program is represented in a way that makes it usable in the future, for example, allowing the computer to know how big objects usually are or which objects are normally found indoors or outdoors.

Moving along the spectrum from having computers understand to having computers produce images, Chris Wojtan's research is in computer graphics. He develops algorithms for the computer simulation and visualization of complex physical processes, especially fluid flows. The Wojtan group achieves realistic and fast simulations by basing their algorithms on principles of physics, such as the conservation of mass and volume in incompressible flows. In their work, mathematics acts as the bridge for translating physics into algorithms. In 2013, three papers from the Wojtan group were presented at the premier international conference in computer graphics. These papers introduced novel techniques for visually rich high-resolution animations of liquids, as well as for the efficient creation of complicated geometry.

As part of its task to control the scientific quality of the Institute, the Scientific Board of IST Austria organizes external evaluations of individual scientific areas present at the Institute. In 2013 computer science was evaluated. As we highlight a scientific area of the Institute in every annual report, we chose computer science this year.

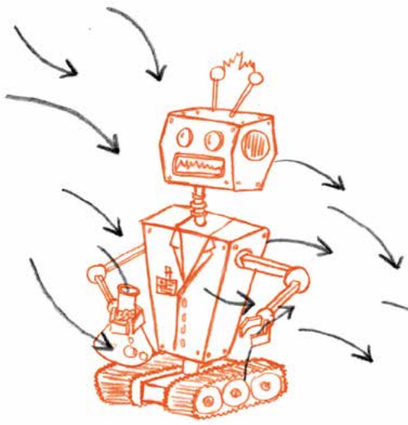
Computer science professors at IST Austria (from left to right): Krishnendu Chatterjee, Thomas Henzinger, Chris Wojtan, Krzysztof Pietrzak, Herbert Edelsbrunner. Not pictured: Christoph Lampert, Vladimir Kolmogorov

Cryptography

Another field of computer science that has enormous practical relevance is cryptography. This research area aims to ensure that computation can be trusted and communication is secure. Using techniques from various mathematical disciplines including information theory, number theory and computational complexity, the Pietrzak group develops cryptographic schemes that can be used on very restricted hardware like RFID tags, for which existing cryptosytems are too complex to be implemented. Another line of research aims at constructing schemes that remain provably secure even against so called side-channel attacks, in which the attacker exploits information inevitably leaked during a cryptographic computation, for example, by measuring the power consumption or electromagnetic radiation. In 2013, Pietrzak presented a scheme for digital signatures where the signature length is significantly shorter than what was previously possible. Shorter signatures mean less overhead is required for authenticating communication. Compact signatures can therefore reduce communication required for authentication – digitally signed documents are sent faster, but can still be trusted.

Computational topology

Straddling both the theoretical and applied sides, Herbert Edelsbrunner's research lies at the intersection of mathematics and computer science. A common theme in his research is the importance of shape and its recognition, matching, and classification – questions that are investigated mostly from the viewpoint of mathematical topology. This research created a new area within mathematics, "computational topology", which started from work on persistent homology. Today, this vibrant research area encompasses mathematicians, computer scientists and engineers. The theoretical research at the same time becomes applied, as a range of questions that arise in applications motivates the Edelsbrunner group, for example, the common question of how to define and measure the length of tube-like structures in biological contexts, such as blood vessels, river networks, trees, lymph vessels, dendrites, and more. In 2013, the mathematical work of the Edelsbrunner group contributed to two papers on the growth of plant roots, identifying genes that control root architecture as well as new forms of communication important for root development.



Current research at IST Austria

Interacting flow

László Erdős

Caroline Uhler

Mathematics

Herbert Edelsbrunner

Uli Wagner

Simon Hippenmeyer

Ryuichi Shigemoto

Gaia Novarino

Neuroscience

Jozsef Csicsvari

Peter Jonas

Krishnendu Chatterjee

Thomas Henzinger

Krzysztof Pietrzak

Vladimir Kolmogorov

Computer Science

Bernd Bickel

Chris Wojtan

Christoph Lampert

Robert Seiringer

Björn Hof

Mikhail Lemeshko

Physics

Gašper Tkačik

Jiří Friml

Jonathan Bollback

Evolutionary Biology

Sylvia Cremer

Nick Barton

Tobias Bollenbach

Daria Siekhaus

Cell Biology

Michael Sixt

Călin Guet

Carl-Philipp Heisenberg

Eva Benková

Harald Janovjak

Currently, research at IST Austria focuses on cell biology, physics, mathematics, computer science, evolutionary biology and neuroscience. There are strong synergies between these fields, and to foster an interdisciplinary spirit, the Institute is not organized into departments.

Mathematical Models of Evolution

Nick Barton

How do new species emerge from a single population? Why do so many organisms reproduce sexually? How quickly can species adapt to changes in conditions? The Barton group develops mathematical models to probe fundamental issues in evolution.

Nick Barton and his group study diverse topics in evolutionary genetics. The main focus of their work is the evolution of populations that are distributed through space and that experience natural selection on many genes. Understanding how species adapt to their environment, and how they split into new species, requires understanding the effects caused by spatial subdivision. The distribution of genes through space can, in turn, tell us about evolutionary processes that are hard to measure directly. The interaction between large numbers of genes is important in the formation of new species as well as in their response to natural and artificial selection. The recent flood of genomic data makes analysis of the interactions amongst large numbers of genes essential, and the Barton group uses mathematical models to make sense of this mass of data and to find answers to fundamental questions of evolution.

Current Projects

- Evolution of sex and recombination
- Evolutionary computation
- Evolution of polygenic traits
- Understanding genealogies in space and at multiple loci
- Limits to a species' range
- Speciation & hybridization in Antirrhinum

CAREER

since 2008	Professor, IST Austria
since 1990	Reader/Professor, University of Edinburgh, Edinburgh, UK
1982–1990	Lecturer/Reader, University College London, London, UK
1980–1982	Demonstrator, Cambridge University, Cambridge, UK
1979	PhD, University of East Anglia, Norwich, UK

SELECTED DISTINCTIONS

ISI Highly Cited Researcher

2013	Erwin Schrödinger Prize, Austrian Academy of Sciences
2013	Mendel Medal, German National Academy of Sciences Leopoldina
2009	Linnean Society Darwin-Wallace Medal
2009	ERC Advanced Grant
2006	Royal Society Darwin Medal
2001	President, Society for the Study of Evolution
1998	American Society of Naturalists President's Award
1994	Fellow, Royal Society of London
1994	David Starr Jordan Prize

SELECTED PUBLICATIONS

- Weissman DB, Barton NH. 2012. Limits to the rate of adaptation in sexual populations. PLoS Genetics 8:e1002740.
- Barton NH, Turelli M. 2011. Spatial waves of advance with bistable dynamics: cytoplasmic and genetic analogs of the Allee effect. American Naturalist 178(3), E48–75.
- Barton NH, Briggs DEG, Eisen JA, Goldstein DB, Patel NH. 2007. Evolution. Cold Spring Harbor Laboratory Press.

TEAM

Tom Ellis (PhD student), David Field (Postdoc), Tamar Friedlander (ISTFELLOW, with Guet and Tkačik groups), Sebastian Novak (PhD student), Tiago Paixao (Postdoc), Pavel Payne (joint PhD student with Bollback group), Melinda Pickup (Postdoc), Jitka Polechova (Postdoc), Srdjan Sarikas (Postdoc), Murat Tugrul (joint PhD student with Tkačik group), Hildegard Uecker (Postdoc), Harold P. de Vladar (Postdoc), Daniel Weissman (Postdoc)

Studies of hybridization between red- and yellow-flowered Antirrhinum in the Pyrenees tell us about the process of speciation.

Plant Developmental Biology

Eva Benková

True to their names' Greek roots, plant hormones `set in motion´ a myriad physiological processes. Influencing and modulating each other, an intricate network of interactions arises. The Benková group seeks to untangle this network and understand its molecular basis.

Plant hormones regulate a multitude of processes, often overlapping and modulating their effects. The two hormones auxin and cytokinin show just how complicated these interactions can be: while they act together to promote cell division, they act antagonistically when regulating the lateral growth of roots. How these interactions are regulated on a molecular level is the main question pursued by the Benková group. To understand the components and mechanisms that balance the output of auxin and cytokinin signaling, they use the lateral outgrowth of roots in Arabidopsis as their model system. Recently, the group has shown that an important mode of interaction is the modulation of auxin transport through cytokinin. They now focus on how cytokinin can control the flow of auxin by controlling auxin efflux on the transcriptional and posttranscriptional level. To determine more components of this regulatory pathway, the Benková group applies profiling and genetic screens to investigate the interaction of cytokinin with the cellular endocytotic machinery. Novel cross-talk components will help the group reveal new mechanisms integrating auxin and cytokinin signaling.

Current Projects

- Convergence of hormonal pathways on transport-dependent auxin distribution
- Identification of hormonal cross-talk components by genetic approaches
- Disclosing the molecular network mediating auxin-cytokinin interactions using a transcriptome profiling approach

CAREER

since 2013	Assistant Professor, IST Austria
2011-2013	Group Leader, Central European Institute of Technology (CEITEC), Brno, Czech Republic
2007-2013	Group Leader, Flanders Institute for Biotechnology, Gent, Belgium
2003-2007	Habilitation position, University of Tübingen, Tübingen, Germany
2001-2003	Postdoc, Centre for Plant Molecular Biology, Tübingen, Germany
1998-2001	Postdoc, Max Planck Institute for Plant Breeding, Cologne, Germany
1998	PhD, Institute of Biophysics of the Academy of Sciences of the Czech Republic, Brno, Czech Republic

SELECTED DISTINCTIONS

2011	FWO grants
2008	ERC Starting grant
2003-2007	Margarete von Wrangell Habilitation Program

SELECTED PUBLICATIONS

- Marhavý P, Vanstraelen M, De Rybel B, Zhaojun D, Bennett MJ, Beeckman T, Benková E. 2013. Auxin reflux between the endodermis and pericycle promotes lateral root initiation. EMBO J 32:149-58.
- Bielach A, Podlešáková K, Marhavý P, Duclercq J, Cuesta C, Müller B, Grunewald W, Tarkowski P, Benková E. 2012. Spatiotemporal regulation of lateral root organogenesis in Arabidopsis by cytokinin. Plant Cell 24:3967-81.
- Marhavý P, Bielach A, Abas L, Abuzeineh A, Duclercq J, Tanaka H, Pařezová M, Petrášek J, Friml J, Kleine-Vehn J, Benková E. 2011. Cytokinin modulates endocytic trafficking of PIN1 auxin efflux carrier to control plant organogenesis. Developmental Cell 21:796-804.

TEAM

Andrej Hurny (PhD student), Candela Cuesta Moliner (Postdoc), Peter Marhavy (Postdoc), Anna Müller (Technician), Krisztina Ötvös (Postdoc), Qiang Zhu (Postdoc)

Plants in the plant growth chamber.

Microbial Experimental Evolution and Statistical Genomics

Jonathan P. Bollback

Microbes can be found everywhere – in the soil, air, water, our food, and even inside of us. The Bollback group uses these ubiquitous organisms to study the process of evolution and to better understand what evolutionary forces have shaped the microbes themselves.

Microbes – viruses, bacteria, Archaea, and protists – account for half of the world's biomass, the majority of the biological diversity on Earth, and are the culprits of many human diseases. Microbes are also an extraordinarily powerful model system for understanding how evolution works. By studying microbes, the Bollback group addresses a variety of fundamental evolutionary questions. Firstly, how does adaptation differ between sexual and asexual populations? Microbes are mostly asexual, and asexuality slows down the rate of adaptation. Secondly, how do microbes defend themselves against parasites? Microbes, like other organisms, have their own parasites, and are thus a good model system for understanding the evolutionary dynamics of host-parasite interactions. Lastly, microbes can readily donate and receive genes, via a process called horizontal gene transfer, from other individuals and species. Yet it is unclear what evolutionary forces are acting to promote and restrict this process.

Current Projects

- The rate of adaptive evolution in sexual and asexual populations
- The evolution of an adaptive heritable immune system in bacteria

CAREER

since 2010	Assistant Professor, IST Austria
2008–2010	Postdoc, Interdisciplinary Centre for Human and Avian Influenza Research, University of Edinburgh, Edinburgh, UK
2004–2008	Postdoc, University of Copenhagen, Copenhagen, Denmark
2004	PhD, University of Rochester, Rochester, USA

SELECTED DISTINCTIONS

2007–2009	Forskningsradet for Natur og Univers, FNU Grant
2007	Featured in Aktuel Naturvidenskab nr 3 (Current Science)
2006	Forskningsradet for Sundhed og Sygdom, FSS Grant
1995–1998	Predoctoral Fellow, Smithsonian Institution, USA

SELECTED PUBLICATIONS

- Bollback JP, Huelsenbeck JP. 2009. Parallel genetic evolution within and among bacteriophage species of varying degrees of divergence. Genetics 181(1), 225–234.
- Bollback JP, Huelsenbeck JP. 2007. Clonal interference is alleviated by high mutation rates in large populations. Molecular Biology and Evolution 24(6), 1397–1406.
- Bollback JP. 2002. Bayesian model adequacy and choice in phylogenetics. Molecular Biology and Evolution 19(7), 1171–1180.

TEAM

Hande Acar (PhD student), Fabienne Jesse, (PhD student), Mato Lagator (Postdoc), Pavel Payne (PhD student, joint with Barton group), Rodrigo A. F. Redondo (Postdoc)

A cluster of Escherichia coli.

Biophysics and Systems Biology

Tobias Bollenbach

Cells perceive a broad spectrum of signals. But how are these signals processed in the cell? And how are conflicts between different signals resolved? The Bollenbach group uses a quantitative approach to understand cellular information processing.

Cells need to respond to a variety of signals in their environment, such as nutrients, drugs and signaling molecules. The Bollenbach group studies how cellular responses are computed and integrated, particularly in environments that contain multiple, potentially conflicting, signals. The experimental system the group currently focuses on is the bacterial response to combinations of antibiotics. While such drug combinations are crucially important for the treatment of infections, bacteria are getting more and more resistant to all available antibiotics. To use available antibiotics more efficiently, and identify any so far unexploited weaknesses, bacterial responses to different drugs and their combinations need to be understood in detail. The Bollenbach group combines quantitative experiments with statistical data analysis and theoretical modeling approaches to identify general design principles of cellular gene regulation responses. Using these quantitative approaches, the group aims to find new strategies of combining the currently available drugs in ways that maximize their efficiency while minimizing the evolution of drug resistance.

Current Projects

- Cellular responses to conflicting signals
- Mechanisms of drug interactions
- Physical descriptions of animal development

CAREER

since 2010	Assistant Professor, IST Austria
2006–2010	Postdoc, Department of Systems Biology, Harvard Medical School, Boston, USA
2005–2006	Postdoc, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany
2005	Guest Scientist, University of Tokyo, Tokyo, Japan
2005	PhD, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

SELECTED DISTINCTIONS

since 2013	HFSP program grant
since 2011	Member of the Young Academy ("Junge Akademie") at the German National Academy of Sciences Leopoldina and the Berlin-Brandenburg Academy of Sciences and Humanities
2007–2009	Feodor Lynen Fellowship, Alexander von Humboldt Foundation
2005	REES Fellowship, Japan International Science & Technology Exchange Center
2000–2005	Student and PhD Fellowships, German National Scholarship Foundation

SELECTED PUBLICATIONS

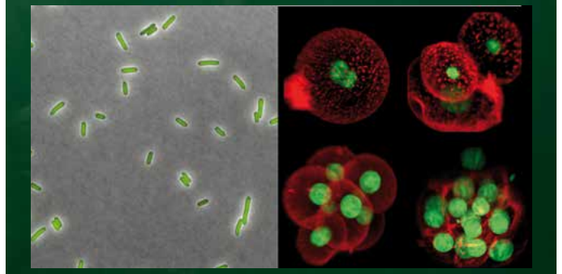
- Bollenbach T, Kishony R. 2011. Resolution of gene regulatory conflicts caused by combinations of antibiotics. Molecular Cell 42(4), 413–425.
- Bollenbach T, Quan S, Chait R, Kishony R. 2009. Nonoptimal microbial response to antibiotics underlies suppressive drug interactions. Cell 139(4), 707–718.
- Kicheva A*, Pantazis P*, Bollenbach T*, Kalaidzidis Y, Bittig T, Jülicher F, González-Gaitán M. 2007. Kinetics of morphogen gradient formation. Science 315(5811), 521–525.

**equal contribution*

TEAM

Veronika Bierbaum (Postdoc), Guillaume Chevereau (Postdoc), Marta Dravecka (PhD student), Marjon de Vos (Postdoc), Karin Mitosch (PhD student), Julia Tischler (Postdoc), Marcin Zagórski (Postdoc)

Green Fluorescent Protein in bacteria (left) and mouse embryos (right, image courtesy N. Plachta).



Computer-Aided Verification, Game Theory

Krishnendu Chatterjee

Life is a game – at least in theory. Game theory has implications for the verification of correctness of computer hardware and software, but also in biological applications, such as evolutionary game theory. The Chatterjee group works on the theoretical foundations of game theory, addressing central questions in computer science.

Game theory, the study of interactive decision problems, can be used to study problems in logic and set theory, economics, cell, population and evolutionary biology, and the design of the internet. The Chatterjee group is interested in the theoretical foundations of game theory and formal verification. Game theory in the formal verification of software involves the algorithmic analysis of various forms of games played on graphs. This broad framework allows effective analysis of many important questions of computer science and helps in the development of software systems. The Chatterjee group works on theoretical aspects for the better understanding of games and develops new algorithms, presenting the theoretical foundations for the formal verification of systems.

Current Projects

- Quantitative verification
- Stochastic game theory
- Modern graph algorithms for verification problems
- Evolutionary game theory

CAREER

since 2009	Assistant Professor, IST Austria
2008–2009	Postdoc, University of California, Santa Cruz, USA
2007	PhD, University of California, Berkeley, USA

SELECTED DISTINCTIONS

2011	Microsoft Research Faculty Fellowship
2011	ERC Starting Grant
2008	Ackerman Award, best thesis worldwide in Computer Science Logic
2007	David J. Sakrison Prize, best thesis in EECS, University of California, Berkeley, USA
2001	President of India Gold Medal, best IIT student of the year

SELECTED PUBLICATIONS

- Brazdil T, Chatterjee K, Forejt V, Kucera A. 2013. Trading Performance for Stability in Markov Decision Processes. Proc. of LICS 2013, 331-340.
- Chatterjee K, Doyen L. 2012. Partial-Observation Stochastic Games: How to Win when Belief Fails. Proc. of LICS. 2012 175–184.
- Chatterjee K, Henzinger M. 2012. An O(n^2) Time Algorithm for Alternating Büchi Games. Proc. of SODA 2012, 1386–1399.

TEAM

Benjamin Aminof (Postdoc), Martin Chmelik (PhD student), Rasmus Ibsen-Jensen (Postdoc), Andreas Pavlogiannis (PhD student), Johannes Reiter (PhD student), Sasha Rubin (Postdoc)

Fighting Disease as a Collective: Social Immunity in Ants

Sylvia Cremer

Due to the high risk of disease spread in their dense and highly related colonies, social insects have evolved collective disease defenses to prevent epidemics. Sylvia Cremer's group investigates social behavior and evolutionary immunology in ants and its impact on disease management in insect societies.

Social insects like ants live together in densely populated colonies, facing a high risk of disease transmission among group members. Disease outbreaks are, however, kept in check as social insects have evolved collective anti-pathogen defenses – a so-called "social immune system" – that complement the individual immune systems of colony members. The Cremer group studies all aspects of social immune defenses in ants to learn more about disease management and epidemiology in societies.
One important way in which ant colonies are protected against disease is the meticulous care of healthy group members performed towards diseased individuals. Ants carrying infectious particles on their body surface are intensively groomed by others – a process similar to the delousing behavior displayed in primates. In 2013, Sylvia Cremer and her group uncovered that grooming is not restricted to the mechanical removal of infectious material, but involves an additional chemical disinfection of the body surface of the sick individual. This is achieved by application of the ants' poison, which contains a very strong antimicrobial component, formic acid. Worker ants do not only apply the poison by spraying from the poison gland opening at their rear end of the body, but also take it up into their mouth and then apply it locally during grooming. This allows for the very accurate treatment of infected surface areas. This discovery of a dual role of grooming reveals both an efficient interaction between behavioral and chemical defenses and an evolutionary expansion of poison use from anti-predator to anti-pathogen defense.

Current Projects

- Social vaccination
- Social interaction networks & epidemiology
- Pathogen detection abilities in ants
- Host-parasite coevolution

CAREER

since 2010	Assistant Professor, IST Austria
2010	Habilitation, University of Regensburg, Regensburg, Germany
2006–2010	Group Leader, University of Regensburg, Regensburg, Germany
2006	Junior Fellow, Institute of Advanced Studies, Berlin, Germany
2002–2006	Postdoc, University of Copenhagen, Copenhagen, Denmark
2002	PhD, University of Regensburg, Regensburg, Germany

SELECTED DISTINCTIONS

2013	Walther Arndt Prize of the German Zoological Society
2013	Co-PI WWTF Life Sciences Grant New Ventures Beyond Established Frontiers
2012	Research Award Lower Austria: Anerkennungspreis des Landes Niederösterreich
2011	Member of "Junge Kurie" of the ÖAW (Austrian Academy of Sciences)
2009	ERC Starting Grant
2008	Member, German Young Academy of Sciences Leopoldina and Berlin Brandenburg
2004–2006	Marie Curie Intra-European Fellowship & Reintegration Grant
2003–2004	Feodor Lynen Fellowship, Alexander von Humboldt Foundation

SELECTED PUBLICATIONS

- Tragust S, Mitteregger B, Barone V, Konrad M, Ugelvig LV & Cremer S. 2013. Ants disinfect fungus-exposed brood by oral uptake and spread of their poison. Current Biology 23(1): 76-82.
- Tragust S, Ugelvig LV, Chapuisat M, Heinze J, Cremer S. 2013. Pupal cocoons affect sanitary brood care and limit fungal infections in ant colonies. BMC Evolutionary Biology 13(1), 225.
- Konrad M, Vyleta ML, Theis FJ, Stock M, Tragust S, Klatt M, Drescher V, Marr C, Ugelvig LV, Cremer S. 2012. Social transfer of pathogenic fungus promotes active immunisation in ant colonies. PLoS Biology 10(4), e1001300.

TEAM

Barbara Casillas-Perez (Joint PhD student with Tkačik group), Thomas Eder (Joint PhD student with Prof T Rattei, University of Vienna), Anna Grasse (Technical Assistant), Matthias Konrad (PhD student), Leila el Masri (Postdoc), Barbara Mitteregger (Technical Assistant), Christopher D. Pull (PhD student), Miriam Stock (PhD student), Line V. Ugelvig (Postdoc), Claudia Westhus (Joint PhD student with Dr C Doums, University Pierre et Marie Curie, Paris)

Lasius neglectus worker ants carrying pupae
© Line Ugelvig, Barbara Mitteregger

Systems Neuroscience

Jozsef Csicsvari

Transforming novel information to memory is essential if we want to remember it again later. Memory formation is therefore crucial for learning new facts or skills. The Csicsvari group studies how learning is implemented in the brain.

During learning, memory traces are processed and encoded in neuronal circuits and consolidated for later recall. The Csicsvari group focuses on the hippocampus, a brain area known to be important for spatial memory formation, and aims to understand how learning leads to memory formation. The group seeks to understand how neuronal circuits process information and form spatial memory by recording the activity of many neurons in different brain circuits during learning tasks and sleep. In addition, optogenetic methods are used to selectively manipulate neuronal activity in the hippocampus. Different place learning tasks allow the researchers to investigate the role of oscillatory activity during encoding, consolidation and recall of spatial information. To store spatial memory, the hippocampus interacts with other cortical regions, and the Csicsvari group investigates whether and how synchronous oscillations between the hippocampus and the entorhinal cortex are required for storing spatial information.

Current Projects

- Oscillatory interactions in working memory
- Role of hippocampal formation in spatial learning
- Activation of brain structures using light sensitive channels to study memory formation

CAREER

since 2011	Professor, IST Austria
2008–2011	MRC Senior Scientist (tenured), MRC Anatomical Neuropharmacology Unit, University of Oxford, Oxford, UK
2003–2008	MRC Senior Scientist (tenure-track), MRC Anatomical Neuropharmacology Unit, University of Oxford, Oxford, UK
2001–2002	Research Associate, Center for Behavioral and Molecular Neuroscience, Rutgers University, New Brunswick, USA
1999–2001	Postdoctoral Fellow, Center for Behavioral and Molecular Neuroscience, Rutgers University, New Brunswick, USA
1993–1999	Graduate Assistant, Center for Behavioral and Molecular Neuroscience, Rutgers University, New Brunswick, USA
1999	PhD, Rutgers University, New Brunswick, USA

SELECTED DISTINCTIONS

2011	ERC Starting Grant (consolidator)
2010	Title of Ad Hominem Professor in Neuroscience at the University of Oxford

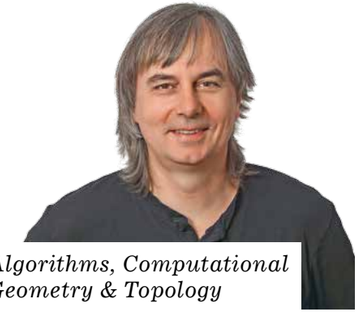
SELECTED PUBLICATIONS

- Dupret D, O'Neill J, Csicsvari J. 2013. Dynamic reconfiguration of hippocampal interneuron circuits during spatial learning. Neuron, 78:166-80.
- Dupret D, O'Neill J, Pleydell-Bouverie B, Csicsvari J. 2010. The reorganization and reactivation of hippocampal maps predict spatial memory performance. Nature Neuroscience 13(8), 995–1002.
- O'Neill J, Senior TJ, Allen K, Huxter JR, Csicsvari J. 2008. Reactivation of experience-dependent cell assembly patterns in the hippocampus. Nature Neuroscience 11(2), 209–215.

TEAM

Peter Baracskay (Postdoc), Karel Blahna (Postdoc), Charlotte Boccara (Postdoc), Desiree Dickerson (Postdoc), Igor Gridchyn (PhD student), Krisztian Kovacs (Postdoc), Michael Lobianco (Technical Assistant), Alessia Manganaro (Student Intern), Joseph O'Neill (Postdoc), Philipp Schönenberger (Postdoc), Haibing Xu (PhD student)

Ultra slow exposure image of a learning experiment on the "cheeseboard" maze.



Algorithms, Computational Geometry & Topology

Herbert Edelsbrunner

Uncovering fundamental shapes in a sea of occurrences is a central task in Computational Geometry and Topology. The Edelsbrunner group drives the frontiers in this constantly reshaping field of science.

Topology, the study of shapes and how they are connected and deform, can be used to address a number of questions in applications as diverse as dynamical systems, scientific visualization, structural molecular biology, systems biology, geometry processing, medical imaging and orthodontics. The common theme in these applications is the importance of recognizing connections and their dependence on scale. The question of scale and how reality changes as we zoom in and out is particularly fascinating. The Edelsbrunner group studies the two related subjects of topology and geometry from a computational point of view, in order to make mathematical insights useful in applications that are workable for nonspecialists. The group believes in a broad approach to problems, including the development of new mathematics, the translation into new computational methods, and the application to frontiers of science. Some candidate areas for fruitful collaborations are cell biology, neuroscience, medical imaging, and astronomy.

Current Projects

- Discrete and computational geometry
- Applied computational algebraic topology
- Topological dynamical systems

CAREER

since 2009	Professor, IST Austria
2004–2012	Professor for Mathematics, Duke University, Durham, USA
1999–2012	Arts and Sciences Professor for Computer Science, Duke University, Durham, USA
1996– 2013	Founder, Principal, and Director, Raindrop Geomagic
1985–1999	Assistant, Associate, and Full Professor, University of Illinois, Urbana-Champaign, USA
1981–1985	Assistant, Graz University of Technology, Graz, Austria
1982	PhD, Graz University of Technology, Graz, Austria

SELECTED DISTINCTIONS

ISI Highly Cited Researcher

2012 Corresponding Member of the Austrian Academy of Sciences
2009 Member, Academia Europaea
2008 Member, German Academy of Sciences Leopoldina
2006 Honorary Doctorate, Graz University of Technology
2005 Member, American Academy of Arts and Sciences
1991 Alan T. Waterman Award, National Science Foundation

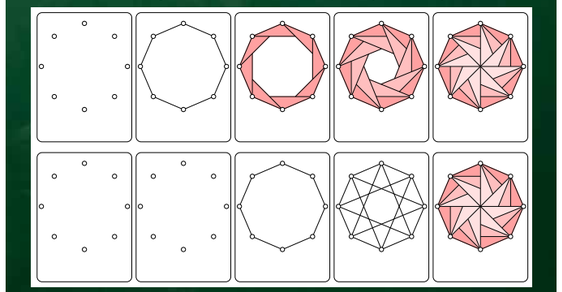
SELECTED PUBLICATIONS

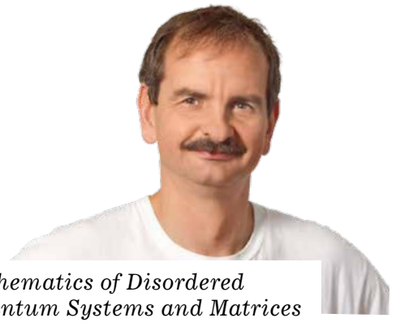
- Edelsbrunner H, Harer JL. 2010. Computational Topology. An Introduction. American Mathematical Society, Providence, Rhode Island
- Edelsbrunner H. 2001. Geometry and topology for mesh generation. Cambridge University Press, Cambridge, England.
- Edelsbrunner H. 1987. Algorithms in combinatorial geometry. Springer-Verlag, Heidelberg, Germany.

TEAM

Ulrich Bauer (Postdoc), Stefan Huber (Postdoc), Mabel Iglesias-Ham (PhD student), Daria Malkova (Student Intern), Salman Parsa (Student Intern), Florian Pausinger (PhD student), Jan Reininghaus (Postdoc), Olga Symonova (Postdoc)

The multi-scale image of connections in a sampled dynamical system.





Mathematics of Disordered Quantum Systems and Matrices

Laszlo Erdős

Wigner's vision that a simple random matrix can replace a multi-dimensional quantum model when calculating nuclear energy levels laid the groundwork for random matrix theory. Whether a random matrix underlies also other physical systems is the central question pursued by the Erdős group.

Surprisingly, a large matrix filled at random allowed for calculating energy levels of nuclei in heavy atoms. With this substitution, Eugene Wigner laid the basis for random matrix theory (RMT), which is now used to find patterns in huge amounts of data, even in stock market trends. Although experimental data leave no doubt that Wigner's substitution is correct, the reason for why it works is still not fully understood. In one part of their research, Laszlo Erdős and his group ask whether this reduction is also justified with mathematical rigor. Extending RMT to other physical systems and looking for universality in them, the group intends to move the simplified random matrix model back towards the original object of research from physics. At the same time, they ask whether the random matrix model is also underlying other physical models, and whether the "intermediate" approaches they develop may be used to mathematically solve other long-standing questions in physics. The mathematical ideas and tools developed as part of the Erdős group's work will extend RMT, and are likely to be used in its many applications, such as network analysis, information theory and other fields of physics.

Current Projects

- Self-consistent resolvent equation and application in random matrices
- Next order correction in the form factor for Wigner matrices
- Local spectral universality for random band matrices

CAREER

since 2013	Professor, IST Austria
since 2003	Chair of Applied Mathematics (C4/W3), Ludwig-Maximilians University, Munich, Germany
1998–2003	Assistant, Associate, Full Professor, Georgia Institute of Technology, Atlanta, USA
1995–1998	Courant Instructor/Assistant Professor, Courant Institute, New York University, New York, USA
1994–1995	Postdoctoral researcher, ETH Zurich, Zurich, Switzerland
1994	PhD in Mathematics, Princeton University, Princeton, USA

SELECTED DISTINCTIONS

2013	ERC Advanced Grant
2007-2016	Participant of SFB TR12, Symmetries and Universality
2002-2005	NSF grant
1999-2002	NSF grant
1993-1994	Alfred P. Sloan Foundation Dissertation Fellowship

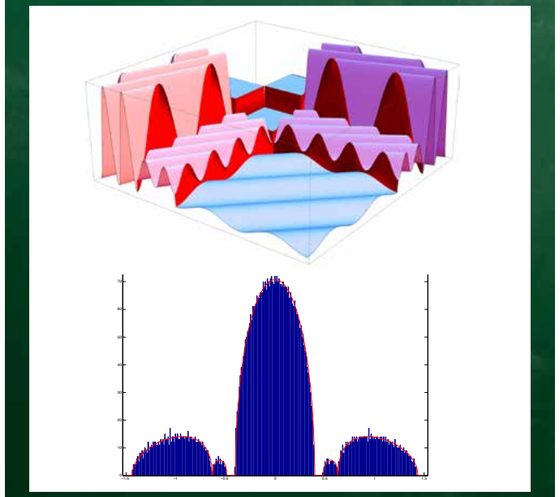
SELECTED PUBLICATIONS

- Erdös L, Yau H-T. 2012. Universality of local spectral statistics of random matrices. Bull. Amer. Math. Soc. 49, no.3, 377–414.
- Erdös L, Yau H-T, Yin J. 2012. Rigidity of Eigenvalues of Generalized Wigner Matrices. Adv. Math. 229, no. 3, 1435–1515.
- Erdös L, Schlein B, Yau H-T. 2011. Universality of Random Matrices and Local Relaxation Flow. Invent. Math. 185, no.1, 75–119.

TEAM

Heikki Oskari Ajanki (Postdoc), Torben Krüger (PhD student)

Variance profile of an inhomogeneous random matrix H.



Eigenvalue distribution of H and its limiting density.

Developmental and Cell Biology of Plants

Jiří Friml

While animals can move away if conditions turn harsh, plants are rooted in their environment. Plants so have become remarkably adaptable to different conditions. The Friml group investigates the mechanisms underlying their adaptability during plants' embryonic and postembryonic development.

Plants and animals live different lives. While animals can react to conditions by changing their behavior, plants have acquired a highly adaptive development that allows them to respond to changes. In development, plants can do much more than animals, such as growing new organs. Many of plants unique developmental events are mediated by auxin, a plant hormone. The Friml group investigates the unique properties of auxin signaling, standing out among plant signaling molecules due to the integration of both environmental and endogenous signals in its gradients within plant tissues. Employing methods spanning physiology, developmental and cell biology, genetics, biochemistry and mathematical modeling, the group focuses on polar auxin transport, cell polarity, endocytosis and recycling, as well as non-transcriptional mechanisms of signaling. In their work, the Friml group obtains fundamental insights into the mechanisms governing plant development. They show how signals from the environment are integrated into plant signaling and result in changes to plant growth and development. Many of their results are relevant for agriculture, providing a conceptual possibility for altering developmental processes.

Current Projects

- Polar auxin transport
- Cell polarity and polar targeting
- Endocytosis and recycling

CAREER

since 2013	Professor, IST Austria
2007-2012	Full Professor, University of Gent, Gent, Belgium
2006	Full Professor, University of Göttingen, Göttingen, Germany
2002-2005	Postdoc, Habilitation in Genetics, University of Tübingen, Tübingen, Germany
2002	PhD, Biochemistry, Masaryk University, Brno, Czech Republic
2000	PhD, Biology, University of Cologne, Cologne, Germany

SELECTED DISTINCTIONS

2012	EMBO Gold Medal
2011	AAAS Fellow
2010	EMBO member
2010	Körber European Science Award
2010	Olchemim Scientific Award
2005	Heinz Maier-Leibnitz Prize
2004	EMBO Young Investigator Award
2000	Max Planck Society Award: The Otto Hahn Medal

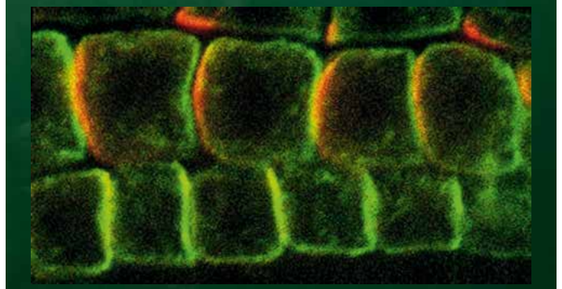
SELECTED PUBLICATIONS

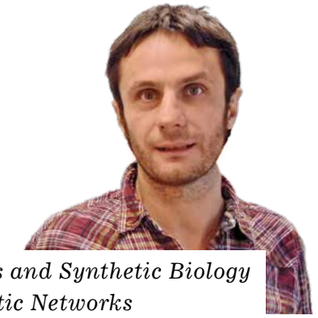
- Wabnik K, Robert HS, Smith RS, Friml J. 2013. Modeling framework for the establishment of the apical-basal embryonic axis in plants. Current Biology 23, 2513-2518.
- Robert HS, Grones P, Stepanova AN, Robles LM, Lokerse AS, Alonso JM, Weijers D, Friml J. 2013. Local auxin sources orient the apical-basal axis in Arabidopsis embryos. Current Biology 23, 2506-2512.
- Tanaka H, Kitakura S, Rakusová H, Uemura T, Feraru MI, De Rycke R, Robert S, Kakimoto T, Friml J. 2013. Cell polarity and patterning by PIN trafficking through early endosomal compartments in Arabidopsis thaliana. PLoS Genetics 9(5),1003540.

TEAM

Maciej Adamowski (PhD student), Xu Chen (Postdoc), Eduardo Cires Rodriguez (Postdoc), Peter Grones (PhD student), Urszula Kania (PhD student), Hongjiang Li (Postdoc), Eva Medvecka (Postdoc), Gergely Molnar (Postdoc), Petra Novakova (PhD student), Tomas Prat (PhD student), Hana Rakusova (PhD student), Yuliya Salanenka (Postdoc), Sibu Simon (Postdoc), Petr Valosek (Technician)

Polarity in Arabidopsis cells.





Systems and Synthetic Biology of Genetic Networks

Călin Guet

Networking is important on any level and in any environment – even in bacteria, genes and proteins are networking. But which basic rules, if any, do these networks follow? Using systems and synthetic biology, the Guet group explores the biology of genetic networks by analyzing both natural and synthetic networks.

Genes and proteins constitute themselves into bio-molecular networks in cells. These genetic networks are engaged in a constant process of decision-making and computation over time scales of few seconds to the time it takes the organism to replicate, and even beyond. By studying existing networks and constructing synthetic networks in living cells, the Guet group aims to uncover the existence of universal rules that govern bio-molecular networks. The group uses the bacterium *Escherichia coli* as a model system due to its relative simplicity and the powerful experimental genetic tools available. One aspect of the Guet group's work covers information processing at complex bacterial promoters, which integrate signals and regulate the expression of genes accordingly. The group uses a variety of classical and modern experimental techniques which together enable them to construct any imaginable network in living bacteria and thus to study the network dynamics at the single-cell level, which is the relevant scale of experimental interrogation.

Current Projects

- Information processing and evolution of complex promoters
- Systems biology of the *mar* regulon
- Single-cell biology and evolutionary dynamics of restriction-modification systems

CAREER

since 2011	Assistant Professor, IST Austria
2009	Postdoc, Harvard University, Cambridge, USA
2005	Postdoc, The University of Chicago, Chicago, USA
2004	PhD, Princeton University, Princeton, USA

SELECTED DISTINCTIONS

2011	HFSP Research Grant
2005	Yen Fellow, The University of Chicago, USA
1997	Sigma XI Membership

SELECTED PUBLICATIONS

- Guet CC, Gupta A, Henzinger TA, Mateescu M, Sezgin A. 2012. Delayed continuous-time Markov chains for genetic regulatory circuits. Lecture Notes in Computer Science CAV 7358, 294–309.
- Yazdi NH, Guet CC, Johnson RC, Marko JF. 2012. Variation of the folding and dynamics of the Escherichia coli chromosome with growth conditions. Molecular Microbiology 86, 1318-1333.
- Guet CC, Elowitz MB, Hsing WH, Leibler S. 2002. Combinatorial synthesis of genetic networks. Science 296(5572), 1466–1470.

TEAM

Anna Andersson (Joint Postdoc with Tkačik group), Tobias Bergmiller (Postdoc), Remy Chait (Postdoc), Tatjana Petrov (Joint Postdoc with Henzinger group), Maros Pleska (PhD student), Anna Staron (Postdoc), Magdalena Steinrück (PhD student)

Colonies of Escherichia coli performing Boolean logic computations with two chemical inputs and green fluorescent protein (GFP) as the output state.

Morphogenesis in Development

Carl-Philipp Heisenberg

The most elaborate shapes of multicellular organisms – the elephant's trunk, the orchid blossom, the lobster's claw – all start off from a simple bunch of cells. This transformation of a seemingly unstructured cluster of cells into highly elaborate shapes is a common and fundamental principle in cell and developmental biology and the focus of the Heisenberg group's work.

The Heisenberg group studies the molecular and cellular mechanisms by which vertebrate embryos take shape. To gain insights into critical processes in morphogenesis, the group focuses on gastrulation movements in zebrafish. Gastrulation is a highly conserved process in which a seemingly unstructured blastula is transformed into a highly organized embryo. The group has chosen a multidisciplinary approach to analyzing gastrulation, employing a combination of genetic, cell biological, biochemical and biophysical techniques. Using these tools, the group is deciphering key effector mechanisms involved in giving vertebrate embryos shape, such as cell adhesion and aggregation, cell polarization and cell migration. One central question they address is how adhesion between cells influences the specification and sorting of different populations of cells, which ultimately develop into different tissues and organs. Insights derived from this work may ultimately have implications for the study of wound healing and cancer biology, as immune and cancer cells share many morphogenetic properties of embryonic cells.

Current Projects

- Cell adhesion
- Actomyosin contractility and morphogenesis
- Cell polarization and migration

CAREER

since 2010	Professor, IST Austria
2001–2010	Group Leader, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany
1997–2000	Postdoc, University College London, London, UK
1996	PhD, Max Planck Institute of Developmental Biology, Tübingen, Germany

SELECTED DISTINCTIONS

2000	Emmy Noether Junior Professorship
1998	Marie Curie Postdoctoral Fellowship
1997	EMBO Postdoctoral Fellowship

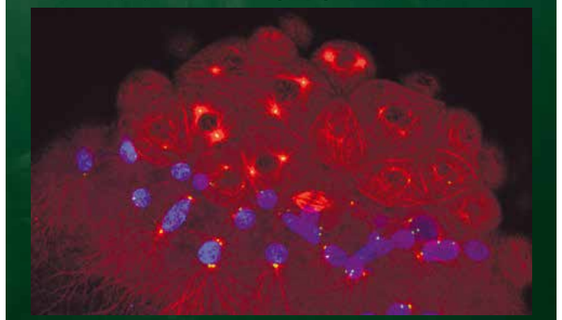
SELECTED PUBLICATIONS

- Campinho P, Behrndt M, Ranft J, Risler T, Minc N, Heisenberg CP. 2013. Nature Cell Biology 15, 1405–1414.
- Behrndt M, Salbreux G, Campinho P, Hauschild R, Oswald F, Roensch J, Grill S, Heisenberg CP. 2012. Forces driving epithelial spreading in zebrafish gastrulation. Science 338(6104), 257–260.
- Maître JL, Berthoumieux H, Krens SF, Salbreux G, Juelicher F, Paluch E, Heisenberg CP. 2012. Adhesion functions in cell sorting by mechanically coupling the cortices of adhering cells. Science 338(6104), 253–256.

TEAM

Vanessa Barone (PhD student), Martin Behrndt (PhD student), Daniel Capek (PhD student), Julien Compagnon (Postdoc), Gabby Krens (Postdoc), Hitoshi Morita (Postdoc), Kornelija Pranjic-Ferscha (Technician), Verena Ruprecht (Joint Postdoc with Sixt Group), Keisuke Sako (Postdoc), Philipp Schmalhorst (Postdoc), Mateusz Sikora (Postdoc), Jana Slovakova (Postdoc), Michael Smutny (Postdoc)

Zebrafish embryo at the onset of gastrulation, stained for nuclei (blue), microtubules (red) and microtubule organizing centers (white).



Design and Analysis of Concurrent and Embedded Systems

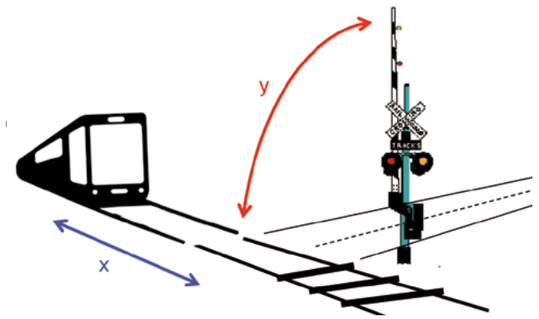
Thomas A. Henzinger

Humans and computers are surprisingly similar: while the interaction between two actors may be simple, every additional actor complicates matters. The Henzinger group builds the mathematical foundations for designing complex hardware and software systems.

Over 90% of today's worldwide computing power is found in unexpected places like cell phones, kitchen appliances, and pacemakers. Software has become one of the most complicated artifacts produced by man, making software bugs unavoidable. The Henzinger group addresses the challenge of reducing software bugs in concurrent and embedded systems. Concurrent systems consist of parallel processes that interact with one another, whether in a global network or on a tiny chip. Because of the large number of possible interactions between parallel processes, concurrent software is particularly error-prone, and sometimes bugs show up only after years of flawless operation. Embedded systems interact with the physical world; an additional challenge for this kind of safety-critical software is to react sufficiently fast. The Henzinger group invents mathematical methods and develops computational tools for improving the reliability of software in concurrent and embedded systems.

Current Projects

- Analysis and synthesis of concurrent software
- Quantitative modeling and verification of reactive systems
- Predictability and robustness for real-time and embedded systems
- Model checking biochemical reaction networks



CAREER

since 2009	Professor, IST Austria
2004-2009	Professor, EPFL, Lausanne, Switzerland
1999-2000	Director, Max Planck Institute for Computer Science, Saarbruecken, Germany
1998-2004	Professor, University of California, Berkeley, USA
1997-1998	Associate Professor, University of California, Berkeley, USA
1996-1997	Assistant Professor, University of California, Berkeley, USA
1992-1995	Assistant Professor, Cornell University, Ithaca, USA
1991	Postdoc, University Joseph Fourier, Grenoble, France
1991	PhD, Stanford University, Palo Alto, USA

SELECTED DISTINCTIONS

ISI Highly Cited Researcher

2013	AAAS Fellow
2012	Wittgenstein Award
2012	Honorary Doctorate, University Joseph Fourier, Grenoble, France
2012	Logic in Computer Science Test-of-Time Award
2011	Member, Austrian Academy of Sciences
2011	ACM SIGSOFT Impact Paper Award
2010	ERC Advanced Grant
2006	ACM Fellow
2006	IEEE Fellow
2006	Member, Academia Europaea
2005	Member, German Academy of Sciences Leopoldina
1995	ONR Young Investigator Award
1995	NSF Faculty Early Career Development Award

SELECTED PUBLICATIONS

- Cerny P, Henzinger TA, Radhakrishna A. 2013. Quantitative abstraction refinement. Proc. Symp. Principles of Programming Languages (POPL), 115-128.
- Dragoi C, Gupta A, Henzinger TA. 2013. Automatic linearizability proofs of concurrent objects with cooperating updates. Proc. Conf. Computer-Aided Verification (CAV), Lecture Notes in Computer Science, 174-190.
- Henzinger TA, Mateescu M. 2013. The propagation approach for computing biochemical reaction networks. IEEE-ACM Transactions on Computational Biology and Bioinformatics 10:310—322.

TEAM

Udi Boker (Postdoc), Przemyslaw Daca (PhD student), Cezara Dragoi (Postdoc), Ashutosh Gupta (Postdoc), Jan Kretinsky (Joint Postdoc with Chatterjee group), Jan Otop (Postdoc), Arjun Radhakrishna (PhD student), Ali Sezgin (Postdoc), Thorsten Tarrach (PhD student), Damien Zufferey (PhD student)

Genetic Dissection of Cerebral Cortex Development

Simon Hippenmeyer

The human brain is a sophisticated network of billions of interconnected neurons. Simon Hippenmeyer's group exploits genetic techniques in the mouse to better understand how the brain's precise connectivity emerges during development.

Our brains are composed of a vast number of neurons, and can function only because of the intricate connections formed between them. In order to better understand how the cerebral cortex accounts for behavior and cognitive activity, the Hippenmeyer group maps the assembly of the neuronal architecture during cortex development in the mouse. The group uses multidisciplinary approaches, including the genetic MADM (Mosaic Analysis with Double Markers) technique, to trace how individual neurons build up the cortex successively during development. Looking at the brain is similar to looking at a forest: While looking at a forest from afar, it is difficult to make out the trimming of a single branch of an individual tree. However, when a tree stands alone in a field, it is easy to observe the snip of even the finest branch. The MADM technique allows the Hippenmeyer group to visualize small groups of neurons, and even individual neurons, at the single cell level and manipulate them at the same time. This unparalleled method allows researchers to navigate through the dense network of neurons in the brain to exactly follow individual neurons and their fine branches. Simon Hippenmeyer's group determines the cellular, molecular and epigenetic mechanisms regulating neurogenesis and the migration of neurons in the cortex.

Current Projects

- Determination of neuronal lineages by clonal analysis
- Dissection of molecular mechanisms of cortical neuron migration
- Probing of genomic imprinting in cortex development

CAREER

since 2012	Assistant Professor, IST Austria
2011–2012	Research Associate, Stanford University, Palo Alto, USA
2006–2011	Postdoctoral Fellow, Stanford University, Palo Alto, USA
2004–2006	Postdoctoral Associate, University of Basel and Friedrich Miescher Institute for Biomedical Research, Basel, Switzerland
2004	PhD, University of Basel and Friedrich Miescher Institute for Biomedical Research, Basel, Switzerland

SELECTED DISTINCTIONS

2013	Marie Curie Career Integration Grant
2009–2011	Fellowship for Advanced Researchers (Swiss National Science Foundation; Bern, Switzerland)
2007–2009	HFSP Long-Term Fellowship
2006	EMBO Long-Term Fellowship
2005	Faculty Prize 2005 for the best PhD thesis of the year 2004 (Faculty of Natural Sciences, University of Basel, Switzerland)
2005	Edmond H. Fischer Prize 2005 (Friedrich Miescher Institute for Biomedical Research, Basel, Switzerland)

SELECTED PUBLICATIONS

- Hippenmeyer S. 2013. Dissection of Gene Function at Clonal Level using Mosaic Analysis with Double Markers. Frontiers in Biology 8 (6), 557-568.
- Hippenmeyer S, Johnson RL, Luo L. 2013. Mosaic Analysis with Double Markers Reveals Cell Type Specific Paternal Dominance. Cell Reports 3, 960-967.
- Hippenmeyer S, Young YH, Moon HM, Miyamichi K, Zong H, Wynshaw BA, Luo L. 2010. Genetic Mosaic Dissection of Lis1 and Ndel1 in Neuronal Migration. Neuron 68 (4), 695-709.

TEAM

Gloria Arque (Postdoc), Susanne Laukoter (Technician), Katharina Leopold (Diploma Student), Melanie Pieber (Student Intern), Siegfried Resch (Student Intern), Carmen Streicher (Technician), Maria-Pia Postiglione (Postdoc)

Nonlinear Dynamics and Turbulence

Björn Hof

Turbulent flow in water and other liquids is the most prominently encountered form of disorder in nature. The Hof group seeks insights into the fundamental nature of turbulence, and the dynamics of complex fluids.

Weather systems, galaxy and planet formation, airflow and networks are governed by complex chaotic dynamics. Fluid turbulence – seen in liquids such as water or oil – is the most common form of disorder in nature. Despite its ubiquity, insights into the nature of turbulence are very limited. To gain a fundamental understanding of turbulence, the Hof group investigates turbulence when it first arises from smooth, laminar flow. The group combines detailed laboratory experiments with highly resolved computer simulations, and applies methods from nonlinear dynamics and statistical physics. This enables the Hof group to decipher key aspects of the transition from smooth to turbulent flow, and identify universal features shared with disordered systems in other areas of physics. Some of the Hof group's insights can be directly applied to control turbulent flow, and the group actively develops such methods.

Current projects:

- Transition from laminar to turbulent flow
- Dynamics of complex fluids

CAREER

since 2013	Professor, IST Austria
2007-2013	Max Planck Research Group Leader, Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany
2005-2007	Lecturer, University of Manchester, Manchester, UK
2003-2005	Research Associate, Delft University of Technology, Delft, The Netherlands
2001	PhD, University of Manchester, Manchester, UK

SELECTED DISTINCTIONS

2012 ERC Starting Grant (consolidator)

2011 Dr. Meyer Struckmann Science Price

2005 RCUK Fellowship

SELECTED PUBLICATIONS

- Hof B, de Lozar A, Avila M, Tu X, Schneider TM. 2010. Eliminating turbulence in spatially intermittent flows. Science 327, 1491-1494.
- Avila K, Moxey D, de Lozar A, Avila M, Barkley D, Hof B. 2011. The onset of turbulence in pipe flow. Science 333, 192-196.
- Hof B, Westerweel J, Schneider TM, Eckhardt B. 2006. Finite lifetime of turbulence in pipe flow. Nature 443, 05089, 59-62.

TEAM

Sebastian Altmeyer (Postdoc), Jose Manuel Gallardo Ruiz (Postdoc), Shreyas Vaman Jalikop (Postdoc), Jakob Kühnen (Postdoc), Gregoire Lemoult (Postdoc), Philipp Maier (Technician), Liang Shi (PhD student), Baofang Song (PhD student), Mukund Vasudevan (Postdoc)

Synthetic Physiology

Harald Janovjak

When first faced with a new machine, an engineer's instinct is to disassemble it to understand its inner workings. The Janovjak group uses optogenetics to take apart the cell's signaling machinery and gain a better insight into how it orchestrates virtually all cellular functions.

Receptors on the cell surface are the antennas that receive signals and pass them on to the inside of the cell, causing specific and tightly controlled responses. The Janovjak group seeks to understand this process and takes a unique biophysical approach to actively manipulate signaling pathways. In multiple experimental systems, receptors are engineered to respond to a light stimulus rather than to the native signal. Light is then used as a "remote control" to activate or inactivate the receptor, allowing the researchers to switch it on or off. This optogenetic approach is used to study circuits and networks by activating or inactivating them at any given point, and allows researchers to analyze information processing in the brain and during signaling processes in general.

Current Projects

- Optogenetic identification of active signaling pathways
- Manipulation of sensory domains to study receptor dimerization
- Theoretical models of receptor activation

CAREER

since 2011	Assistant Professor, IST Austria
2010-2011	Postdoc, University of Munich, Munich, Germany
2006–2010	Postdoc, University of California, Berkeley, USA
2005	PhD, University of Dresden, Dresden, Germany

SELECTED DISTINCTIONS

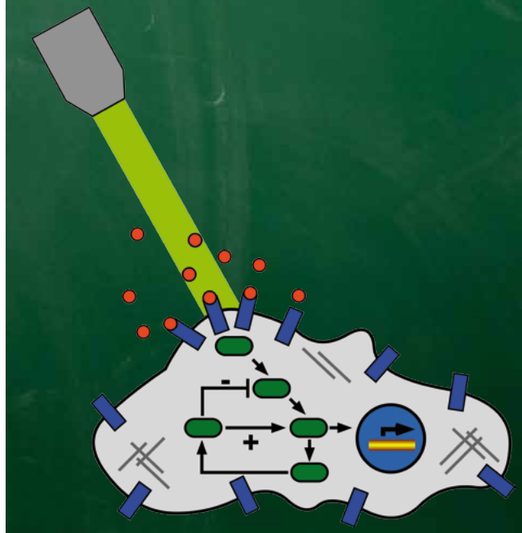
2011	HFSP Grant
2007–2009	Long-term fellow of the European Molecular Biology Organization
2005	PhD with highest honors (summa cum laude)

SELECTED PUBLICATIONS

- Levitz J, Pantoja C, Gaub B, Janovjak H, Reiner A, Hoagland A, Schoppig D, Kane B, Stawski P, Schier AF, Trauner D, Isacoff EY. 2013. Optical control of metabotroptic glutamate receptors. Nature Neuroscience 16, 507-516.
- Janovjak H, Sandoz G, Isacoff EY. 2011. A modern ionotropic glutamate receptor with a potassium-selectivity signature sequence. Nature Communications 2, 232.
- Janovjak H, Szobota S, Wyart C, Trauner D, Isacoff EY. 2010. A light-gated, potassium-selective glutamate receptor for the optical inhibition of neuronal firing. Nature Neuroscience 13(8), 1027–1032.

TEAM

Alvaro Ingles Prieto (Postdoc), Catherine McKenzie (PhD student), Maurizio Morri (PhD student), Robert Riedler (Student Intern), Inmaculada Sanchez Romero (Postdoc), Miroslava Spanova (Technician)



Using optogenetics to manipulate the cell signaling machinery.

Synaptic Communication in Hippocampal Microcircuits

Peter Jonas

Synapses enable communication between neurons in the brain. The Jonas group investigates how signals pass through these vital interfaces – a major undertaking in the field of neuroscience.

Understanding the function of neuronal microcircuits is one of the major challenges of life science in the 21st century. The human brain is comprised of approximately 10 billion neurons, which communicate with each other at a huge number of synapses, specialized sites of contact between neurons. Broadly, synapses in the brain fall into two categories: excitatory synapses releasing the transmitter glutamate and inhibitory synapses releasing Gamma-Aminobutyric acid (GABA). The Jonas group seeks to quantitatively address the mechanisms of synaptic signaling, using multiple-cell recording, subcellular patch-clamp techniques, Ca^{2+} imaging, and modeling. Amongst other projects, the group examines subcellular elements of the fast-spiking, parvalbumin–expressing GABAergic interneurons in the hippocampus, which are thought to contribute to storage and retrieval of memories. These interneurons play a key role in cortical neuronal networks, and the Jonas group aims to obtain a quantitative nanophysiological picture of signaling in this type of interneuron. This research has far reaching implications for understanding the contribution of GABAergic interneurons to neuronal coding and brain energetics, and may lay the basis for the development of new therapeutic strategies against diseases of the nervous system.

Current Projects

- Nanophysiology of fast-spiking, parvalbumin-expressing GABAergic interneurons
- Analysis of synaptic mechanisms of information storage
- Analysis of hippocampal synaptic transmission *in vivo*

CAREER

since 2010	Professor, IST Austria
1995–2010	Professor & Department Head, University of Freiburg, Freiburg, Germany
1994–1995	Associate Professor, Technical University of Munich, Munich, Germany
1990–1994	Research Assistant, Max Planck Institute for Medical Research, Heidelberg, Germany
1988–1989	Postdoc, University of Giessen, Giessen, Germany
1987	PhD, University of Giessen, Giessen, Germany

SELECTED DISTINCTIONS

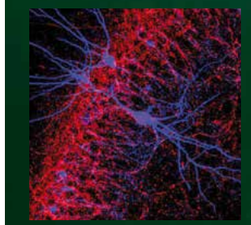
2011	ERC Advanced Grant
2009	Adolf-Fick-Award, Physicomedical Society, Würzburg, Germany
2008	Member, Academy of Sciences, Heidelberg, Germany
2007	Tsungming Tu Award, National Science Council Taiwan
2006	Szentagothai memorial lecture, University of California, Irvine, USA
2006	Gottfried Wilhelm Leibniz Award, German Research Foundation
2002	Member, German Academy of Sciences Leopoldina
1998–2001	Human Frontiers Science Program Organization Grant
1998	Max-Planck Research Award
1997	Medinfar European Prize in Physiology, Portugal
1994	Heinz Maier Leibnitz Award, German Ministry for Education and Science
1992	Heisenberg Fellowship, German Research Foundation

SELECTED PUBLICATIONS

- Pernía-Andrade A, Jonas. P 2013. Theta–gamma modulated synaptic currents in hippocampal granule cells in vivo define a mechanism for network oscillations. Neuron 81 (1), 140-152.
- Kim S, Guzman SJ, Hu H, Jonas P. 2012. Active dendrites support efficient initiation of dendritic spikes in hippocampal CA3 pyramidal neurons. Nature Neuroscience 15(4), 600–606.
- Eggermann E, Jonas P. 2012. How the "slow" Ca^{2+} buffer parvalbumin affects transmitter release in nanodomaincoupling regimes. Nature Neuroscience 15(1), 20–22.

TEAM

Itaru Arai (Postdoc), Michelle Duggan (Technical Assistant), Jian Gan (Postdoc), Sarit Goswami (PhD student), José Guzmán (Postdoc), Hua Hu (Postdoc), Sooyun Kim (Postdoc), Janina Kowalski (Postdoc), Eva Kramberger (Administrative Assistant, on maternity leave), Florian Marr (Technician), Rajiv Mishra (PhD student), Alejandro Pernía-Andrade (Postdoc), Alois Schlögl (Software Engineer), Amália Solymosi (interim Administrative Assistant), Nicholas Vyleta (Postdoc), Shih-Ming Weng (Postdoc)



Presynaptic hippocampal basket cell (lower right) and postsynaptic granule neurons (upper left).

Computer Vision and Discrete Optimization Algorithms

Vladimir Kolmogorov

Stepping out on the street, we automatically judge the distance and speed of cars. For computers, estimating the depth of objects in an image requires complex computation. The Kolmogorov group's work on algorithms gives computers "stereo vision".

Research of Vladimir Kolmogorov's group focuses on the development of efficient algorithms for inference in graphical models, which have applications in many different fields such as computer vision, computer graphics, data mining, machine learning and bioinformatics. Two classical examples from computer vision are binary image segmentation and stereo vision problems. Binary image segmentation gives automatic systems the ability to divide an image into foreground and background, while stereo vision allows them to infer the depth of objects. Kolmogorov has developed algorithms widely used in computer vision, such as the "Boykov-Kolmogorov" maximum flow algorithm and the "TRW-S" algorithm for inference in graphical models. His "Blossom V" algorithm is currently the fastest technique for computing a minimum cost perfect matching in a graph. Vladimir Kolmogorov has also done theoretical work on the analysis of discrete optimization problems.

Current Projects

- Inference in graphical models
- Combinatorial optimization problems
- Theory of discrete optimization

CAREER

since 2011	Assistant Professor, IST Austria
2005–2011	Lecturer, University College London, London, UK
2003–2005	Assistant Researcher, Microsoft Research, Cambridge, UK
2003	PhD, Cornell University, Ithaca, USA

SELECTED DISTINCTIONS

2013	ERC Consolidator Grant
2012	Koenderink Prize at the European Conference on Computer Vision for fundamental contributions to computer vision
2007	Honorable mention, outstanding student paper award (to M. Pawan Kumar) at Neural Information Processing Systems Conference
2006–2011	The Royal Academy of Engineering/EPSRC Research Fellowship
2005	Best paper honorable mention award at IEEE Conference on Computer Vision and Pattern Recognition
2002	Best paper award at the European Conference on Computer Vision

SELECTED PUBLICATIONS

- Kolmogorov V. 2009. Blossom V: A new implementation of a minimum cost perfect matching algorithm. Mathematical Programming Computation 1(1), 43–67.
- Kolmogorov V. 2013. The power of linear programming for valued CSPs: a constructive characterization. 40th International Colloquium on Automata, Languages and Programming (ICALP), 2013.
- Gridchyn I, Kolmogorov V. 2013. "Potts model, parametric maxflow and k-submodular functions". In IEEE International Conference on Computer Vision (ICCV), Sydney, Australia

TEAM

Rustem Takhanov (Postdoc)

Example of the "Grabcut" interactive image segmentation algorithm based on graph cuts, which has been incorporated in Microsoft Office 2010.

Computer Vision and Machine Learning

Christoph Lampert

Every kid knows how to play "I spy with my little eye", but to a computer the task of analyzing images and recognizing objects in them is tremendously difficult. The Lampert group helps computers "see" with the tools of Computer Vision and Machine Learning.

Recognizing objects in an image is child's play to humans, but presents an exceedingly difficult challenge to computers. The Lampert group develops algorithms and methods that allow computers to analyze high-dimensional data and make decisions based on it. In machine learning, computers arrive at knowing general rules by making abstractions based on examples provided. Object recognition is one aspect of machine learning essential for applications requiring computer vision.

In their research, the Lampert group members develop algorithms that enable automatic image understanding systems to analyze digital images regarding their contents. In the long run, the Lampert group is interested in building automatic systems that understand images on the same semantic level as humans do, enabling them to answer questions like: What objects are visible in an image? Where are they located? How do they interact?

Current Projects

- Life-long learning for visual scene understanding
- Object recognition and localization
- Structured prediction and learning
- Attribute representations

CAREER

since 2010	Assistant Professor, IST Austria
2007–2010	Senior Research Scientist, Max Planck Institute for Biological Cybernetics, Tübingen, Germany
2004–2007	Senior Researcher, German Research Center for Artificial Intelligence, Kaiserslautern, Germany
2003	PhD, University of Bonn, Bonn, Germany

SELECTED DISTINCTIONS

2012	ERC Starting Grant
2008	Best Paper Award, IEEE Conference for Computer Vision and Pattern Recognition (CVPR)
2008	Best Student Paper Award, European Conference for Computer Vision (ECCV)
2008	Main Price, German Society for Pattern Recognition (DAGM)

SELECTED PUBLICATIONS

- Lampert CH, Nickisch H, Harmeling S. 2009. Learning to detect unseen object classes by between-class attribute transfer. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 951–958.
- Lampert CH, Blaschko MB, Hofmann T. 2008. Beyond sliding windows: Object localization by efficient subwindow search. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 1–8.
- Blaschko MB, Lampert CH. 2008. Learning to localize objects with structured output regression. European Conference on Computer Vision (ECCV), 2–15.

TEAM

Emilie Morvant (Postdoc), Tomas Kazmar (co-supervised PhD student at IMP Vienna), Anastasia Pentina (PhD student), Viktoriia Sharmanska (PhD student)

Object recognition in natural images: learning-based computer vision techniques aim at detecting objects and describing them semantically.

Cryptography

Krzysztof Pietrzak

Cryptography, the science of information security, is often relegated to the realm of spies and agents. However, we all rely on cryptography on a daily basis, for example when using internet banking or a wireless car key.

The Pietrzak group works on theoretical and practical aspects of cryptography. One focus of their work is the construction of provably secure cryptographic schemes for light-weight devices such as RFID tags, which are used in many security-relevant applications like electronic passports or for access control. RFID tags are typically too constrained to run existing cryptographic schemes, and thus one must design schemes that are provably secure, but at the same time extremely simple and efficient.

Another line of work is concerned with so called "side-channel attacks". These are attacks on cryptographic devices, for example smart-cards, in which one measures information leaked during computation, and then exploits it to break the security of the scheme. This information can for example be the power consumption or emitted radiation. The group works on "leakage-resilient" cryptography, which aims at constructing schemes which remain provably secure even in the context of side-channel attacks.

Current Projects

- Leakage-resilient cryptography
- Cryptosystems for light-weight devices
- Computational Entropy

CAREER

since 2011	Assistant Professor, IST Austria
2005–2011	Scientific staff member, Centrum Wiskunde & Informatica, Amsterdam, Netherlands
2006	Postdoc, École Normale Supérieure, Paris, France
2005	PhD, ETH Zurich, Zurich, Switzerland

SELECTED DISTINCTIONS

2010	ERC Starting Grant

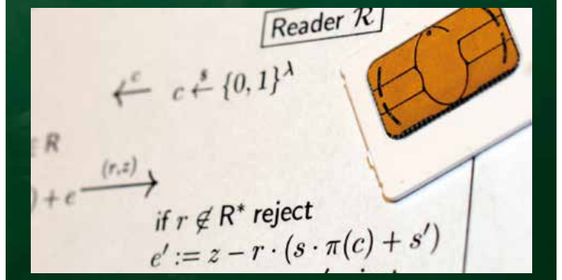
SELECTED PUBLICATIONS

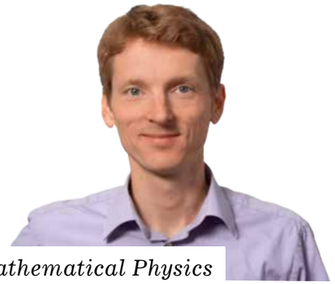
- Kiltz E, Pietrzak K, Szegedy M. 2013. Digital Signatures with Minimal Overhead from Indifferentiable Random Invertible Functions. CRYPTO (1) 2013: 571-588.
- Kiltz E, Pietrzak K, Cash D, Jain A, Venturi D. 2011. Efficient authentication from hard learning problems. EUROCRYPT, 7–26.
- Dziembowski S, Pietrzak K. 2008. Leakage-resilient cryptography. IEEE Symposium on Foundations of Computer Science, 293–302.

TEAM

Georg Fuchsbauer (Postdoc), Peter Gaži (Postdoc), Stefan Krenn (Postdoc), Michal Rybar (PhD student)

Light-weight devices require simple and efficient cryptographic schemes.





Mathematical Physics

Robert Seiringer

Many-body systems in quantum mechanics display a rich variety of complex phenomena. The Seiringer group develops new mathematical tools in the quest to seek a thorough understanding of their basic underlying principles.

Ice and water may look different, but are in fact described by the same equations of quantum mechanics. How the same equations can lead to two such very different macroscopic manifestations is one of the questions that inspire the Seiringer group in their effort to precisely understand physical systems. The Seiringer group focuses on many-body systems in quantum mechanics, in particular on problems in quantum statistical mechanics and condensed matter physics. They investigate how atoms and molecules, the building blocks of matter, interact and how this interplay of fundamental parts affects the entire system, and mathematically analyze the behavior of condensed matter at very low temperatures. The Seiringer group applies modern mathematical techniques and even develops new mathematical tools for the rigorous analysis of physical systems, of which they seek to gain a thorough theoretical understanding.

Current Projects

- The Heisenberg ferromagnet at low temperature and the spin-wave approximation
- Structure and dynamics of polarons at strong coupling
- Excitation spectrum and superfluidity for weakly interacting Bose gases

CAREER

since 2013	Professor, IST Austria
2010-2013	Associate Professor, McGill University, Montreal, Canada
2005	Habilitation, University of Vienna, Vienna, Austria
2003-2010	Assistant Professor, Princeton University, Princeton, USA
2001-2003	Postdoc, Princeton University, Princeton, USA
2000-2001	Assistant, University of Vienna, Vienna, Austria
2000	PhD, University of Vienna, Vienna, Austria

SELECTED DISTINCTIONS

2012-2017	William Dawson Scholarship
2012-2014	NSERC E.W.R. Steacie Memorial Fellowship
2009-2010	U.S. National Science Foundation CAREER grant
2009	Henri Poincare Prize of the International Association of Mathematical Physics
2004-2006	Alfred P. Sloan Fellow
2001-2003	Erwin Schrödinger Fellow

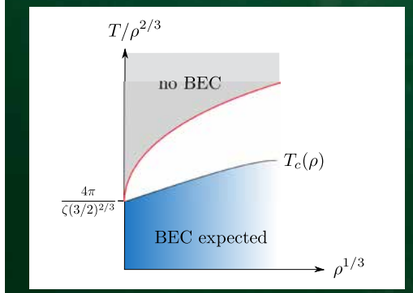
SELECTED PUBLICATIONS

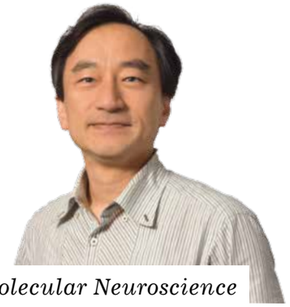
- Seiringer R, Frank RL, Heinzl C, Solovej JP. 2012. Microscopic Derivation of Ginzburg-Landau Theory. J. Amer. Math. Soc. 25, 667–713.
- Seiringer R, Frank RL, Lewin M, Lieb EH. 2011. Energy cost to make a hole in the Fermi sea. Phys. Rev. Lett. 106, 150402.
- Seiringer R. 2011. The Excitation Spectrum for Weakly Interacting Bosons. Commun. Math. Phys. 306, 565–578.

TEAM

Phan Thanh Nam (Postdoc), Jimena Royo-Letelier (Postdoc)

Phase diagram of a dilute Bose gas.





Molecular Neuroscience

Ryuichi Shigemoto

Information transmission, the formation of memory and plasticity are all controlled by various molecules at work in the brain. Focusing on the localization and distribution of molecules in brain cells, the Shigemoto group investigates their functional roles in higher brain functions.

The release of neurotransmitters from a nerve cell into the synapse, where they act on receptors on the connecting nerve cell, is the primary way of information transmission and computation in the brain. The Shigemoto group studies the localization of single neurotransmitter receptors, ion channels and other functional molecules to understand the molecular basis of neuronal computation. The group has pioneered several methods for studying the localization of functional molecules at an unprecedented sensitivity, detecting and visualizing even single membrane proteins in nerve cells using SDS-digested freeze fracture replica labeling. They apply these methods to investigate the mechanisms of signaling and plasticity in the brain, with questions ranging from neurotransmission to learning. The Shigemoto group studies the molecular mechanisms for long-term memory formation and stabilization, focusing on motor and spatial learning and emotional memory formation, mediated by structural changes in brain regions. They are also working on the left-right asymmetry of synaptic connections, receptor allocations and behaviors, to clarify both its physiological significance and the mechanism of asymmetry formation. The laterality of brain function is well known in humans, but the molecular determinants of this laterality are still largely elusive.

Current Projects

- Ultrastructural localization and function of receptors and ion channels in the brain
- Mechanisms of long-term memory formation
- Left-right asymmetry of hippocampal circuitry

CAREER

since 2013	Professor, IST Austria
since 1998	Professor, National Institute for Physiological Sciences, Okazaki, Japan
1990-1998	Assistant Professor, Kyoto University Faculty of Medicine, Kyoto, Japan
1994	PhD, Kyoto University, Kyoto, Japan
1985	M.D., Kyoto University Faculty of Medicine, Kyoto, Japan

SELECTED DISTINCTIONS

ISI Highly Cited Researcher

2000 ISI Citation Laureate Award

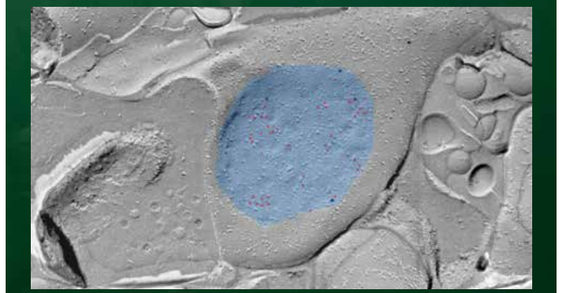
SELECTED PUBLICATIONS

- Shinohara Y, Hirase H, Watanabe M, Itakura M, Takahashi M, Shigemoto R. 2008. Left-right asymmetry of the hippocampal synapses with differential subunit allocation of glutamate receptors. Proceedings of National Academy of Science, USA, 105:19498-503.
- Fukazawa Y, Shigemoto R. 2012. Intra-synapse-type and inter-synapse-type relationships between synaptic size and AMPAR expression. Current Opinion in Neurobiology 22 (3), 446-452.
- Wang W, Nakadate K, Masugi-Tokita M, Shutoh F, Aziz W, Tarusawa E, Lorincz A, Molnár E, Kesaf S, Li YQ, Fukazawa Y, Nagao S, Shigemoto R. 2014. Distinct cerebellar engrams in short-term and long-term motor learning. Proceedings of National Academy of Science, USA, 111:E188-93.

TEAM

Pradeep Bhandari (PhD student), Matthew Julian Case (PhD student), Harumi Harada (Postdoc), Sebnem Kesaf (PhD student)

Clustering of P/Q-type voltage dependent calcium channels (red) in the presynaptic active zone (blue) of parallel fiber-Purkinje cell synapses in the rat cerebellum.



Invasive Migration

Daria Siekhaus

Cells actively move to get around the body. Cells' ability to migrate is crucial for their function in the immune system, formation of the body and the spread of cancer. The Siekhaus group investigates how cells move in the complex environment of an organism.

Cells, the building blocks of life, mostly remain stationary to form stable organs and tissues. However, some of our cells need to migrate through our body, as they fight infecting pathogens. The group of Daria Siekhaus studies how these immune cells move during the development of the fruit fly *Drosophila melanogaster* from the place they are born to their final locations in the embryo. The Siekhaus group has shown that one particular developmental path taken by the immune cells requires them to squeeze through a tissue barrier. This behavior displays similarities with that of vertebrate immune cells that use the vasculature as a highway for easy migration through the body, and therefore need to squeeze through the wall of the blood vessels to enter and leave the vasculature. The Siekhaus group has identified many genes required for cells to overcome such barriers, and has shown that some of them allow cells to change how "sticky" cells are. Using a powerful combination of imaging, genetics, cell biology and biophysics, the Siekhaus group seeks to understand the functions of these genes, the pathways they act in, and the strategies and principles that underlie invasive migration. Similar barrier penetration is involved in the metastatic spread of cancer cells, and the results of the Siekhaus group's Drosophila studies may be translated to autoimmunity and metastasis.

Current Projects

- Understanding the communication between hemocytes and the barriers that they move through
- Understanding the regulation of adhesion that occurs during hemocyte migration

CAREER

since 2012	Assistant Professor, IST Austria
2003–2011	Research Scientist, Department of Developmental Genetics, Skirball Institute, New York University Medical Center, New York, USA
1999–2003	Postdoctoral Fellow, University of California, Berkeley, USA
1998	PhD, Stanford University, Stanford, USA

SELECTED DISTINCTIONS

2012	Marie Curie Career Integration Grant
2003–2005	NIH Fellowship
2000–2003	NSRA Fellowship

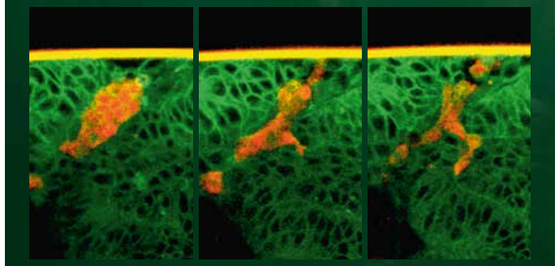
SELECTED PUBLICATIONS

- DeGennaro M, Hurd T, Siekhaus D, Biteau B, Jasper H, Lehmann R. 2011. Peroxiredoxin stabilization of E-cadherin promotes primordial germ cell adhesion. Developmental Cell 20(2), 233–243.
- Siekhaus D, Haesemeyer M, Moffitt O, Lehmann R. 2010. RhoL controls invasion and Rap1 localization during immune cell transmigration in Drosophila. Nature Cell Biology 12(6), 605–610.
- Siekhaus D, Drubin DG. 2003. Spontaneous receptor-independent heterotrimeric G protein signaling in an RGS mutant. Nature Cell Biology 5(3), 231–235.

TEAM

Aparna Ratheesh (Postdoc), Vera Belyaeva (PhD student), Katarina Hribikova (PhD student), Attila Gyoergy (Technician)

Immune cells (red) of the fruit fly Drosophila melanogaster.



Morphodynamics of Immune Cells

Michael Sixt

Immune cells zip through our body at high speed to fight off infections and diseases. The Sixt group works at the interface of cell biology and immunology to investigate how cells are able to migrate through tissues.

Most cells in our body are stationary, forming solid tissues and encapsulated organs. One exception are leukocytes, immune cells essential for both the innate and adaptive immune response to infections. Leukocytes migrate with extraordinary speed, and are used by the Sixt group as a model to study cell migration. The group works at the interface of cell biology, immunology and biophysics and aims to identify mechanistic principles that then might be generalized to other migrating cells, such as metastasizing cancer cells or migratory cells during development or regeneration. A current focus of research is how the cell's internal skeleton, the actin cytoskeleton, generates the force to deform the cell body and how this force is transduced to the surrounding tissue in order to move the cell forward. The group also investigates other, closely related aspects, such as cell polarization and guidance within tissues. To challenge their findings in the context of living tissues, the Sixt group has developed tissue explants and whole-animal imaging techniques that complement studies in reductionist *in vitro* systems.

Current Projects

- Environmental control of leukocyte migration
- Cellular force generation & transduction
- Invasion of tissue barriers

CAREER

since 2013	Professor, IST Austria
2010–2013	Assistant Professor, IST Austria
2008–2010	Endowed Professor, Peter Hans Hofschneider Foundation for Experimental Biomedicine
2005–2010	Group Leader, Max Planck Institute of Biochemistry, Martinsried, Germany
2003–2005	Postdoc, Institute for Experimental Pathology, Lund, Sweden
2003	MD, University of Erlangen, Erlangen, Germany
2002	Full approbation in human medicine

SELECTED DISTINCTIONS

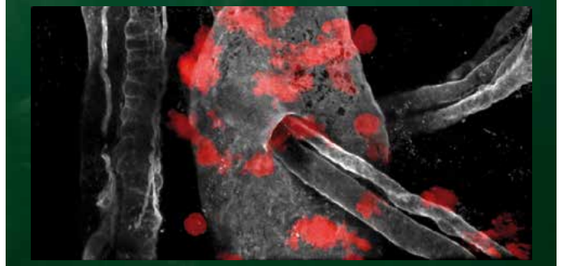
2013	European Biophysical Societies Association (EBSA) Young Investigator Medal
2013	Elected member of the "Young Academy" of the Austrian Academy of Sciences
2012	Ignaz L. Lieben Award
2011	ERC Starting Grant
2011	FWF START Award
2008	Endowed Professor of the Peter Hans Hofschneider Foundation
2003	Novartis research price for the best medical dissertation at the University of Erlangen

SELECTED PUBLICATIONS

- Weber M, Hauschild R, Schwarz J, Moussion C, de Vries I, Legler DF, Luther SA, Bollenbach T, Sixt M. 2013. Interstitial dendritic cell guidance by haptotactic chemokine gradients. Science 339(6117):328-32.
- Schumann K, Lämmermann T, Bruckner M, Legler DF, Polleux J, Spatz JP, Schuler G, Förster R, Lutz MB, Sorokin L, Sixt M. 2010. Immobilized chemokine fields and soluble chemokine gradients shape migration patterns of dendritic cells. Immunity 32(5), 703–713.
- Lämmermann T, Bader BL, Monkley SJ, Worbs T, Wedlich-Söldner R, Hirsch K, Keller M, Förster R, Critchley DR, Fässler R, Sixt M. 2008. Rapid leukocyte migration by integrin-independent flowing and squeezing. Nature 453(7191), 51–55.

TEAM

Alexander Eichner (PhD student), Miroslav Hons (Postdoc), Eva Kiermaier (Postdoc), Aglaja Kopf (Student Intern), Alexander Leithner (PhD student), Christine Moussion (Postdoc), Jan Muller (PhD student), Anne Reversat (Postdoc), Verena Ruprecht (Joint Postdoc with Heisenberg Group), Jan Schwarz (PhD student), Kari Vaahtomeri (Postdoc), Ingrid de Vries (Technician)



Cells entering a lymph vessel.

Theoretical Biophysics and Neuroscience

Gašper Tkačik

Networks that process and transmit information are everywhere in biology. Neurons, signaling molecules, genes, and organisms are part of extensive networks that have evolved to detect, represent, and compute responses to changes in the environment or the organism's internal state. The Tkačik group uses theoretical biophysics to study information processing in such biological networks.

The Tkačik group focuses on information flow in biological networks, using tools from statistical physics of disordered systems and information theory to analyze, compare and model examples of biological computation. This biological computation takes place across a large range of time scales and is implemented using very different substrates, for instance electrical signals, transcription factor concentrations, covalent modification states of signaling molecules, or visual and auditory signals. The group looks for design principles that would predict how biological networks are wired to perform their functions well under biophysical noise and resource constraints. Their work spans the range from biophysics, signal transduction and genetic regulation over computational neuroscience and neural coding to the collective motion of groups of organisms. For example, the Tkačik group studies how the visual systems of various organisms have adapted to their environments to efficiently extract information from natural stimuli and send it to the central nervous system.

Current Projects

- Visual encoding in the retina
- Genetic regulation during early embryogenesis
- Collective dynamics in groups of organisms

CAREER

since 2011	Assistant Professor, IST Austria
2008–2010	Postdoc, University of Pennsylvania, Philadelphia, USA
2007	Postdoc, Princeton University, Princeton, USA
2007	PhD, Princeton University, Princeton, USA

SELECTED DISTINCTIONS

2012	HFSP grant
2006	Charlotte E Procter Honorific Fellowship, Princeton University
2003	Burroughs-Wellcome Fellowship, Princeton University
2002	Golden sign of the University of Ljubljana

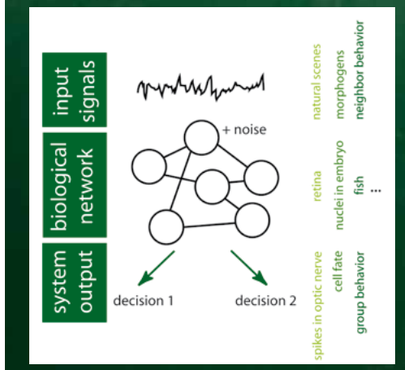
SELECTED PUBLICATIONS

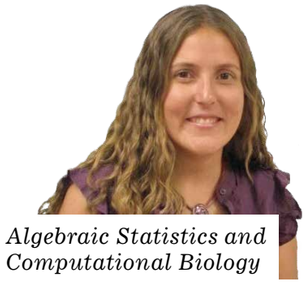
- Dubuis JO, Tkačik G, Wieschaus EF, Gregor T, Bialek W.2013. Positional information in bits. PNAS 110(41): 16301-16308
- Tkačik G, Granot-Atedgi E, Segev R, Schneidman E. 2013. Retinal metric: a stimulus distance measure derived from population neural responses. Physical Review Letters 110(5):058104.
- Tkačik G, Prentice JS, Victor JD, Balasubramanian V. 2010. Local statistics in natural scenes predict the saliency of synthetic textures. PNAS 107(42), 18149–18154.

TEAM

Anna Andersson (Postdoc), Katarina Bodova (Postdoc), Vicente Botella Soler (Postdoc), Tamar Friedlander (Postdoc / IST Fellow, joint with Barton and Guet groups), Gabriel Mitchell (Postdoc), Cristina Savin (Postdoc / IST Fellow), Georg Rieckh (PhD student)

Processing of information input by biological networks.





Algebraic Statistics and Computational Biology

Caroline Uhler

How are chromosomes packed into the cell's nucleus? How many observations are minimally needed for estimating interactions between genes? How can privacy be ensured when releasing genomic data? The Uhler group works on algebraic statistics and addresses questions in computational biology.

Algebraic statistics exploits the use of algebraic techniques to study statistical problems, and to develop new paradigms and algorithms for data analysis and statistical inference. Algebraic methods have proven to be useful for statistical theory and applications alike. As such, the work of the Uhler group is at the interface of mathematical modeling, statistics and computational biology. On the theoretical side, the Uhler group works on gaining a better understanding of the mathematics and geometry of graphical models with hidden variables, particularly for causal inference. Another research direction consists of developing methods for model selection in random graph models. Projects motivated by biological problems include the understanding of the spatial organization of chromosomes inside the cell's nucleus. Gene expression is, amongst others, dependent on the proximity of different chromosomes and chromosomal regions. The Uhler group studies the organization of the mammalian genome under a probabilistic model, a fascinating problem at the interface of computational biology, statistics, optimization and computational geometry. Other questions addressed include the development of methods to release data from genomewide association studies without compromising an individual's privacy.

Current Projects

- Causal inference
- Graphical models with hidden variables
- Model selection in random graph models
- Chromosome packing in cell nuclei
- Privacy preserving data sharing for genomic data

CAREER

since 2011	Assistant Professor, IST Austria
2013	Research Fellow, Theoretical Foundations of Big Data Analysis, Simons Institute, University of California, Berkeley, USA
2012	Postdoc, Seminar of Statistics, ETH Zurich, Zurich, Switzerland
2011	Postdoc, Institute of Mathematics and its Applications, University of Minnesota, Minneapolis, USA
2011	PhD, University of California, Berkeley, USA

SELECTED DISTINCTIONS

2010–2011	Janggen-Poehn Fellowship
2007–2010	International Fulbright Science and Technology Award
2006	Best Student Award of the University of Zurich

SELECTED PUBLICATIONS

- Uhler C, Raskutti G, Bühlmann P, Yu B. 2013. Geometry of faithfulness assumption in causal inference. Annals of Statistics 41(2), 436-463.
- Uhler C, Wright SJ. 2013. Packing ellipsoids with overlap. SIAM Review 55(4), 671-706.
- Uhler C. 2012. Geometry of maximum likelihood estimation in Gaussian graphical models. Annals of Statistics 40(1), 238–261.

TEAM

Abraham Martin del Campo (Postdoc), Mabel Iglesias Ham (PhD student, joint with Edelsbrunner group), Anna Klimova (Postdoc), Patrik Norén (Postdoc)

Gaussian distributions on three nodes for which causal inference fails.

Combinatorics, Geometry and Topology

Uli Wagner

How are molecules connected through chemical bonds? How do people know each other? How is a city's road network laid out? All these are questions on connections – of objects, places or people. Asking questions about connections mathematically, the Wagner group's focus lies on combinatorial and computational geometry and topology.

Graphs consist of vertices – points such as houses – and edges which connect vertices – for example connecting roads. Classical graph theory then asks questions on these graphs: is a graph planar, so can all points be connected without the connections crossing each other? What does the fact that a graph is planar tells us about the connections, e.g. about a city's road map? Such graphs are one-dimensional shapes. The Wagner group studies questions analogous to these classical questions of graph theory for geometric shapes and structures of higher dimensions. They ask whether a shape can be fitted in higher dimensional space, and what information this conveys about the shape's structure and complexity. Their research combines geometry and topology with combinatorics, as they study questions in geometry and topology from a combinatorial viewpoint, while also applying methods from topology to problems in combinatorics, discrete geometry and theoretical computer science. The group also asks to what extent classical questions in topology and geometry can be answered in a mechanical way, i.e. by a computer program.

Current Projects

- Continuous deformation of one function into another
- Higher-dimensional generalizations of graph planarity

CAREER

since 2013	Assistant Professor, IST Austria
2012–2013	SNSF Research Assistant Professor, Institut de Mathématiques de Géométrie et Applications, EPFL Lausanne, Lausanne, Switzerland
2008–2012	Senior Research Associate, Institute of Theoretical Computer Science, ETH Zurich, Zurich, Switzerland
2006–2008	Postdoctoral Researcher, Institute of Theoretical Computer Science, ETH Zurich, Zurich, Switzerland
2004–2006	Postdoctoral Fellow, Einstein Institute for Mathematics, The Hebrew University of Jerusalem, Jerusalem, Israel
2004–2004	Postdoctoral Fellow, Department for Applied Mathematics, Univerzita Karlova, Prague, Czech Republic
2003–2003	Postdoctoral Fellow, Mathematical Sciences Research Institute, Berkeley, USA
2000–2004	PhD in Mathematics, ETH Zurich, Zurich, Switzerland

SELECTED DISTINCTIONS

2012	Research Assistant Professorship Grant of Swiss National Science Foundation (SNSF)
2012	Co-winner of Best Paper Award at Symposium of Discrete Algorithms (SODA)
2004	Richard Rado Prize

SELECTED PUBLICATIONS

- Čadek M, Krčál M, Matoušek J, Sergeraert F, Vokřínek L, Wagner U. 2012. Computing all maps into a sphere. Proc. 23rd Ann. ACM-SIAM Symp. on Discrete Algorithms (SODA), 1–10.
- Wagner U. 2011. Minors in Random and Expanding Hypergraphs. Proc. 27th Ann. ACM Symp. on Comput. Geom. (SoCG), 351–360.
- Matoušek M, Tancer M, Wagner U. 2011. Hardness of embedding simplicial complexes in Rd. J. Eur. Math. Soc. 13(2), 2011, 259–295.

TEAM

Marek Krcal (Postdoc), Isaac Mabillard (PhD student), Martin Tancer (Postdoc)

Computer Graphics

Chris Wojtan

Deceptively realistic virtual worlds, animated movies and computer games are highly popular. Complex calculations and models operate in the background to achieve these accurate simulations. The Wojtan group uses numerical techniques to provide the basis for complex animations and graphics.

The realistic simulation of complex processes in the physical world is the focus of research in the Wojtan group. Using numerical techniques, they create computer simulations of physical phenomena such as fluids, deformable bodies or cloth. Such accurate representations are required not only for computer animation, but also for medical simulations, computational physics and digital modeling. In their work, the Wojtan group combines mathematical methods from computational physics with geometric techniques from computer graphics. A key contribution of the Wojtan group is the efficient treatment of topological changes with deforming meshes that split and merge, in order to simulate highly detailed surface tension phenomena, such as the formation of water droplets and splashes. This method is used for the realistic animation of flowing and splashing water. The latest research of the group couples high-resolution embedded surface geometry to low-resolution simulations, to simulate detailed animations of elastic, plastic, and fluid phenomena.

Current Projects

- Simulating fractured materials to create highly detailed surfaces
- Generating temporally coherent deforming surfaces with changing topology from space-time data
- Efficient simulation of fluid dynamics

CAREER

since 2011	Assistant Professor, IST Austria
2010	PhD, Georgia Institute of Technology, Atlanta, USA

SELECTED DISTINCTIONS

2013	Microsoft Visual Computing Award
2011	Georgia Institute of Technology Sigma Chi Best PhD Thesis Award
2010	Outstanding Graduate Research Assistant Award (Georgia Institute of Technology)
2005	National Science Foundation Graduate Research Fellowship
2004	Presidential Fellowship
2003	James Scholarship

SELECTED PUBLICATIONS

- Ando R, Thürey N, Wojtan C. 2013. Highly adaptive liquid simulations on tetrahedral meshes. ACM Transactions on Graphics 32(4) (Proceedings of SIGGRAPH 2013), Article 10.
- Bernstein G, Wojtan C. 2013. Putting holes in holey geometry: topology change for arbitrary surfaces. ACM Transactions on Graphics 32(4) (Proceedings of SIGGRAPH 2013), Article 34.
- Bojsen-Hansen M, Li H, Wojtan C. 2012. Tracking Surfaces with Evolving Topology. ACM Transactions on Graphics 31(4) (Proceedings of SIGGRAPH 2012), Article 53.

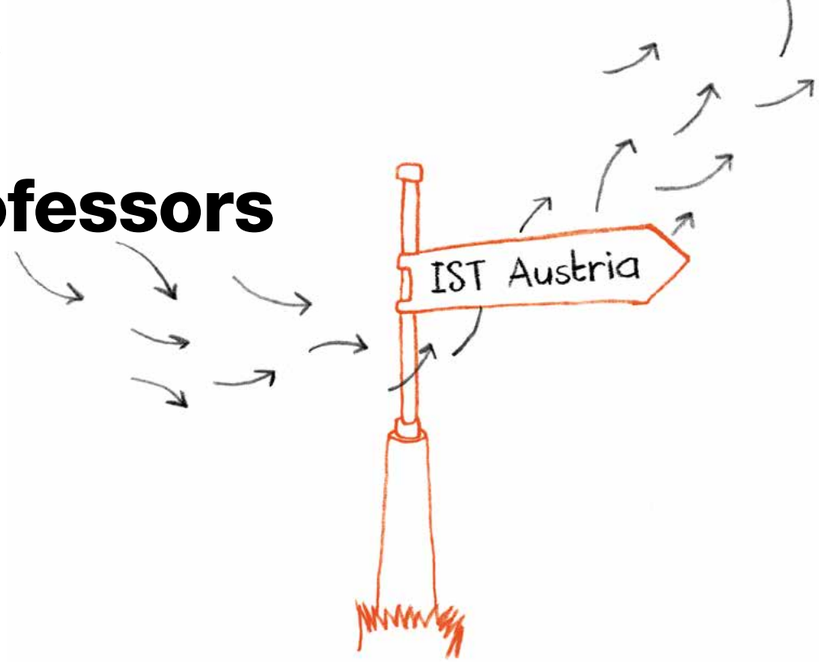
TEAM

Ryoichi Ando (Visiting Scientist), Morten Bojsen-Hansen (PhD Student), David Hahn (PhD student), Stefan Jeschke (Postdoc), Karthik Raveendran (PhD student, co-advised with Prof. Greg Turk at Georgia Institute of Technology)

Simulation of highly detailed surface tension phenomena such as the formation of water droplets using mesh-based surface tracking.

Starting in 2014 and 2015

New Professors



Mikhail Lemeshko

studies complex physics phenomena using controllable quantum systems. Lemeshko studied Physics at the Southern Federal University in Rostov-on-Don, Russia. He obtained his PhD in 2011, having worked in the group of Bretislav Friedrich in the Department of Molecular Physics at the Fritz Haber Institute of the Max Planck Society in Berlin. In his doctoral research, Lemeshko focused on the manipulation of molecules and their interactions with external fields, with one of the main results being the development of a new model for molecular scattering. Since 2011, Lemeshko has been an independent postdoctoral fellow at the Institute for Theoretical Atomic, Molecular, and Optical Physics at Harvard University. He is interested in using tools of atomic physics to answer questions arising in condensed matter physics and far-from-equilibrium behavior of open quantum systems. Mikhail Lemeshko joins IST Austria as Assistant Professor in 2014.

Gaia Novarino

investigates the genetic and molecular basis of epilepsy and cognitive disorders. Novarino studied Molecular Biology and received her PhD in Cell Biology in 2006 at Sapienza University in Rome, Italy, having performed her predoctoral studies at "La Sapienza", at the Vanderbilt University Medical Center in Nashville, Tennessee and at the Center for Molecular Neurobiology in Hamburg. Novarino spent four years as postdoctoral fellow at the Max-Delbrück Center for Molecular Medicine in Berlin before moving to the laboratory of Joseph Gleeson at University of California San Diego in November 2010. A core interest of Novarino's research are the molecular functions of genes underlying epilepsy, autism and intellectual disability in humans. This research program is based on the combination of the new generation of DNA sequencing techniques with cell and molecular biology and animal modeling. Gaia Novarino joins IST Austria as Assistant Professor in 2014.

Bernd Bickel

is interested in computer graphics and its applications in animation, biomechanics, material science and computational design for digital fabrication. Bickel studied Computer Science at ETH Zurich, where he also received his PhD in 2010, having performed research in the Computer Graphics Laboratory under the supervision of Markus Gross. Following his PhD, Bickel joined Disney Research Zurich as Postdoc, and was appointed as Visiting Professor at TU Berlin from 2011 to 2012. Since 2012, Bickel is a researcher and research group leader at Disney Research Zurich. Bickel's recent work includes next generation 3D surface scanner devices, performance capture, measuring and modeling the deformation behavior of soft tissue, animation tools, and computational synthesis for 3D printing. Bernd Bickel will join IST Austria as Assistant Professor in 2015.

Grants & Prizes

Awards, prizes, grants and other honors are an important mark of recognition and also a metric for measuring scientific excellence. The scientists of IST Austria regularly receive such distinctions at both the international and national level, as the examples below show.

International awards

In 2013, evolutionary biologist Nick Barton received the Mendel Medal by the German National Academy of Sciences Leopoldina. With this distinction, the Leopoldina honors pioneering achievements in the fields of general or molecular biology or genetics. Nick Barton is one of the world's leading scientists in the field of evolutionary population genetics. His work is regarded as a significant contribution to the further development of Charles Darwin's 150 year-old insights into evolutionary mechanisms. Barton's research significantly furthers the understanding of how species adapt and split into new species. In November, Thomas Henzinger was named a Fellow of the American Association for the Advancement of Science (AAAS) for contributions to formal verification and hybrid systems. Election as an AAAS Fellow is an honor bestowed upon AAAS members by their peers, and Henzinger is only the seventh Austrian scientist to receive this distinction. Sylvia Cremer received this year's Walther Arndt Award of the German Zoological Society for her research on the social immune system of ants.

International grants

The most prestigious grants for basic research on the European level are awarded by the European Research Council (ERC). Established in 2007 by the European Union, the ERC is the first pan-European funding organization for frontier research. It aims to stimulate scientific excellence in Europe by encouraging competition for funding between the very best researchers of any nationality. In 2013, two faculty members of IST Austria received ERC grants. The mathematician Laszlo Erdős received an ERC Advanced Investigator Grant, while the computer scientist Vladimir Kolmogorov received an ERC Consolidator Grant, bringing the total number of ERC grantees among the IST Austria faculty to 14. Erdős obtained the grant for his work on the mathematics of disordered quantum systems and matrices. In the ERC-funded project, he will tackle the universality of random matrix theory. Kolmogorov received the ERC grant for his project on "Discrete Optimization in Computer Vision", which will allow him to focus on so-called MAP estimation algorithms. These algorithms have revolutionized the field of computer vision in the past decade and are now commonly used also in commercial products.

The Human Frontier Science Program (HFSP), a global funding agency, competitively selects cutting-edge, risky projects that are pursued by international, interdisciplinary teams. In 2013, a prestigious HFSP grant was awarded to an international team that includes IST Austria professor Tobias Bollenbach and performs research on the limits of cell growth. This brings the total number of HFSP projects at IST Austria to five.

National awards

The scientists of IST Austria were also honored through national awards and prizes. For his exceptional contributions in the field of evolutionary population genetics, Nick Barton also received this year's Erwin Schrödinger Prize of the Austrian Academy of Sciences. The Erwin Schrödinger Prize is awarded each year to a scientist working in Austria with outstanding scientific achievements. Also the postdocs and students of IST Austria received several prizes recognizing their research. One such prize went to mathematician Hildegard Uecker, postdoc in the group of Nick Barton, who received the L'Oréal Austria „For Women in Science" fellowship for early-stage researchers. The award is aimed at excellent young female scientists and will support Uecker's research on the circumstances under which a population endangered with extinction can ensure its continued survival by genetic adaption to the new environment.
Other early-stage researchers who received recognition this year include Mateusz Sikora, who received an EMBO long-term fellowship to support his postdoctoral studies in the group of Carl-Philipp Heisenberg, and Martin Behrndt, also of the Heisenberg group, who received the Hansgeorg Schindler Young Investigator Award by Biophysics Austria.

Research grants and awards (selection)

- ERC Advanced Grantees - Nick Barton, Laszlo Erdős, Thomas Henzinger, Peter Jonas
- ERC Starting and Consolidator Grantees - Eva Benková, Krishnendu Chatterjee, Sylvia Cremer, Jozsef Csicsvari, Jiří Friml, Björn Hof, Vladimir Kolmogorov, Christoph Lampert, Krzysztof Pietrzak, Michael Sixt
- Mega Grant by the Russian Government – Herbert Edelsbrunner
- HFSP Grants – Tobias Bollenbach, Călin Guet, Harald Janovjak, Michael Sixt, Gašper Tkačik
- Microsoft Research Faculty Fellowship – Krishnendu Chatterjee
- Wittgenstein Award – Thomas Henzinger
- Mendel Medal – Nick Barton
- Erwin Schrödinger Prize – Nick Barton
- START Award – Michael Sixt
- Ignaz L. Lieben Prize – Michael Sixt

Peer-reviewed research grants acquired or active in 2013

Barton group
- „For Women in Science“, ÖAW L'Oréal, €20'000, 10/2013-05/2014
- Limits to selection in biology and in evolutionary computation, ERC Advanced Grant, €1'975'000, 7/2010-6/2015
- Mating system and the evolutionary dynamics of hybrid zones, FWF Lise Meitner, €133'000, 11/2012-10/2014
- Speed of Adaptation in Population Genetics and Evolutionary Computation, FP7-Cooperation, €585'000, 01/2014-12/2016

Benková group
- HCPO, ERC Starting Grant, €87'000, 04/2013-03/2014

Bollenbach group
- ÖAW APART, €225'000, 05/2012-04/2015
- Optimality principles in responses to antibiotics, MC-CIG Career Integration Grant, €100'000, 02/2013-01/2017
- Revealing the fundamental limits of cell growth, HFSP Program Grant, €256'000, 09/2013-08/2016

Chatterjee group
- Microsoft Research Faculty Fellowship, Microsoft Research, $200'000, 04/2011-03/2013
- Modern Graph Algorithmic Techniques in Formal Verification, FWF, €212'000, 09/2011-08/2014
- Quantitative Graph Games: Theory and Applications, ERC Starting Grant, €1'163'000, 12/2011-11/2016
- Rigorous Systems Engineering, FWF NFN, €455'000, 03/2011-02-2015

Cremer group
- Coevolution between the invasive garden ant and its parasites. DFG German Research Foundation Priority Programme 'Host Parasite Coevolution', €160'000, 02/2010 - 01/2013
- Antnet, Junge Akademie Leopoldina & Berlin-Brandenburg Akademie der Wissenschaften, €12'500, 01/2012-12/2013
- Collective disease defence and pathogen detection abilities in ant societies: a chemo-neuro-immunological approach, MC-IEF Intra-European Fellowship, €180'000, 07/2008-06/2013
- Individual function and social role of oxytocin-like neuropeptides in ants, WWTF Life Sciences 2013 New Ventures Beyond Established Frontiers, Co_PI (PI: C. Gruber, Medical University Vienna) €155'000; 01/2014-12/2017
- Social Vaccines - Social Vaccination in Ant Colonies: from Individual Mechanisms to Society Effects, ERC Starting Grant, €1'300'000, 04/2010-03/2015

Csicsvari group
- Inter-and intracellular signalling in schizophrenia, MC-ITN Initial Training Networks, €240'000, 10/2013-09/2017
- Memory-related information processing in neuronal circuits of the hippocampus and entorhinal cortex, ERC Starting Grant, €1'441'000, 11/2011-10/2016

Edelsbrunner group
- Persistent Homology - Images, Data and Maps, MC-IEF Intra-European Fellowship, €250'000, 04/2014-03/2016
- Topological Complex Systems, FP7-Cooperation, €498'000, 10/2012-09/2015
- Discrete and Computational Geometry, Mega grant from the Russian government, € 3'700'00, 10/2011-12/2013
- Applied and Computational Algebraic Topology, ESF Research Network, € 320'000

Erdős group
- Random matrices, universality and disordered quantum systems, ERC Advanced Grant, €1'755'000, 03/2014-02/2019

Friml group
- PSDP, ERC Starting Grant, €1'269'000, 04/2013-01/2017
- NÖ Technologieförderung, €60'000, 01/2014-12/2014

Guet group
- The Systems Biology of Transcriptional Read-Through in Bacteria: from Synthetic Networks to Genomic Studies, MC-IEF Intra-European Fellowship, €187'000, 03/2014-02/2016
- Multi-Level Conflicts in Evolutionary Dynamics of Restriction-Modification Systems, HFSP Young Investigators' Grant, €262'000, 11/2011-10/2014
- Internship, FFG FEMTech, €10'600, 01/2013-07/2013
- SNF Fellowship, €54'000, 10/2013-03/2015

Heisenberg group
- Cell- and Tissue Mechanics in Zebrafish Germ Layer Formation, FWF Herta Firnberg, €212'000, 02/2012-01/2015
- Cell Cortex and Germ Layer Formation in Zebrafish Gastrulation, FWF DACH DFG, €280'000, 10/2011-09/2014
- Control of Epithelial Cell Layer Spreading in Zebrafish, FWF DACH DFG, €344'000, 05/2012-04/2015
- DFG Forschungsstipendium, €27'000, 12/2013-11/2014
- DFG Forschungsstipendium, €54'000, 12/2011-11/2013
- EMBO Fellowship, EMBO LTF, €70'400, 07/2013-06/2015
- Japan PostDoc Stipendium, JSPS Postdoctoral Fellowships for Research Abroad, €103'000, 10/2012-09/2014

Henzinger group
- Quantitative Reactive Modelling, ERC Advanced Grant, €2'326'000, 05/2011-04/2016
- Rigorous Systems Engineering, FWF NFN, €455'000, 03/2011-02-2015

Hippenmeyer group
- MOMECODE, MC-CIG Career Integration Grant, €100'000, 09/2013-08/2017

Hof group
- Decoding the complexity of turbulence at its origin, ERC Starting Grant, €1'397'000, 06/2013-12/2017
- Promotionsstipendium der Max-Planck-Gesellschaft, €12'000, 09/2013-05/2014
- DFG SFB, €52'000, 06/2013-04/2014
- Georg August Universität Göttingen Stiftung, 09/2013-04/2014
- Max Planck Institut, €34'000, 02/2013-05/2014
- DFG FOR, €273'000, 12/2013-11/2016

Janovjak group
- In situ real-time imaging of neurotransmitter signaling using designer optical sensors, HFSP Young Investigators' Grant, €264'000, 08/2012-07/2015
- Internship, FFG FEMTech, €8'900, 01/2013-06/2013
- Microbial Ion Channels for Synthetic Neurobiology, MC-CIG Career Integration Grant, €100'000, 03/2012- 02/2016

Jonas group
- Mechanisms of transmitter release at GABAergic synapses, FWF, €491'000, 10/2012-09/2015
- Nanophysiology of fast-spiking, parvalbumin-expressing GABAergic interneurons, ERC Advanced Grant, €2'500'000, 06/2011-5/2016
- NIH Grant award for the 2014 Synaptic Transmission GRC/GRS, $25'000

Kolmogorov group
- DOiCV : Discrete Optimization in Computer Vision: Theory and Practice, ERC Starting Grant, 1'642'000, 06/2014-05/2019

Lampert group
- Lifelong Learning of Visual Scene Understanding, ERC Starting Grant, €1'465'000, 01/2013-12/2017

Pietrzak group
- Provable Security for Physical Cryptography, ERC Starting Grant, €1'005'000, 09/2011-10/2015

Siekhaus group
- Breaking barriers: Investigating the junctional and mechanobiological changes underlying the ability of Drosophila immune cells to invade an epithelium, MC-IIF International Incoming Fellowship, €180'000, 03/2013-02/2015
- Investigating the role of transporters in invasive migration through junctions, MC-CIG Career Integration Grant, €100'000, 04/2013-03/2017

Sixt group
- Role of the WAVE-complex in the haematopoietic system, DFG SPP, €150'000, 11/2010-10/2013
- Modeling of Polarization and Motility of Leukocytes in Three-Dimensional Environments, WWTF LS 2013 Step 2, €196'000
- Einfluss der Chemokinpräsentation auf das Reaktionsmuster von Leukozyten, DFG SPP, €220'000, 01/2011-01/2013
- Cytoskeletal force generation and force transduction of migrating leukocytes, FWF START, €200'000, 08/2011-07/2017
- Stromal Cell-immune Cell Interactions in Health and Disease, MC–ITN Initial Training Networks, €248'000, 01/2012-12/2015
- Cell migration in complex environments: from in vivo experiments to theoretical models, HFSP Program Grant, €254'000, 11/2011-10/2014
- LeukocyteForces : "Cytoskeletal force generation and force transduction of migrating leukocytes", ERC Starting Grant, €1'460'000, 04/2012-03/2017
- Juselius Foundation Fellowship, €60'000, 11/2012-10/2013
- Böhringer Ingelheim Fonds Fellowship, €46'000, 10/2012-09/2014
- Juselius Foundation Fellowship, €60'000, 11/2013-10/2014
- DFG SBH, €188'000, 11/2013-10/2016

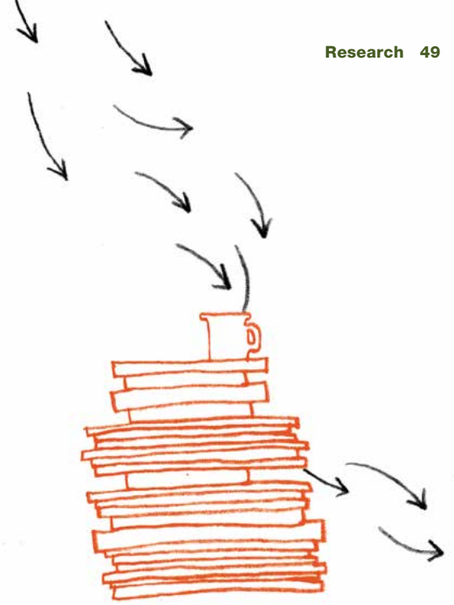
Tkačik group
- Information processing and computation in fish groups, HFSP Program Grant, €264'000, 10/2012-09/2015
- Sensitivity to higher-order statistics in natural scenes, FWF, €351'000, 09/2013-08/2016

Wagner group
- Förderprofessur, SNF, €174'000, 03/2013-06/2016

Wojtan group
- Deep Pictures: Creating Visual and Haptic Vector Images, FWF, €342'000, 08/2012-07/2015
- Chinese Scholarship Council Student Grant, €12'000, 09/2012-08/2013

Publications 2013

Ideas flowing from IST Austria



Publications by IST Austria members published or accepted in 2013 (joint publications involving several groups are listed multiple times)

Barton group
- Aeschbacher S, Futschik A, Beaumont MA. Approximate Bayesian computation for modular inference problems with many parameters: the example of migration rates. Molecular Ecology 22,987-1002.
- Barton NH, Etheridge AM, Kelleher J, Véber A. Genetic hitchhiking in spatially extended populations. Theoretical Population Biology 87,75-89.
- Barton NH, Etheridge AM, Kelleher J, Véber A. Inference in two dimensions: Allele frequencies versus lengths of shared sequence blocks. Theoretical Population Biology 87,105-119.
- Barton NH, Etheridge AM, Véber A. Modelling evolution in a spatial continuum. Journal of Statistical Physics 2013, P01002.
- Barton NH, Paixão T. Can quantitative and population genetics help us understand evolutionary computation? GECCO: Genetic and evolutionary computation conference 2013, 1573-1580.
- Barton NH. Does hybridisation influence speciation? Journal of Evolutionary Biology 26,267-269.
- Barton NH. Recombination and sex. In: The Princeton Guide to Evolution. Princeton University Press; 2013.
- Field DL, Pickup M, Barrett SCH. Comparative analyses of sex-ratio variation in dioecious flowering plants. Evolution 67, 661–672.
- Field DL, Pickup M, Barrett SCH. Ecological context and metapopulation dynamics affect sex-ratio variation among dioecious plant populations. Annals of Botany 111, 917–923.
- Hearn J, Stone GN, Bunnefeld L, Nicholls J, Barton NH, Lohse K. Likelihood-based inference of population history from low coverage de novo genome assemblies. Molecular Ecology, DOI: 10.1111/mec.12578 .
- Kelleher J, Barton NH, Etheridge AM. Coalescent simulation in continuous space. Bioinformatics 29,955-956.
- Long H, Paixão T, Azevedo RBR, Zufall R A. Accumulation of spontaneous mutations in the ciliate Tetrahymena thermophila. Genetics 195, 527-540.
- Novak S, Chatterjee K, Nowak MA. Density Games. Journal of Theoretical Biology 334, 26-34.
- Paixão T, Barton NH. A variance decomposition approach to the analysis of genetic algorithms. GECCO: Genetic and evolutionary computation conference. 2013, 845-852.
- Phadke SS, Paixão T, Pham T, Pham S, Zufall RA. Genetic background alters dominance relationships between mat alleles in the ciliate Tetrahymena thermophile. Journal of Heredity 105, 130-135 .
- Pickup M, Barrett SCH. The influence of demography and local mating environment on sex ratios in a wind-pollinated dioecious plant. Ecology and Evolution 3,629-639.
- Pickup M, Field DL, Rowell DM, Young AG. The importance of source population for heterosis in fragmented plant populations. Proceedings of the Royal Society B. 5, 913–924.
- Pickup M, Wilson S, Freudenberger D, Nicholls N, Gould L, Hnatiuk S, Delandre J. Post-fire recovery of revegetated woodland communities in south-eastern Australia. Australian Ecology 38,300-312.
- Vladar HP. The game of active search for extra terrestrial intelligence Breaking the Great Silence . International Journal of Astrobiology 12,53-62.

Benková group
- Cazzonelli CI, Vanstraelen M, Simon S, Yin K, Carron-Arthur A, Nisar N, Tarle G, Cuttriss AJ, Searle IR, Benková E, Mathesius U, Masle J, Friml J, Pogson BJ. Role of the Arabidopsis PIN6 auxin transporter in auxin homeostasis and auxin-mediated development. PLoS One 8:e70069.
- Cires E, Baltisberger M, Cuesta Moliner C, Vargas P, Prieto JAF. Allopolyploid origin of the Balkan endemic Ranunculus wettsteinii (Ranunculaceae) inferred from nuclear and plastid DNA sequences. Organisms Diversity and Evolution. 2013 DOI:10.1007/s13127-013-0150-6.
- Galbiati F, Sihna Roy D, Simonini S, Cucinotta M, Ceccato L, Cuesta C, Simaskova M, Benková E, Kamiuchi Y, Aida M, Weijers D, Simon R, Masiero S, Colombo L. An integrative model of the control of ovule primordia formation. Plant Journal 76, 446-455.
- Li H, Xu T, Lin D, Wen M, Xie M, Duclercq J, Bielach A, Kim J, Reddy GV, Zuo J, Benková E, Friml J, Guo H, Yang Z. Cytokinin signaling regulates pavement cell morphogenesis in Arabidopsis. Cell Research 23,290-299.
- Marhavý P, Vanstraelen M, De Rybel B, Zhaojun D, Bennett MJ, Beeckman T, Benková E. Auxin reflux between the endodermis and pericycle promotes lateral root initiation. EMBO Journal 32,149-158.
- O'Brien JA, Benková E. Cytokinin cross-talking during biotic and abiotic stress responses. Frontiers in Plant Science 4,451.
- Péret B, Middleton AM, French AP, Larrieu A, Bishopp A, Njo M, Wells DM, Porco S, Mellor N, Band LR, Casimiro I, Kleine-Vehn J, Vanneste S, Sairanen I, Mallet R, Sandberg G, Ljung K, Beeckman T, Benková E, Friml J, Kramer E, King JR, De Smet I, Pridmore T, Owen M, Bennett MJ. Sequential induction of auxin efflux and influx carriers regulates lateral root emergence. Molecular Systems Biology 9, 699.
- Rosquete MR, von Wangenheim D, Marhavý P, Barbez E, Stelzer EH, Benková E, Maizel A, Kleine-Vehn J. An auxin transport mechanism restricts positive orthogravitropism in lateral roots. Current Biology 23,817-822.
- Vandenbussche F, Callebert P, Zadnikova P, Benková E, Van Der Straeten D. Brassinosteroid control of shoot gravitropism interacts with ethylene and depends on auxin signaling components. American Journal of Botany 100,215-225.

Bollback group
- Kupczok A, Bollback JP. Probabilistic models for CRISPR spacer content evolution. BMC Evolutionary Biology 13, 54.
- Redondo RAF, Kupczok A, Stift G, Bollback JP. Complete genome sequence of the novel phage MG-B1 infecting bacillus weihenstephanensis. Genome Announcements 1, 0216-13.

Bollenbach group
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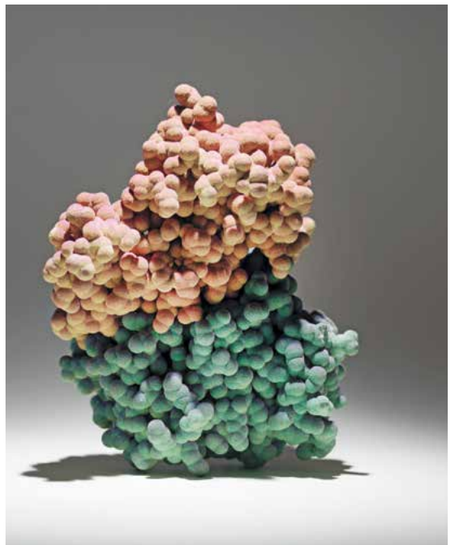

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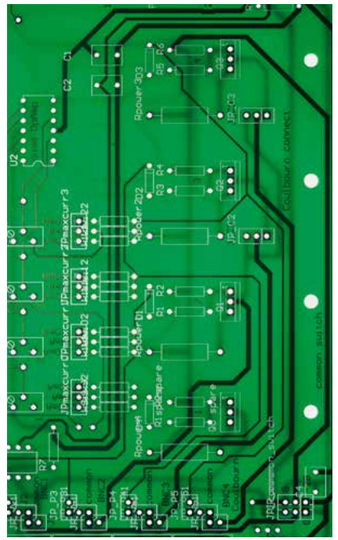
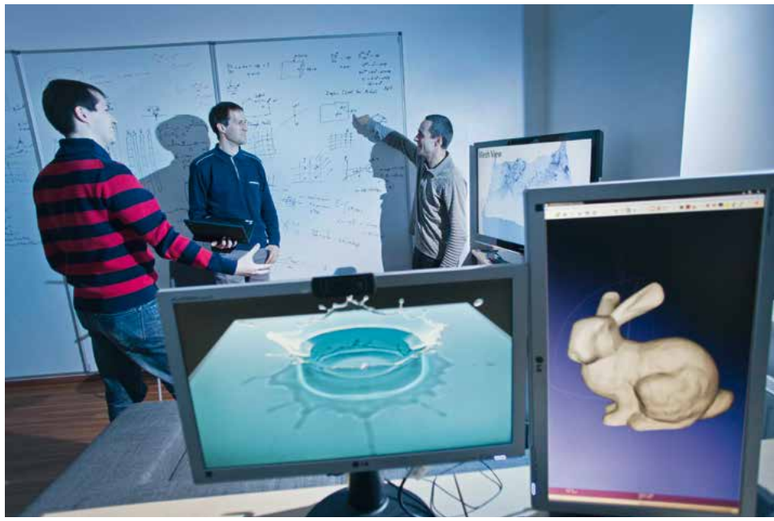
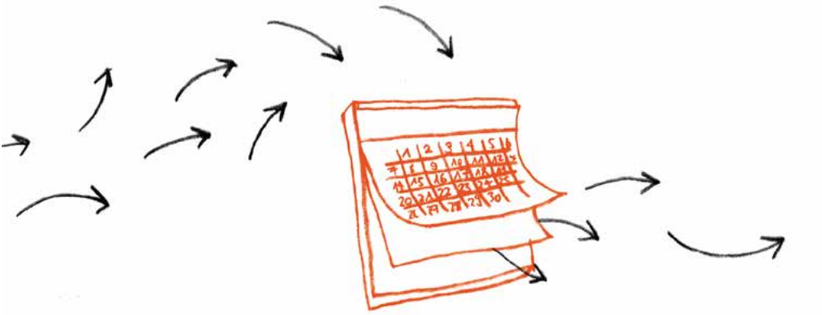
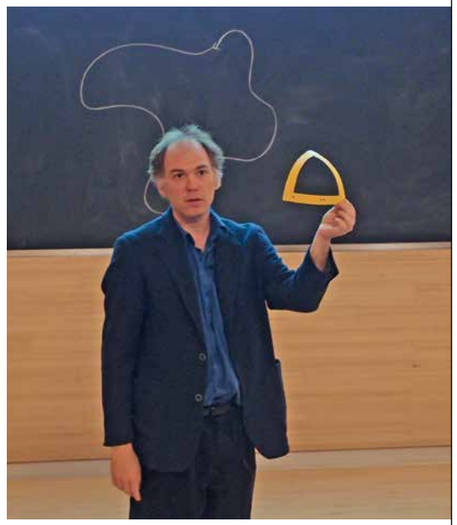




Scientific events





An integral part of scientific discovery and progress is sharing and discussing new findings. Scientific conferences, symposia, and seminars provide a platform for exchange. IST Austria is linked to the scientific community through a range of scientific events, from annual conferences to weekly seminars.

Conferences and symposia

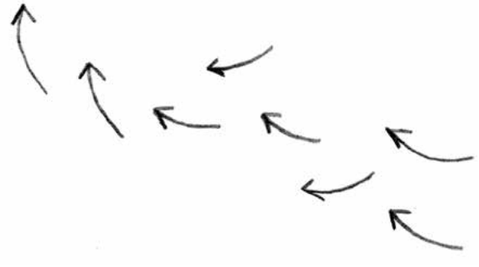
In August, IST Austria hosted the 38th International Symposium on Mathematical Foundations of Computer Science (MFCS). The series of MFCS symposia, organized in rotation by the Czech Republic, Poland, and Slovakia since 1972, has a long and well-established tradition. The five-day symposium at IST Austria was the first MFCS symposium to be held outside the three countries. For IST Austria, it was the largest scientific event held on its campus so far. Another large conference took place in September: The 11th International Conference on Computational Methods in Systems Biology (CMSB) brought together computer scientists, biologists, mathematicians, engineers, and physicists interested in a system-level understanding of biological processes. It covered theory, computation as well as applications of the modelling and analysis of biological systems. In addition, several one-day symposia were held at IST Austria to exchange ideas, with topics ranging from „Frontiers of Solid-State Research“ to „Quantum Information“. IST Austria was also host to scientific networking events, connecting researchers in the Vienna region and in Austria working on related topics, such as the Vienna Plant Network, the Neuroscience Vienna Network, and the Austrian Computer Science Day.

The IST Colloquium

An integral part of research activities are regular seminars on the latest developments in the scientific topics represented at the Institute. The IST Colloquium is IST Austria's principal seminar series, to which leading international scientists from all disciplines of the natural, mathematical, and computer sciences are invited to present their latest findings. IST Colloquia have a strong interdisciplinary outlook, as they are aimed at the entire scientific community of IST Austria. Scientists from Vienna and its vicinity are also invited. IST Colloquia are open to any interested person; a preview of speakers can be found on the IST Austria website (www.ist.ac.at) as well as in the Institute's quarterly newsletter.

ERC widening participation

In spring 2013, the European Research Council (ERC), in cooperation with IST Austria, invited ERC grantees from EU member states and candidate countries of Central and Eastern Europe to a „Widening Participation Event“ on the IST Austria campus. The two-day event brought together present and potential ERC applicants from this region with ERC grantees, the ERC Scientific Council and Executive Agency, and policy makers, to highlight scientific achievements, connect grantees and applicants, and discuss administrative issues.



Scientific Events in 2013 (selection)

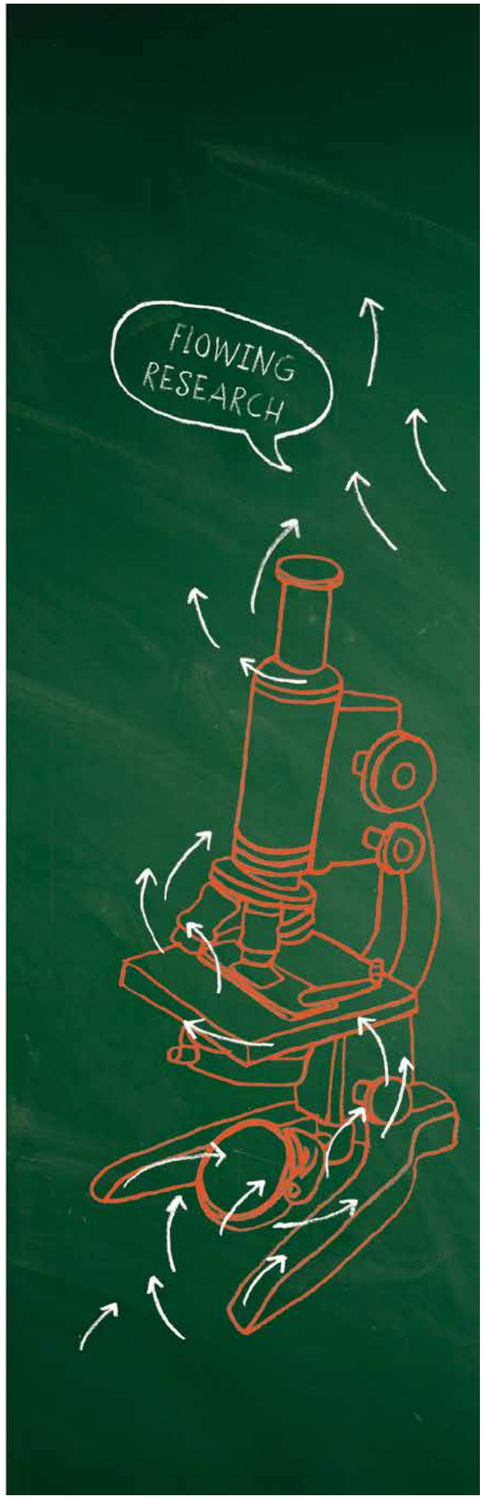
February 28 - March 1	Widening Participation – ERC event
March 7	Symposium: Quantum Information
April 10	Neuroscience Vienna Network Meeting
April 26	Young Scientist Symposium
May 3	Austrian Computer Science Day 2013
August 26-30	Mathematical Foundations of Computer Science
September 23-25	Computational Methods in Systems Biology
October 9	Vienna Plant Network Meeting
October 11	Symposium: Frontiers of Solid State Research

Speakers at IST Austria in 2013

Aleksejeva, Jekaterina (Vienna, Austria), **Ando, Yoichi** (Osaka, Japan), **Ando, Ryoichi** (Fukuoka, Japan), **Arber, Silvia** (Basel, Switzerland), **Aspuru-Guzik, Alán** (Cambridge, USA), **Bahler, Jurg** (London, UK), **Bajoghli, Baubak** (Heidelberg, Germany), **Barnes, Carol** (Tucson, USA), **Barrett, Spencer** (Toronto, Canada), **Barriere, Antoine** (Chicago, USA), **Barvinok, Alexander** (Ann Arbor, USA), **Bathellier, Brice** (Vienna, Austria), **Baubec, Tuncay** (Basel, Switzerland), **Bellare, Mihir** (San Diego, USA), **Ben-David, Shai** (Waterloo, Canada), **Benvenuti, Federica** (Trieste, Italy), **Bergthaler, Andreas** (Vienna, Austria), **Berulava, Tea** (Essen, Germany), **Bickel, Bernd** (Zurich, Switzerland), **Bierbaum, Veronika** (Potsdam, Germany), **Biere, Armin** (Linz, Austria), **Birbaumer, Niels** (Tübingen, Germany), **Bloch, Immanuel** (Garching, Germany), **Bock, Christoph** (Vienna, Austria), **Borile, Claudio** (Padua, Italy), **Bozic, Ivana** (Cambridge, USA), **Brandic, Ivona** (Vienna, Austria), **Bray, Dennis** (Cambridge, UK), **Brueckner, Katja** (San Francisco, USA), **Brugues, Jan** (Cambridge, USA), **Buehler, Katja** (Vienna, Austria), **Bühler Paschen, Silke** (Vienna, Austria), **Buss, Sam** (San Diego, USA), **Butz, Maximilian** (Munich, Germany), **Catoni, Olivier** (Paris, France), **Černý, Robert** (Prague, Czech Republic), **Chait, Brian** (New York, USA), **Chazelle, Bernard** (Princeton, USA), **Chen, Yulin** (Oxford, UK), **Chen, Alon** (Rehovot, Israel), **Cherian, Anoop V.** (Munich, Germany), **Christandl, Matthias** (Zurich, Switzerland), **Christandl, Matthias** (Zurich, Switzerland), **Coen, Enrico** (Norwich, UK), **Connor, Ed** (Baltimore, USA), **Coros, Stelian** (Zurich, Switzerland), **Crane, Keenan** (Pasadena, USA), **Damascelli, Andrea** (Vancouver, Canada), **de la Torre, Fernando** (Pittsburgh, USA), **DeGennaro, Matthew** (New York, USA), **del Àlamo, David** (Heidelberg, Germany), **Dragoi, George** (Cambridge, USA), **Draisma, Jan** (Eindhoven, Netherlands), **Eichenbaum, Howard** (Boston, USA), **Emery, Gregory** (Montreal, Canada), **Emonet, Thierry** (New Haven, USA), **Epstein, Leah** (Haifa, Israel), **Feinberg, Martin** (Columbus, USA), **Felser, Claudia** (Dresden, Germany), **Fenk, Lisa M.** (Vienna, Austria), **Fensel, Dieter** (Innsbruck, Austria), **Fenton, Flavio H.** (Ithaca, USA), **Ferrari, Vittorio** (Edinburgh, UK), **Ferri, Massimo** (Bologna, Italy), **Filipp, Stefan** (Zurich, Switzerland), **Fioravante, Diasynou** (Cambridge, USA), **Formentin, Marco** (Padua, Italy), **Friedrich, Gerhard** (Klagenfurt, Austria), **Fürst, Matthias A.** (London, UK), **Germain, Pierre** (New York, USA), **Ghashghaei, Troy** (Raleigh, USA), **Goodman-Strauss, Chaim** (Fayetteville, USA), **Goubault-Larrecq, Jean** (Cachan, France), **Goulielmakis, Eleftherios** (Garching, Germany), **Graystock, Peter** (Leeds, UK), **Gretton, Arthur** (London, UK), **Grohe, Martin** (Berlin, Germany), **Guillot, Charlene** (Marseille, France), **Hahn, Andreas** (Vienna, Austria), **Hainfellner, Johannes** (Vienna, Austria), **Hall, Barry** (Bellingham, USA), **Hatakeyama, Jun** (Kumamoto, Japan), **Havenith, Martina** (Bochum, Germany), **Inglés Prieto, Álvaro** (Granada, Spain), **Jain, Kavita** (Bangalore, India), **Jungwirth, Tomas** (Prague, Czech Republic), **Katsaros, Georgios** (Linz, Austria), **Kelemen, Eduard** (Tübingen, Germany), **Kent, Stephen** (Chicago, USA), **Kinney, Justin B.** (Cold Spring Harbor, USA), **Klumpp, Stefan** (Potsdam, Germany), **Kofler, Johannes** (Garching, Germany), **Kondorosi, Eva** (Szeged, Hungary), **Koroteev, Maxim** (Okinawa, Japan), **Koutsoupias, Elias** (Oxford, UK), **Kováčiková, Ines** (Bratislava, Slovakia), **Lagator, Mato** (Coventry, UK), **Lancaster, Madeline** (Vienna, Austria), **Lanzenberger, Rupert** (Vienna, Austria), **Lázár, Viktória** (Szeged, Hungary), **Lehmann, Ruth** (New York, USA), **Lemeshko, Mikhail** (Cambridge, USA), **Locke, James** (Cambridge, UK), **Loizou, Joanna** (Vienna, Austria), **Lygeros, John** (Zurich, Switzerland), **Maass, Wolfgang** (Graz, Austria), **Manfredini, Fabio** (State College, USA), **Marklof, Jens** (Bristol, UK), **Marlovits, Thomas** (Vienna, Austria), **Marx, Andreas** (Konstanz, Germany), **Matas, Jiri** (Prague, Czech Republic), **Matschke, Benjamin** (Bonn, Germany), **McVean, Gilean** (Oxford, UK), **Mehta, Amit** (Stanford, USA), **Mertz, Aaron F.** (New Haven, USA), **Meshulam, Roy** (Haifa, Israel), **Messer, Philipp** (Stanford, USA), **Milutinovic, Barbara** (Muenster, Germany), **Mitchell, Gabriel** (Atlanta, USA), **Möglich, Andreas** (Berlin, Germany), **Möller, Torsten** (Vienna, Austria), **Murray, Andrew** (Cambridge, USA), **Nokia, Miriam** (Jyväskylä, Finland), **Nowotny, Marcin** (Warsaw, Poland), **Nygaard, Rie** (Stanford, USA), **Palmer, Adam** (Cambridge, USA), **Pekker, David** (Pasadena, USA), **Penttonen, Markku** (Jyväskylä, Finland), **Pintz, Janos** (Szeged, Hungary), **Piterman, Nir** (Leicester, Uk), **Pohl, Walter** (Vienna, Austria), **Portugues, Ruben** (Cambridge, USA), **Rajamani, Sriram** (Karnataka, India), **Reichenbach, Tobias** (New York, USA), **Remy, Stefan** (Bonn, Germany), **Renkawitz, Jörg** (Martinsried, Germany), **Ridley, Anne** (London, UK), **Robinson, David** (Heidelberg, Germany), **Rosasco, Lorenzo** (Genoa, Italy/ Harvard, USA), **Rothman, James** (New Haven, USA), **Salazar-Ciudad, Isaac** (Barcelona, Spain), **Sanchez Ruiz, José Manuel** (Granada, Spain), **Sarikas, Srdjan** (Munich, Germany), **Sasai, Yoshiki** (Kobe, Japan), **Savin, Cristina** (Klosterneuburg, Austria), **Schneidman, Elad** (Rehovot, Israel), **Schölkopf, Bernhard** (Tübingen, Germany), **Schrödel, Tina** (Vienna, Austria), **Schultz, Daniel** (Cambridge, USA), **Schwing, Alexander** (Zurich, Switzerland), **Seitz, Alexander** (Vienna, Austria), **Shashidhara, LS** (Pune, India), **Shinohara, Yoshiaki** (Wako, Japan), **Shivashankar, G.V.** (Singapore), **Sigrist, Stephan** (Berlin, Germany), **Slovakova, Jana** (Alicante, Spain), **Smale, Steve** (Hong Kong), **Søgaard-Andersen, Lotto** (Marburg, Germany), **Sokolowski, Thomas** (Amsterdam, Netherlands), **Stainier, Didier** (San Francisco, USA), **Stam, Jos** (Toronto, Canada), **Steinerberger, Stefan** (Bonn, Germany), **Stepanek, Frantisek** (Prague, Czech Republic), **Stroeymeyt, Nathalie** (Lausanne, Switzerland), **Sturmfels, Bernd** (Berkeley, USA), **Szabadics, János** (Budapest, Hungary), **Székelyhidi, László** (Leipzig, Germany), **Taunton, Jack** (San Francisco, USA), **Tecumseh Fitch, William** (Vienna, Austria), **Theisen, Ulrike** (Coventry, UK), **Toprak, Erdal** (Istanbul, Turkey), **Treves, Alessandro** (Trieste, Italy), **Tsai, Tony Yu-Chen** (Stanford, USA), **Typas, Nassos** (Heidelberg, Germany), **van den Nest, Maarten** (Garching, Germany), **Vandenberghe, Lieven** (Los Angeles, USA), **Vida, Imre** (Berlin, Germany), **Vidick, Thomas** (Cambridge, USA), **Wang, Xiaoqun** (Beijing, China), **Wehner, Stephanie** (Singapore), **Weißmann, Steffen** (Berlin, Germany), **Wolf, Verena** (Saarbrücken, Germany), **Wrachtrup, Jörg** (Stuttgart, Germany), **Zagórski, Marcin** (Krakow, Poland), **Żebrowski, Piotr** (Warsaw, Poland), **Zeindler, Dirk** (Bielefeld, Germany)

Communicating science

In the communication flow



IST Lectures

In the IST Lecture series, eminent scientists are invited to IST Austria to present their research and address topics of interest to the scientifically interested general public. In 2013, two distinguished scientists gave public IST Lectures at IST Austria. On April 24, the American mathematician Stephen Smale presented his work on the three-dimensional structures of proteins. On October 10, the biologist Bruce Levin shared his insights into the adaptive immune system of bacteria and its evolutionary dynamics.

Science-Industry Talk

The Science-Industry Talk series is a joint initiative of IST Austria and the Federation of Austrian Industries (IV). This year's Science-Industry Talk on „Partners in Innovation: Synergies between Industry and Basic Research" offered a forum to discuss relations and exchanges between academia and industry with the aim of learning from the respective partners. The panel discussion included entrepreneur Horst Domdey, venture capitalist Hermann Hauser, TTTech founder Hermann Kopetz, and Assistant Managing Director of Microsoft Research India Sriram Rajamani.

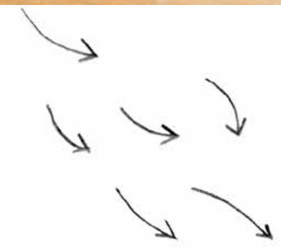
Open Campus

The IST Austria campus was open to the public at the annual Open Campus. The friends and neighbors of IST Austria and their families were invited to spend the day at IST Austria and explore the day-to-day life of a research institution. Many hands-on science stations, such as cryptography workshops and fluid explorations, gave the visitors the opportunity to experience research for themselves. The Open Campus was rounded off with the award ceremony for the 2013 School Science Competition run by IST Austria, this year on the topic of „Forces in Nature".

Science Slams

2013 marked a first for the participation of IST Austria scientists in Vienna Science Slams. Designed as a platform for researchers to talk about their work to a non-scientific public, the participants explain their research in simple terms in five minutes, with the audience judging who performed the best „slam". Tom Ellis, PhD student in Nick Barton's group, won the Vienna Science Slam on June 20 with an entertaining glimpse into his research on evolutionary dynamics using snapdragons. Leila el Masri, postdoc in the group of Sylvia Cremer, won the Science Slam held as part of the Vienna Science Festival on September 15, describing her work on ant immune systems.

IST Austria aims to increase the public awareness of basic research and actively seeks to reach out into the community. The Institute participates in many local and regional events, such as the Vienna Science Festival, and hosts many visits by different groups and constituencies.

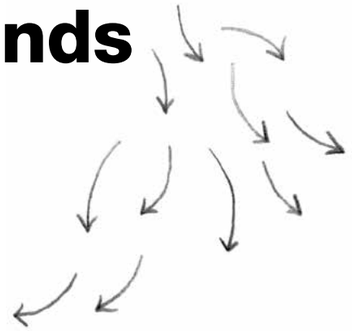


Public Events 2013

April 24	IST Lecture Stephen Smale
June 4	Science-Industry Talk
June 8	Open Campus
October 10	IST Lecture Bruce R. Levin

Cash flow

Diverse Funds



Public funding, peer-reviewed research grants, private donations and, in the future, income from technology transfer set up a broad basis for the success of IST Austria. Private donations provide an essential pillar of support and IST Austria is profoundly grateful to the individuals and companies that have so generously contributed to research at the Institute.

In 2013, a new donor, Steven Heinz, together with existing donor OMV AG, supported the establishment of a scholarship program for new PhD students. Six students, who at the start of their scientific career show special promise, were chosen to be named Heinz and OMV scholars and begun their doctoral studies at IST Austria's graduate school in September 2013. In June, IST Austria inaugurated the Miba Machine Shop, named to honor the generous support of IST Austria by the technology company Miba AG. The Miba Machine Shop is a mechanical and electronic workshop for building experimental set-ups for our scientists.

In the future, IST Austria intends to use income from intellectual property rights to build a fourth pillar of financial support. The Institute is committed to promote the use of scientific discoveries through licensing and technology transfer. A technology park is planned adjacent to the IST Austria campus and a dedicated Technology Transfer Office takes care of all matters related to intellectual property developed at IST Austria.

Donors

Platinum Club
Invicta Foundation

Gold Club
Mondi AG
OMV AG
Raiffeisen Group
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Silver Club
Berndorf AG
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Miba AG
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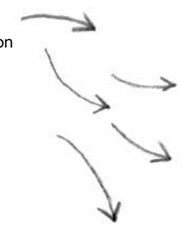

Boards of IST Austria

Angelika Amon

Catherine Cesarsky

Tony F. Heinz

Gisela Hopfmüller

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Claus J. Raidl

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- Ernst-Ludwig Winnacker, Secretary General, Human Frontiers Science Program, Strasbourg, France

Administration

Supporting flow

The hospitality support and the dual career service were expanded to ease the transition of researchers and their families to Austria.

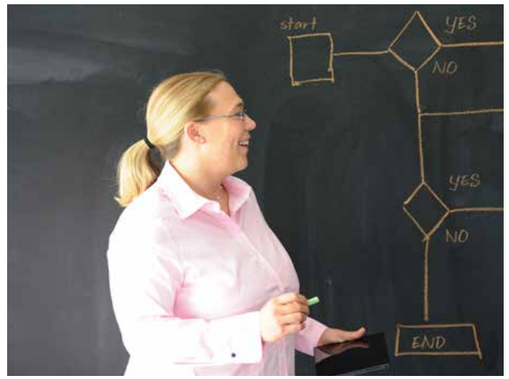
The ordering system ISTOS went live, providing researchers and administration with a **central procurement platform** for convenient ordering, easy tracking and processing.

A student life-cycle software was implemented to manage the dynamic requirements and growing number of students in the graduate school's PhD program.

„Excellent service for excellent science. The goal of IST Austria's administrative personnel is to provide excellent service to give scientists the ability to focus on their research. The growth of IST Austria also sets a challenge for the administration, which we are excited to take on. Several projects undertaken in 2013 to maintain top service standards in a growing research institute included a student life cycle software, expanded hospitality support, dual career service, and a new ordering platform. I thank all administrative employees for their excellent work and dedication in 2013." — Georg Schneider, Managing Director, IST Austria

Heads of administrative units
from left to right: Barbara Abraham (Grant Office), Beate Zöchmeister (Executive Office), Stefan Hipfinger (Construction and Maintenance), Manuela Raith (Finance), Laurenz Niel (Academic Affairs), Georg Schneider (Managing Director), Claudia Kernstock (Human Resources), Wolfgang Erdhart (Campus Services), Peter Jakubitz (Organization, Processes and Project Management).
Not pictured: Susanne Wertheimer-Wiegel (Environment, Health & Safety), Egenhard Link (Technology Transfer Office)

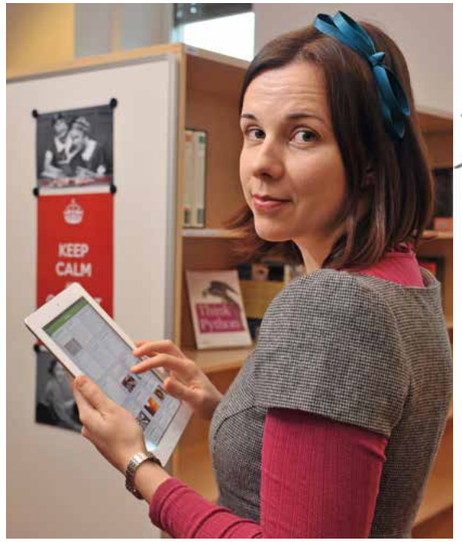
Construction and maintenance develops and maintains the growing campus.



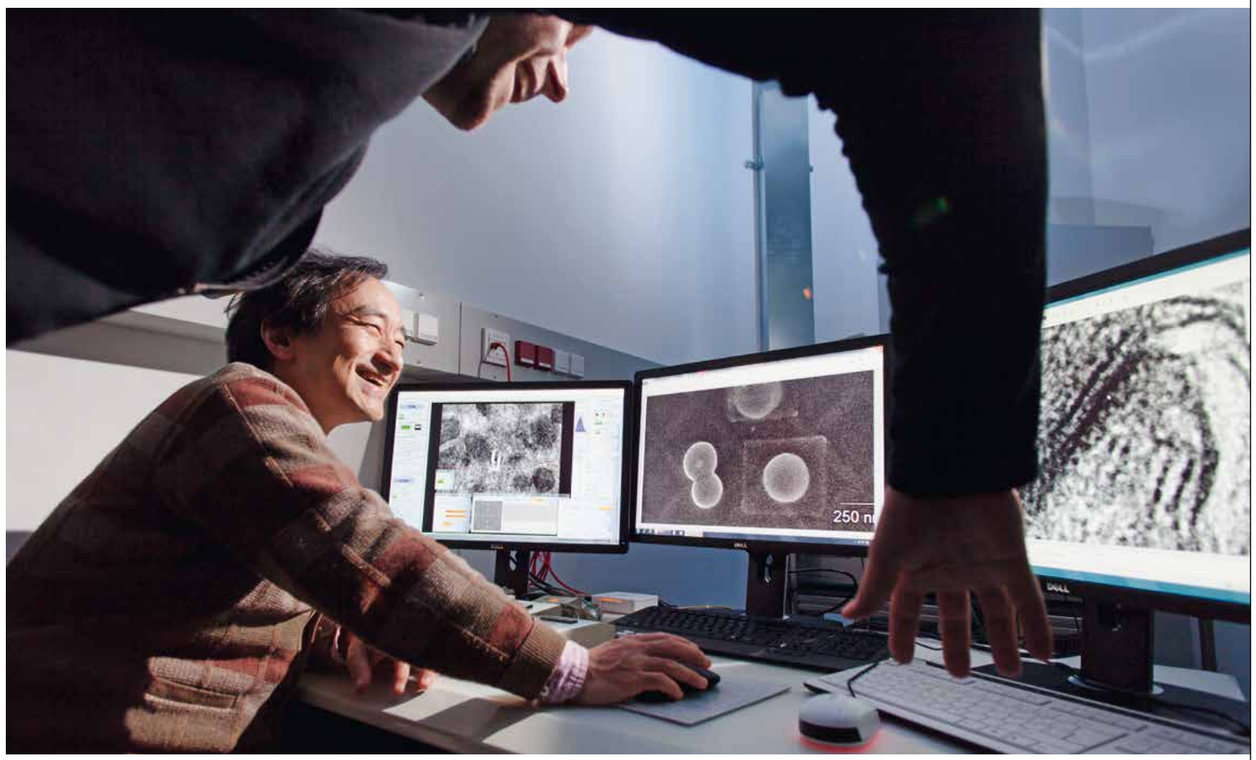
The newly established unit **Organization, Processes and Project Management** designs and improves important processes of management, and handles large internal development projects.

Scientific Service Units

A core for flow



This year, **the library** of IST Austria, designed predominantly as an electronic library, worked on archiving of data in digital repositories and on an Open Access support policy, to enable all scientists of IST Austria to publish open access.



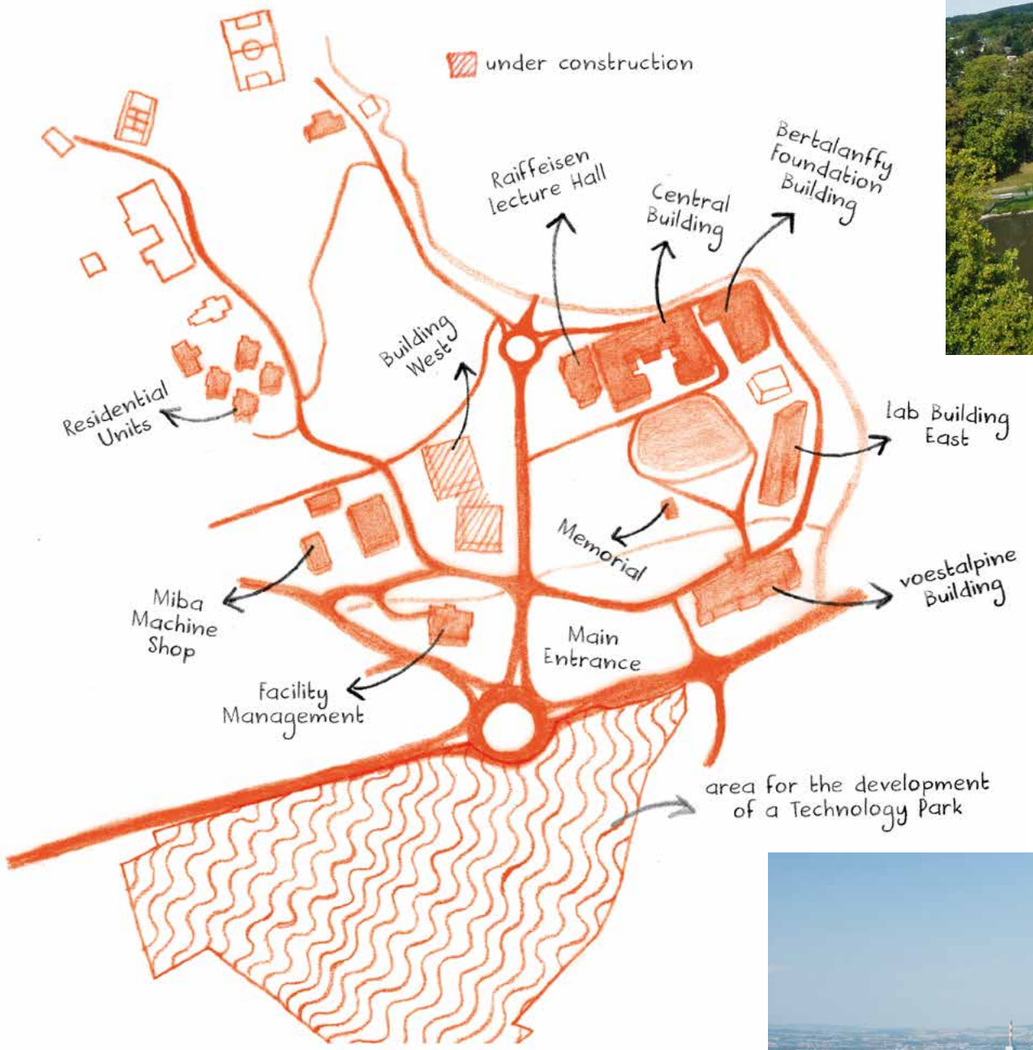
In 2013, **the Electron Microscopy facility** (EMF) was established to satisfy the need for ultra-structural analysis in the fields of neuroscience and cell biology. The EMF offers innovative state-of-the-art technologies, with one of the microscopes being the first of its kind in Europe. In addition, the expert personnel of the EMF support researchers with technically demanding procedures like sample preparation and image analysis.

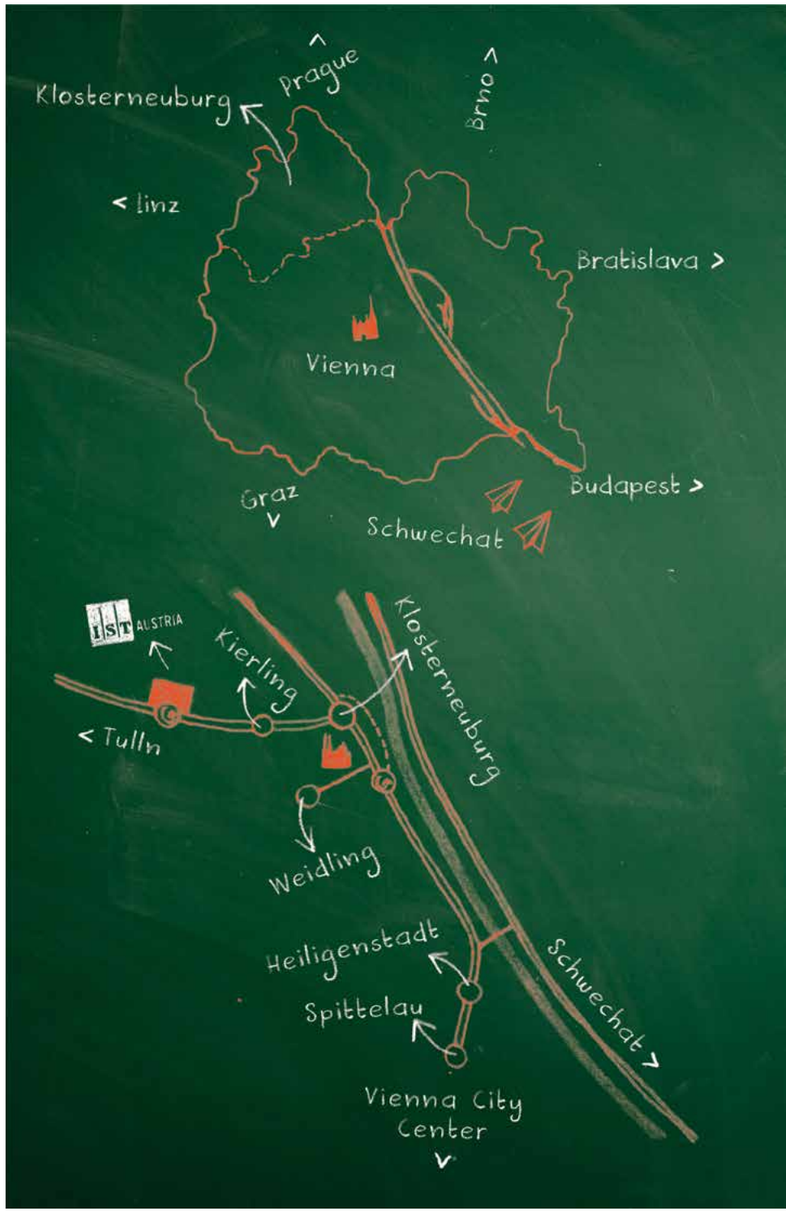
IST Austria is committed to the sharing of scientific resources among research groups wherever possible. To optimize cost efficiency and utilization, all shared resources are organized in central core facilities - Scientific Service Units (SSUs) – which support all scientists, students and staff of IST Austria by offering professional services, expertise and state-of-the-art equipment. The goal of the SSUs is to provide optimal conditions for cutting-edge research at an internationally competitive level. With the growth of IST Austria, the need for equipment and services provided by the SSUs is constantly expanding.

With the move of the first experimental physics group to IST Austria, **the Miba Machine Shop** as well as the Life Science facility widened their services to now also support physics experiments.

To further support the theoretical disciplines on campus a dedicated new cluster offers **computing capacity** and storage for complex calculations and simulations.

Location and Directions





IST Austria is located in the city of Klosterneuburg, a suburb of Vienna known for its high standard of living. The location of IST Austria's campus amidst the hills of the Vienna woods provides a tranquil and stimulating environment for scientific research. The city of Klosterneuburg offers educational, medical, cultural, and recreational facilities of the highest standard.

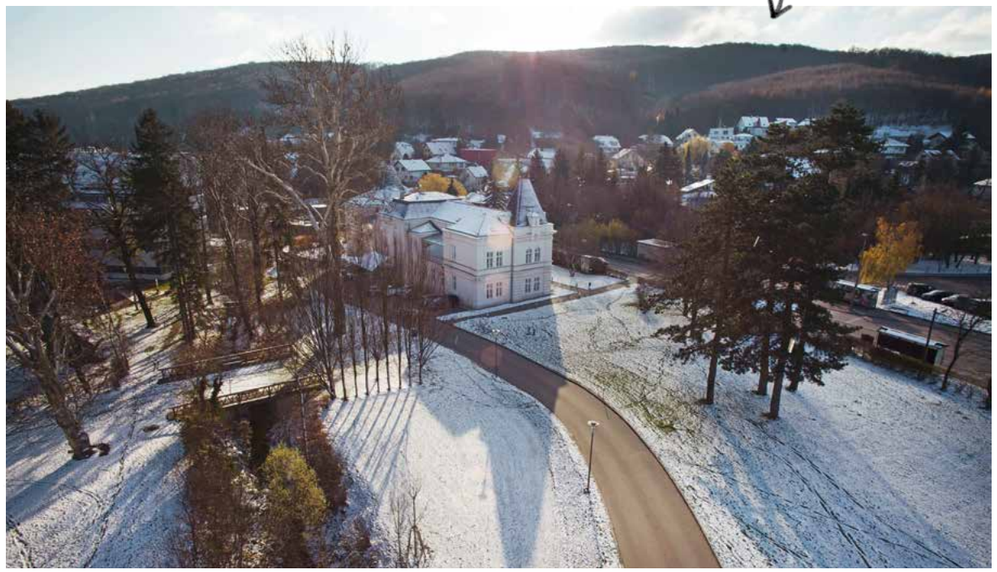
The historical center of Klosterneuburg is dominated by its medieval monastery, redesigned in the Baroque style as a residence for the Austrian emperor in the early 18th century. The Essl Museum, world-famous for its collection of contemporary art, is located close to the city center. Our immediate neighbor on campus is the internationally renowned Art Brut Center Gugging.

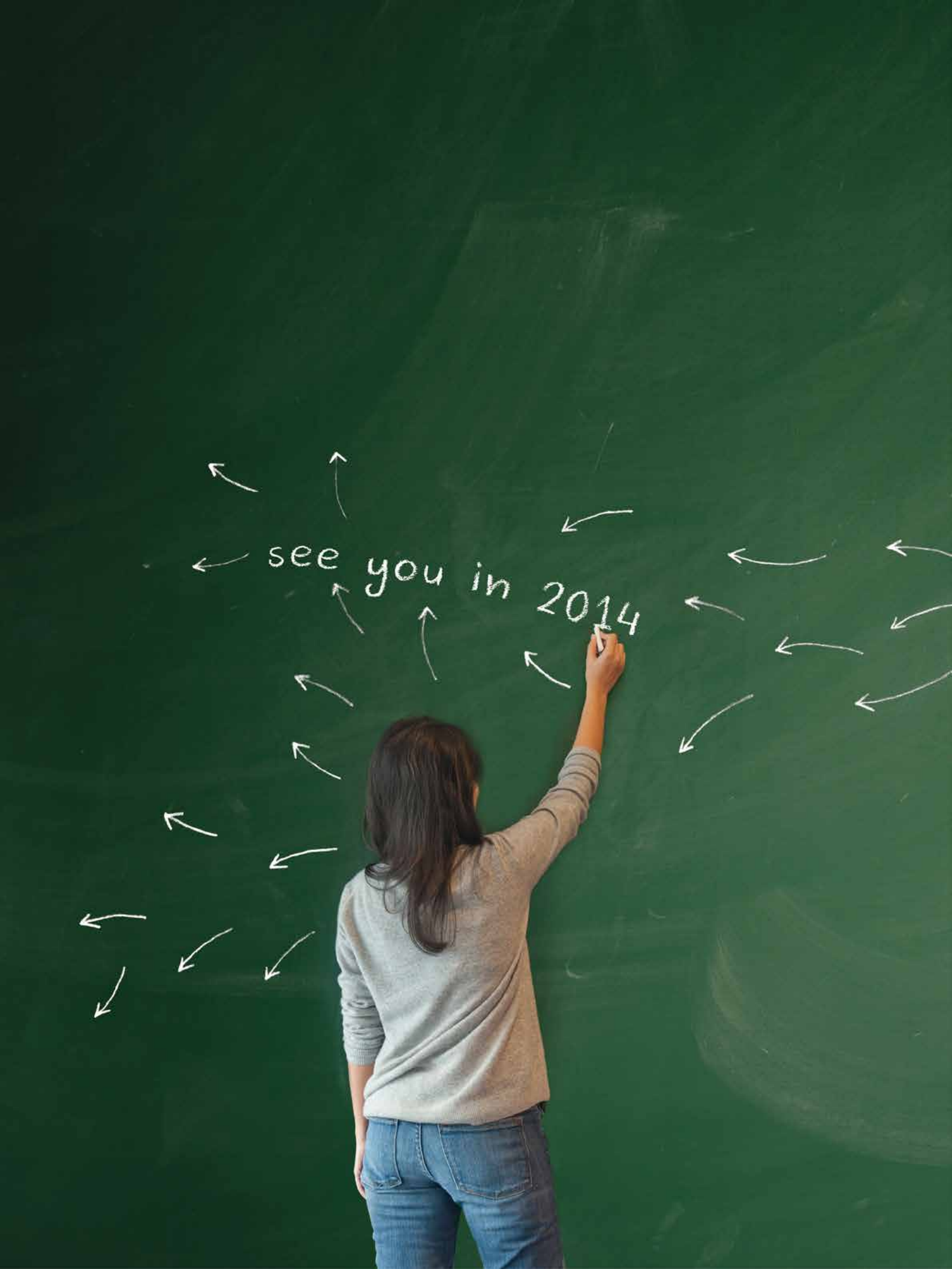
IST Austria can be reached easily by public and individual transportation, including the IST Austria shuttle bus 242 from the subway station Heiligenstadt in Vienna.

Winter impressions

Flowing progress

The campus of IST Austria is expanding to provide infrastructure for excellent research. Currently, the Raiffeisen Lecture Hall, Central Building, Bertalanffy Foundation Building, Lab Building East, voestalpine Building and Miba machine shop are in operation.




see you in 2014