IST AUSTRIA

Institute of Science and Technology

Annual Report **2010**

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2 Jonathan Bollback University of Edinburgh, UK
3 Tobias Bollenbach Harvard Medical School, Boston, USA
4 Krishnendu Chatterjee University of California, Santa Cruz, USA
5 Sylvia Cremer University of Regensburg, Germany
6 Jozsef Csicsvari University of Oxford, UK
7 Herbert Edelsbrunner Duke University, Durham, USA
8 Călin Guet Harvard University, Cambridge, USA
9 Carl-Philipp Heisenberg Max-Planck Institute, Dresden, Germany
10 Thomas Henzinger EPFL, Lausanne, Switzerland
11 Harald Janovjak LMU Munich, Germany
12 Peter Jonas University of Freiburg, Germany
13 Christoph Lampert Max-Planck Institute, Tübingen, Germany
14 Michael Sixt Max-Planck Institute, Martinsried, Germany
15 Gašper Tkačik University of Pennsylvania, Philadelphia, USA
16 Chris Wojtan Georgia Institute of Technology, Atlanta, USA

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18 Paul Bendich Duke University, Durham, USA
19 Pavol Cerný University of Pennsylvania, Philadelphia, USA
20 Chao Chen Rensselaer Polytechnic Institute, Troy, USA
21 Julien Compagnon Paris Diderot, France
22 Rodrigo Fernandes Redondo Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
22 Jian Gan University of Glasgow, UK
23 Jose Guzman University of Leipzig, Germany
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26 Simon Frederick Gabriel Krens University of Leiden, Netherlands
27 Janina Kowalski University of Freiburg, Germany
28 Anne Kupczok University of Vienna, Austria
29 Dejan Ničković Verimag Laboratory, Grenoble, France
30 Ferran Palero University of Barcelona, Spain
31 Alejandro Pernia-Andrade Venezuelan Institute for Scientific Research, Caracas, Venezuela
32 Jitka Polechová University of Prague, Czech Republic
33 Keisuke Sako Osaka University, Japan
34 Philipp Schmalhorst Hannover Medical School, Germany
35 Ali Szegin University of Utah, Salt Lake City, USA
36 Vasu Singh EPFL, Lausanne, Switzerland
37 Michael Smutny University of Vienna, Austria
38 Yvonne Stickler Technical University of Vienna, Austria
39 Mathieu Tracol University of Paris 11, France
40 Line V. Ugelvig University of Copenhagen, Denmark
41 Harold Paul Vladar University of Groningen, Netherlands
42 Meghan Vyleta Oregon Health and Science University, Portland, USA
43 Nick Vyleta Oregon Health and Science University, Portland, USA
44 Michele Weber University College London, UK
45 Daniel Weissman Stanford University, Palo Alto, USA
46 Thomas Wies University of Freiburg, Germany

PHD STUDENTS (by nationality)
47 Hande Acar Turkey
48 Simon Aeschbacher Switzerland
49 Vanessa Barone Italy
50 Martin Behrndt Germany
51 Pedro Campinho Portugal
52 Ines Cristo Portugal
53 Alexander Eichner Germany
54 Tom Ellis UK
55 Brittany Fasy USA
56 Sarit Goswami India
57 Sooyun Kim USA
58 Matthias Konrad Germany
59 Rajiv Mishra India
60 Jean-Léon Maître France
61 Arjun Radhakrishna India
62 Johannes Reiter Austria
63 Viktoriia Sharmanska Ukraine
64 Magdalena Steinrück Austria
65 Miriam Stock Germany
66 Ruby Tandon India
67 Anmol Tomar India
68 Simon Tragust Italy
69 Murat Tugrul Turkey
70 Damien Zufferey Switzerland

Growing Up

Thomas A. Henzinger » President, IST Austria

I began my term as first president of IST Austria on September 1, 2009. The past sixteen months have been a period of rapid growth for the Institute, which recently surpassed 100 employees and 100 scientific publications.

› In October 2010, we opened the Bertalanffy Foundation Building for experimental research in the life sciences. The name of the building, which is the first laboratory building of IST Austria, honors a donation of ten million Euro that was given to the Institute in support of basic research. As science without experiments remains speculation, and a research institute without a laboratory building remains a think tank, the opening of the Bertalanffy Foundation Building marks a critical milestone on the way of IST Austria towards entering the first league of international institutions for basic science.

› At the end of 2010, twelve research groups were at work on campus, and four additional professors were scheduled to arrive in the first months of 2011. There are already four scientific fields in which IST Austria has obtained international visibility: evolutionary biology; the interface of cell biology and biophysics; neuroscience; and computer science. The Institute is committed to further strengthen these four areas and aims to hire also professors in the physical and mathematical sciences in the coming years.

› In September 2010, the first students of the IST Graduate School arrived on campus. They represent eleven nationalities and pursue a multidisciplinary PhD program that brings together biology and computer science. Every new student is required to work with three different research groups before choosing a supervisor. This way we will train a new generation of researchers that will be able to approach a scientific question from several different angles. As much as the innovation in science happens where traditionally separate disciplines meet, they will be well-positioned to help bring about the scientific break-throughs of the future.

As IST Austria aims to become a beacon of scientific excellence, there is always the underlying question of how one objectively measures quality in basic research. In recent years, the awards of the European Research Council (ERC) have become a key indicator for research excellence in Europe. By that measure, we are on the right path. Three professors of IST Austria–the evolutionary biologist Nick Barton, the neuroscientist Peter Jonas, and myself, a computer scientist–have been awarded ERC Advanced Grants. The ERC Starting Grant of Sylvia Cremer brings the total number of ERC funded researchers at IST Austria to four. Together we receive more than eight million Euro of research funding from the European Union, in addition to about two million Euro from other funding agencies.

I want to use this opportunity to thank Mag. Peter Bertalanffy for his singular generosity and show of confidence in IST Austria. I would like to thank also all other friends of the Institute–in science, in industry, in government, in the local community, and in the public–for their support, without which we cannot succeed. I especially thank the Federal Minister for Science and Research, Dr. Beatrix Karl, the governor of the province of Lower Austria, Dr. Erwin Pröll, and the president of the Federation of Austrian Industry, Dr. Veit Sorger, for their constant commitment to IST Austria. Last but not least, I thank the entire administrative team of IST Austria, led by Gerald Murauer, for its hard work. Any growth spurt brings with it considerable stress, and it is a great relief for me to be able to rely on such a dedicated and efficient staff.

Thomas A. Henzinger

The Bertalanffy Foundation Building. The structure of the facade was used as design element for the cover of the Annual Report 2010.

The Blueprint Becomes Alive

Kurt Mehlhorn » Trustee and Chairman, Scientific Board of IST Austria

Director, Max-Planck Institute for Computer Science, Saarbrücken, Germany

IST Austria has been built following the blueprint written by Haim Harari, Olaf Kübler, and Hubert Markl. Back in 2006 this international committee looked at successful scientific institutions around the world and selected key elements that they believed would fit together to create a unique new institution fitting for Austria. For six years, I served as Vice President of the Max-Planck Society. Therefore I am pleased to see that many of these elements resemble the principles of my own institution. Other aspects, of course, differ from the Max-Planck Society as IST Austria has to meet its own specific requirements.

Similar to the Max-Planck Society, the freedom of research and the primacy of the scientist–rather than predefined topics, programs, or projects–is one of the basic principles at IST Austria. The commitment to basic research at the world-class level is as fundamental to this Institute as it is to all Max-Planck Institutes. While a Max-Planck Institute usually deals with one scientific area and its various aspects, IST Austria is set up as a single institution with different scientific fields present on one campus. I look forward to scientific advances in this environment which will cross the borders of traditional disciplines.

As Max-Planck Institutes cannot award PhD degrees they always work in close collaboration with universities. IST Austria has its own Graduate School with the right to grant PhD degrees. Excellent PhD training lays the foundation for a scientific career and provides the backbone for a dynamic research institution. Yet it does not discourage the Institute from setting up close collaborations with universities, but allows it to pursue research collaborations purely on the basis of scientific merit, maximizing the benefits for the scientific community in Austria. IST Austria offers a modern tenure-track system for assistant professors. Recently, the Max-Planck Society has also started to offer such opportunities to young researchers.

Last but not least, IST Austria and the Max-Planck Institutes are evaluated regularly and rigorously through international peers. Independent evaluations are an indispensable tool to maintain quality in science. To organize and oversee these evaluations was one of my main duties as Vice President of the Max-Planck Society, as it is now in my new function as Chairman of the Scientific Board of IST Austria. The first evaluation of IST Austria will take place in 2011 and the members of the Scientific Board are looking forward to the report by the international review panel.

Finally, I would like to use this occasion to say that I am impressed–impressed that Austria is committed to the important enterprise of establishing a world-class research institute for basic science. And I am impressed by the achievements that have been accomplished so far by President Tom Henzinger and the employees–scientists as well as non-scientists–of IST Austria. I would also like to thank my colleagues on the Board of Trustees and the Scientific Board. The international scientific community has been enriched, and the visibility of basic research in Austria enhanced, through the establishment of IST Austria. The blueprint has become alive!

Kurt Mehlhorn

The bridge connecting the modern Bertalanffy Foundation Building and the Art Nouveau Central Building; connecting theoreticians with experimental scientists.

IST AUSTRIA at a Glance

Nationalities of Scientists at IST Austria

2 % each: Brazil, Czech Republic, Hungary, Luxemburg, Netherlands, Portugal, Rumania, Serbia, Slovak Republic, Slovenia, Spain, Ukraine, Venezuela (24 %)
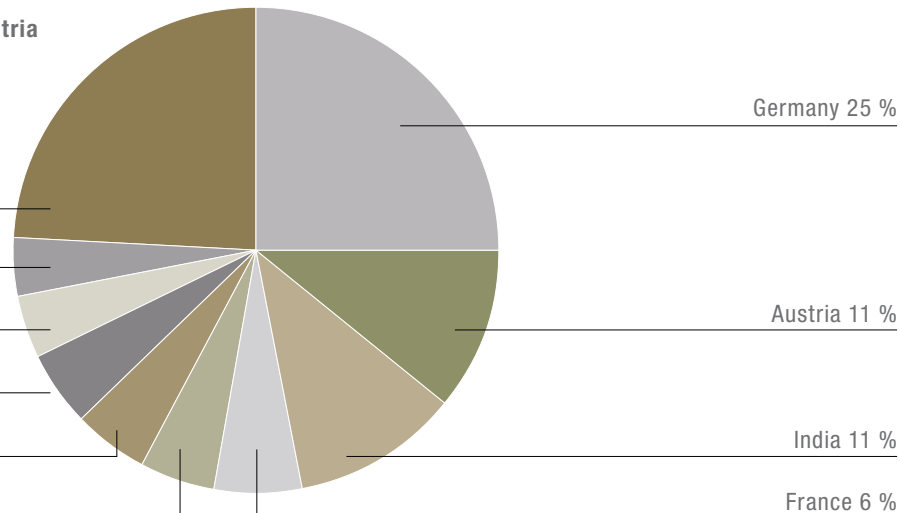
Germany 25 %

UK 4 %

Italy 4 %

USA 5 %

Turkey 5 %

Switzerland 5 %

Austria 11 %

India 11 %

France 6 %

The Institute of Science and Technology Austria (IST Austria) is a PhD granting institution located in the city of Kloster-neuburg, 18 km from the center of Vienna. The Institute is dedicated to basic research in the natural and mathematical sciences. Its international graduate school educates aspiring young scientists in an English-language environment.

Established jointly by the federal government of Austria and the provincial government of Lower Austria, the Institute was inaugurated in 2009. By the end of 2009 the Institute had 37 employees. With the opening of the first laboratory building, the Bertalanffy Foundation Building, in October 2010 the first experimental research groups moved to campus. Together with the arrival of the first doctoral students and the establishment of the first Scientific Service Units, IST Austria grew to 12 professors and 105 employees by the end of 2010. The planned campus development will allow a growth to 40–50 professors and 500–600 employees by 2016.

The scientists of IST Austria are organized into independent research groups, each led by a Professor or tenure-track Assistant Professor. The Institute recruits its scientists–from doctoral students to postdoctoral fellows and professors–in the whole world, based exclusively on their research excellence and promise. Currently the scientists of IST Austria represent 22 nationalities.

Sources of Funding

While IST Austria is dedicated to the principle of basic research, driven solely by the curiosity of the scientist, the In-stitute owns the rights to all scientific discoveries and is committed to promote their use. The long-term financial health of the Institute will rely on four diverse sources of funding: public funding, peer-reviewed research grants, technology licensing, and donations. For the period until 2016 the federal government of Austria will provide up to 290 million Euro in operational funds, of which 195 million Euro are guaranteed. The payment of the remaining 95 million Euro is conditioned on the Institute raising an equal amount of third-party funds. By the end of 2010 IST Austria has received 17 million Euro in donations and almost 10 million Euro in research grants, bringing the current third-party total to 27 million Euro. The province of Lower Austria contributes to the Institute the budget for construction and campus maintenance, so far in the amount of approximately 140 million Euro.

Independent Leadership

The governance and management structures of IST Austria guarantee its independence and freedom from political and commercial influences. The Institute is headed by the President, who is appointed by the Board of Trustees and advised by the Scientific Board. The Institute is evaluated periodically by an international panel of external scientists. The first President of IST Austria is Thomas Henzinger, a leading computer scientist and former professor of the University of California at Berkeley and the EPFL in Lausanne, Switzerland. The administration of the Institute is led by the Managing Director, Gerald Murauer.

IST EMPLOYEES 2010

	HEAD COUNT
Scientists	52
▪ Professors	12
▪ Postdocs	19
▪ PhD Students	20
▪ Staff Scientists	1
Scientific Support	24
Administration	29
TOTAL	105

RESEARCH GRANTS

ERC European Research Council	8'080'000 €
FWF Austrian Science Fund	900'000 €
DFG Deutsche Forschungsgemeinschaft	480'000 €
European Commission Framework Program 7	310'000 €
NSF National Science Foundation	120'000 €
TOTAL	9'890'000 €

DONATIONS

DONOR	CATEGORY
▪ Invicta Foundation	10'000'000 €
▪ Raiffeisen consortia (Agrana Beteiligungs-AG, Leipnik-Lundenburg Invest Beteiligungs-AG, Raiffeisen Holding Niederösterreich-Wien GmbH, Raiffeisen Zentralbank Österreich AG, STRABAG AG, UNIQA Versicherungen AG)	1'500'000–4'999'000 €
▪ voestalpine AG (voestalpine, Böhler-Uddeholm AG)	
▪ MONDI (Mondi Business Paper Services AG, Mondi Packaging AG)	500'000–1'499'000 €
▪ OMV AG	
▪ Miba AG	250'000–499'000 €
▪ Oberbank AG	
▪ Berndorf AG	100'000–249'000 €
▪ Prinzhorn Holding GmbH	
▪ Schoeller Bleckmann Oilfield Equipment AG	
▪ W. Hamburger GmbH	
▪ Alcatel-Lucent Austria AG	10'000–99'000 €
▪ Gebrüder Weiss GmbH	
▪ Kapsch AG	
TOTAL	17'000'000 €

THE IST GRADUATE SCHOOL
Starting a Scientific Career

The international Graduate School of IST Austria offers doctoral studies as a first step into a scientific career in the fields of Biology, Computer Science, Neuroscience, and interdisciplinary areas. Students with a background in related disciplines, such as physics and mathematics, are also encouraged to apply. The language of research and instruction at IST Austria is English.

A Multidisciplinary PhD Program

The length of the doctoral studies, which lead to a PhD degree, depends on previous degrees and individual progress, and will on average last four to five years. The Graduate School offers a single joint program for all scientific fields represented at IST Austria, underlining the interdisciplinary spirit of the Institute. In this way we expect to train a new generation of researchers that will be able to approach a scientific question from several different angles.

During the first phase of the doctoral program, which normally lasts one year, a student takes advanced courses and works with three different research groups. The student uses this period to identify a thesis supervisor and a thesis topic. At the end of the first phase, the student prepares a thesis proposal and passes a qualifying examination. During the second phase of the doctoral program, the student focuses on research towards a doctoral thesis. The progress of the student is monitored through regular reviews by the entire faculty. After a successful thesis defense, the student receives the PhD degree.

Annual Calls for PhD Students

All interested students must apply by January 15 in order to enter the PhD program of IST Austria in the subsequent September. The applicants need not identify a potential supervisor, but are evaluated by all IST faculty. All admitted PhD students are offered employment contracts with an internationally competitive salary and full Austrian social-security coverage. Depending on availability, accommodations on campus can be rented for a period of one year from arrival.

The deadline for the first call for students was January 15, 2010. Ninety-nine applications were received from 28 different countries and 21 applicants were invited to campus for interviews. The Graduate School made eleven offers, of which seven were accepted. These seven–among them two Austrians–joined the Institute as PhD students in September 2010. Together with the PhD students who moved to IST Austria from other institutions as members of the research groups of newly recruited professors, 24 students from eleven countries currently work at the Institute.

APPLICATION
› BS or MS or equivalent degree
› Academic CV and Statement of Purpose
› Official university transcripts
› Contact addresses for three reference letters
› GRE and TOEFL scores optional
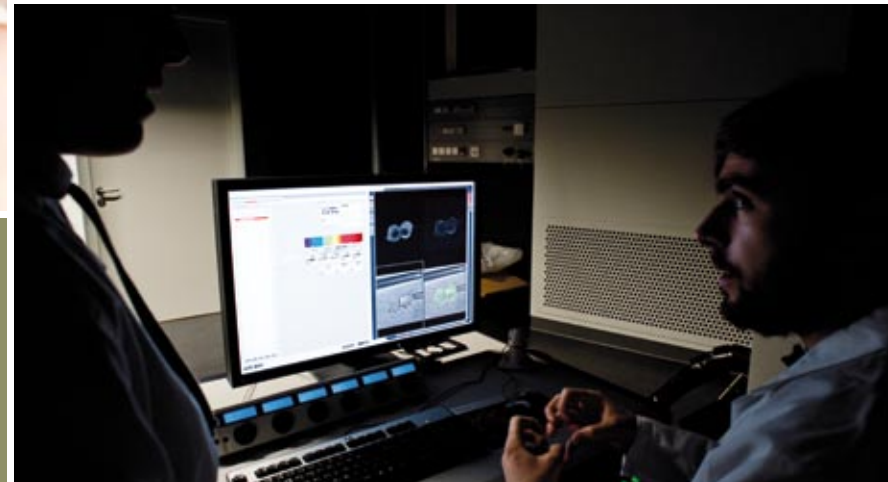
ADMISSION TO THE IST GRADUATE SCHOOL
› Annual call
› Online application open November 15 (www.ist.ac.at)
› Open day for prospective students in November
› Application deadline January 15
› Visit day for chosen candidates in March
  (travel expenses reimbursed)
› Deadline for accepting an offer April 15
› Program start September 15

Outstanding research is a **NECESSARY FOUNDATION** to stay innovative in the future. IST Austria and its researchers have already **ACCOMPLISHED A LOT** in a short period of time. I am convinced that education and research at the **HIGHEST INTERNATIONAL LEVEL WILL BE IMPORTANT CORNERSTONES** for the future. IST Austria contributes substantially to the strengthening of Austria as a **PRIME LOCATION FOR RESEARCH.**

Dr. Beatrix Karl » Federal Minister of Science and Research

The **OPENING OF THE BERTALANFFY FOUNDATION BUILDING** was celebrated only **500 DAYS AFTER THE OFFICIAL CAMPUS OPENING** in 2009. This ceremony **MARKED A MILESTONE** for Lower Austria—and for Austria as a whole—with respect to its **INTERNATIONAL VISIBILITY** as a location for cutting-edge research.

Dr. Erwin Pröll » Governor of Lower Austria

INAUGURATING the Bertalanffy Foundation Building

The opening ceremony of the Bertalanffy Foundation Building in October 2010 marked the beginning of experimental research at IST Austria. It also afforded the Institute the opportunity for a gesture of profound gratitude towards Peter Bertalanffy, the successful entrepreneur whose Invicta Foundation donated 10 million Euro to IST Austria, by naming the new building in recognition of his great contribution to the Institute.

Representing Minister Karl, Department Head Elisabeth Freismuth of the Federal Ministry of Science and Research (BMWF) emphasized that "IST Austria is a key project for the BMWF. If IST Austria is successful, this will increase also the attractiveness of the universities and of all other research in-

stitutions in Austria." The Governor of Lower Austria, Erwin Pröll, underlined the importance of the Institute for the province: "Lower Austria will continue on its forward-looking path in science policy, especially in difficult economic times." Pröll concluded: "Where there is research, there is the future."

On the way from the ceremonial inauguration act in the Raiffeisen Lecture Hall to the Bertalanffy Foundation Building, the dignitaries performed the groundbreaking for the second laboratory building on the campus of IST Austria, which is to be completed in 2012. Thereafter, they took a tour of the newly inaugurated Bertalanffy Foundation Building. Musical interludes by the Big Band of the BRG Klosterneuburg completed the festive ceremony.

I like the **IDEA BEHIND THIS INSTITUTE:** The aim to bring some of the best researchers in the world to Austria, the **COMPLETE INDEPENDENCE** from all political and economic interests, and the **PROFESSIONAL EXPLOITATION** of scientific discoveries; I think all of these are **ESSENTIAL CORNERSTONES FOR A WORLD-CLASS INSTITUTE** of basic research.

Mag. Peter Bertalanffy » IST Austria Donor; Grantor of the Invicta Foundation

THE BERTALANFFY
Foundation Building

The Bertalanffy Foundation Building can be seen as a symbol for the interdisciplinary culture at IST Austria. The modern laboratory building–the first one on campus–is connected with the renovated Central Building from the nineteenth century by a bridge. Just as the bridge connects the offices in the Art Nouveau Central Building to the state-of-the-art laboratories in the Bertalanffy Foundation Building, it brings together theoretical and experimental research groups.

The challenge for the architects (ARGE Maurer–Neumann & Partners) was to design a functional and attractive building that harmonizes with the Central Building and the Raiffeisen Lecture Hall. The project supervision was managed by NÖ Real-Consult GmbH (formerly NÖ Hypo Bauplan). It took only two and a half years of planning and construction to complete the Bertalanffy Foundation Building. By comparison, the Max-Planck Society usually estimates four years for similar construction projects.

The Architecture
The gross floor area of the four levels comprises 4'300 m². The ground floor houses several common services, including a washing room for laboratory equipment, areas for the preparation of biological media, and space for image processing. The first floor is the home of four research groups working on topics in evolutionary biology and biophysics. Three groups in cell and systems biology have moved into the second floor. The third floor is dedicated to neuroscience. The building services are on the roof level and in the basement, which contains also

spaces for microscopy and an IT security cell for servers and a computer cluster. The building is linked to an underground collector that serves all campus buildings for maintenance, supply, and disposal purposes.

The interior spaces of the building are designed for maximum flexibility and can be configured according to the needs of the scientists. The individual laboratories differ in size as also the research groups vary in size, type of research, and demand for interaction. While some of the groups prefer smaller rooms for specialized work and equipment, other groups benefit from a more communicative, open laboratory layout.

The bridge from the second floor to the Central Building is designed as a lounge: a large, yet comfortable space for informal communication inviting the theoretical scientists from the Central Building to meet and exchange ideas with the experimental scientists from the laboratory building. A spiral staircase leads to the second deck of the bridge, where the central node of the Institute's library is located.

The facade of the Bertalanffy Foundation Building is made of vertical glass fins that follow the curved footprint of the complex. The glass fins–alternating tinted sunscreens and reflective panels–cause the building to blend into its green environment. The random scattering of the vertical elements repeats the irregular appearance of the

Construction period	18 months
Gross floor space	4'300 m²
Floors (including basement)	5
Scientists (approx.)	100

surrounding forest and points to the flexibility of the interior layout. The glass curtain enables the entry of glare-free daylight while at the same time offering optimal sun protection during all seasons, without hindering natural ventilation. In winter, the space between the glass shell and the wall serves as a climatic buffer, modulating the temperature range and thus reducing heating costs.

On the north and east sides, the building is surrounded by a ring road for deliveries. To the south, the Bertalanffy Foundation Building faces the site of the next laboratory building: a 5'800 m² complex that will accommodate up to twelve research groups by 2012.
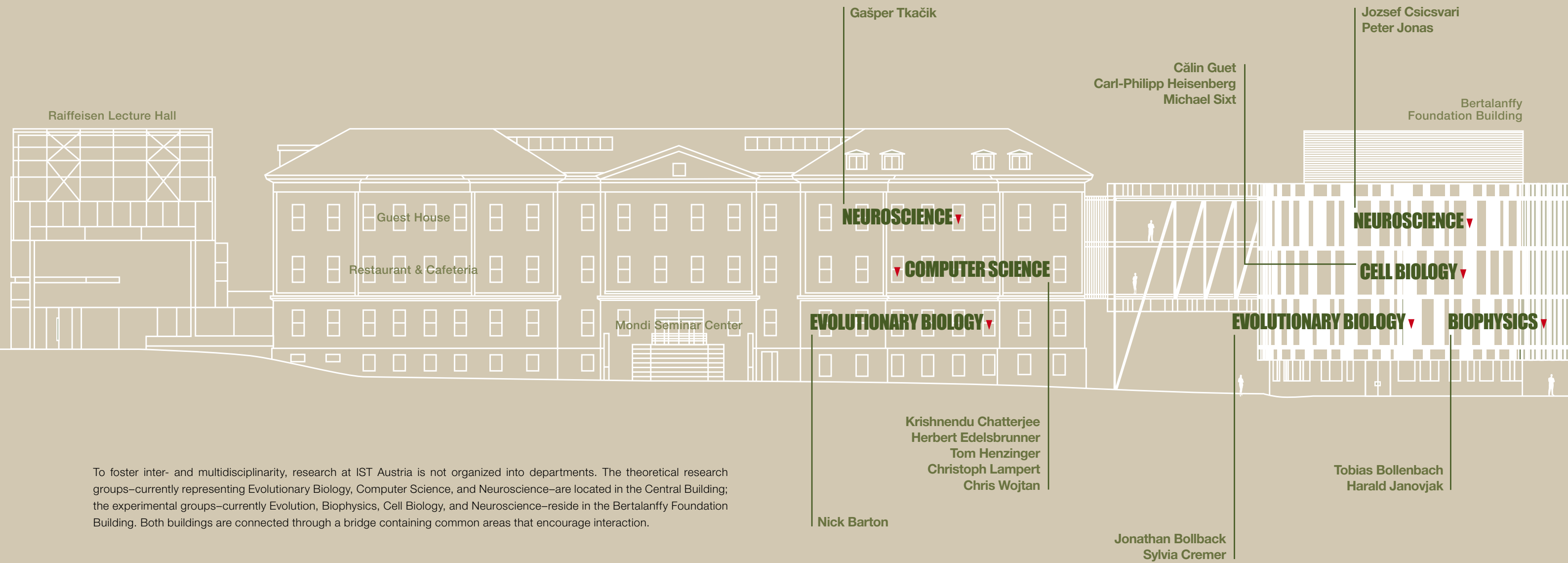
The Scientists
Shortly after the opening in October 2010, seven research groups started to work in the building, and two more groups will follow in the first months of 2011. Their work focuses on different aspects of biology and neuroscience.

Jonathan Bollback studies seemingly simple organisms like microbes in the context of evolution. Tobias Bollenbach uses methods of physics to understand the information processing within cells. Sylvia Cremer investigates the astounding social abilities of ants. Cǎlin Guet explores questions of systems biology by designing networks under synthetic conditions. Carl-Philipp Heisenberg studies quantitative aspects of the development of cells into an organism. Michael Sixt investigates problems of cell biology and immunology, such as how cells change their form. Neuroscientist Peter Jonas researches how signals pass through synapses.

Starting in 2011, Jozsef Csicsvari will combine aspects of neuroscience with computing techniques in order to analyze the activities of certain types of neurons. And Harald Janovjak will develop optical methods to control the behavior of cells. The building has room for one or two additional groups, meaning that in total ten or eleven research groups will have their home in the Bertalanffy Foundation Building.

CURRENT RESEARCH
at IST Austria

Gašper Tkačik

Jozsef Csicsvari
Peter Jonas

Călin Guet
Carl-Philipp Heisenberg
Michael Sixt

Raiffeisen Lecture Hall

Bertalanffy
Foundation Building

Guest House

Restaurant & Cafeteria

NEUROSCIENCE ▾

NEUROSCIENCE ▾

COMPUTER SCIENCE

CELL BIOLOGY ▾

Mondi Seminar Center

EVOLUTIONARY BIOLOGY ▾

EVOLUTIONARY BIOLOGY ▾   **BIOPHYSICS** ▾

Krishnendu Chatterjee
Herbert Edelsbrunner
Tom Henzinger
Christoph Lampert
Chris Wojtan

Tobias Bollenbach
Harald Janovjak

To foster inter- and multidisciplinarity, research at IST Austria is not organized into departments. The theoretical research groups–currently representing Evolutionary Biology, Computer Science, and Neuroscience–are located in the Central Building; the experimental groups–currently Evolution, Biophysics, Cell Biology, and Neuroscience–reside in the Bertalanffy Foundation Building. Both buildings are connected through a bridge containing common areas that encourage interaction.

Nick Barton

Jonathan Bollback
Sylvia Cremer

NICK BARTON MATHEMATICAL MODELS OF EVOLUTION

How do new species emerge from a single population? Why do so many organisms reproduce sexually, despite the obvious costs? How quickly can species adapt to changing conditions? The Barton Group uses mathematical models of genetic change to better understand such fundamental questions about evolution.

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

We study diverse topics in evolutionary genetics, but focus on the evolution of populations that are distributed through space, and that experience natural selection on many genes. Understanding how species adapt, and how they split into new species, requires understanding of spatial subdivision, whilst interactions between genes are important in species formation, and in the response to selection. The recent flood of genomic data makes analysis of the interactions amongst large numbers of genes essential.

Current Projects

Spatially Continuous Populations

Classical models assume that individuals reproduce and disperse independently, and so miss many features of real populations. Correlations between genes reveal their shared history, patterns may extend over very large spatial scales, and diversity is often lower than expected from the number of individuals. I am working with Alison Etheridge (Oxford) on a model of long-range extinction and recolonisation that includes these features.

Evolution of Sex and Recombination

Why do almost all eukaryotes reproduce sexually? The most plausible explanation is that recombination helps to bring together favorable gene combinations, thus accelerating adaptation. The challenge is to find how recombination is favored, given that selection acts on a very large number of genes. We are analyzing a variety of stochastic models of selection on multiple recombining loci.

Limits to Selection

How can the development of extraordinarily complex morphologies and behaviors be guided by a functional genome of ~10^8 bases–much less information than is held in a personal computer? This issue is relevant not only to natural selection, but also to evolutionary computation, in which selection is used to evolve better algorithms. We are studying the relation between information, entropy, and fitness.

Statistical Mechanics and the Evolution of Quantitative Traits

We have formalized an analogy between statistical mechanics and population genetics; the results are applied to study the evolution of quantitative traits, allowing for arbitrary interaction effects.

We also study several other topics in evolutionary genetics, including the genetics of hybrid zones, limits to a species' range, models of sympatric speciation, and methods for inferring population structure.

CV

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

SELECTED DISTINCTIONS
	ISI Highly Cited Researcher
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
1995	Fellow, Royal Society of Edinburgh
1994	Fellow, Royal Society of London
1994	David Starr Jordan Prize

P

SELECTED PUBLICATIONS

1. Barton NH. 2009. Why sex and recombination? Cold Spring Harbor Symposia Quant. Biol. 74.

2. Barton NH, de Vladar HP. 2009. Statistical mechanics and the evolution of polygenic traits. Genetics 181: 997-1011.

3. Barton NH, Briggs DEG, Eisen JA, Goldstein DB, Patel NH. 2007. Evolution. Cold Spring Harbor Laboratory Press.

T

TEAM

Simon Aeschbacher, PhD student
Ferran Palero, Postdoc
Jitka Polechová, Postdoc
Harold P. de Vladar, Postdoc
Daniel Weissman, Postdoc

JONATHAN P. BOLLBACK MICRO-BIAL EXPERIMENTAL EVOLUTION AND STATISTICAL GENOMICS

Microbes are everywhere: in our gut, on our skin, and at the source of many diseases. The Bollback Group studies the abilities of seemingly simple organisms in the context of Evolutionary Biology. One of the questions: Why sex may not be needed (at least for microbes)?

Microbes–viruses, bacteria, archaea, and protists–account for half of all the biomass and the majority of organismal diversity on planet earth. Microbes gave rise to higher organisms and have left their genomic calling cards in the form of organelles, genes, and so called junk DNA. Microbes are the source of the majority of human diseases. For these reasons alone microbes are worthy of scientific study. Yet, they are also important in another way: they are an extraordinarily powerful model system for understanding in very fine detail how evolution works. Our research focuses on microbial evolution, evolutionary interactions between hosts and parasites, and the evolution of bacterial immunity. To accomplish this we use experimental evolution, population genetics, and statistical modeling.

Current Projects
The Rate of Adaptive Evolution in Sexual and Asexual Populations
In the absence of recombination, beneficial mutations appearing on different genetic backgrounds cannot fix simultaneously in a population together. There-fore, only one beneficial mutation can fix at a time, and all other beneficial mutations are lost in a process called clonal interference. As a result, asexual populations suffer a slower rate of adaptation relative to their sexual counterparts: in sexual populations recombination can quickly bring competing mutations together accelerating the rate of adaptation. It has been shown experimentally that in large asexual populations with high mutation rates, mutation alone can provide a recombination-like benefit by bringing together the two competing mutations. Our group is using experimental evolution to understand the mutational dynamics and rates of adaptation in (i) purely asexual populations, (ii) asexual populations with recurrent mutation, and (iii) sexual populations with recombination.

The Evolution of an Adaptive Heritable Immune System in Bacteria
Bacteria and archaea have independently, from multicellular organisms, evolved an adaptive heritable immune system called CRISPR. In this system infected bacteria identify the infecting virus, encode viral information into their immune system conferring immunity, and then pass this immunity onto daughter cells. While we are beginning to understand functional aspects of how this system works, we know little if anything about the evolutionary dynamics of the system. My group is working to understand how this unique immune system evolves by monitoring the dynamics of wild populations of soil bacteria and their viruses, by developing statistical evolutionary models, and by genomic sequence analysis of *Staphylococcus pseudintermedius* in collaboration with Ross Fitzgerald (Royal Infirmary, Edinburgh).

A cluster of *Escherichia coli.*

CV

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

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

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

T

TEAM
Flávia Gama Gomes Leite, Technical assistant
Anne Kupczok, Postdoc
Rodrigo A. F. Redondo, Postdoc

TOBIAS BOLLENBACH
PHYSICAL AND SYSTEMS BIOLOGY OF CELL SIGNALING

Cells respond to signals by altering the expression of their genes. But how are such signals processed inside cells? And how are cellular responses controlled? The Bollenbach Group uses methods of biological physics and systems biology to gain a better understanding of these processes.

Cells ranging from those in the tissues of multi-cellular organisms to single-celled microbes respond to signals in the environment by modifying the expression of their genes. While recent technological advances have enabled us to measure and manipulate such gene expression responses genome-wide, i.e. across all genes of an organism, little is known about the high-level capabilities and limitations of the cellular machinery that controls these responses. Our long-term goal is to gain a deeper, more quantitative understanding of the relation between the signals present in the cell's environment and the information processing and other events, which they trigger inside cells. In particular, we aim to identify general principles that capture key properties of gene regulatory responses. To this end, we combine quantitative experiments, often based on fluorescence measurements in single cells or entire populations, with theoretical approaches from physics. Our emphasis is on quantitative approaches, i.e. whenever possible we measure and interpret numbers, rather than pictures or qualitative effects.

Current Projects

› Cells are often faced with the simultaneous presence of multiple signals that individually elicit opposite gene expression responses. How do cells resolve such gene regulatory conflicts? As a first step, we use fluorescent transcriptional reporters, time-lapse microscopy, and a state-of-the-art robotic system to reveal how the bacterium Escherichia coli responds to combinations of antibiotics. Antibiotics are important drugs for the treatment of infectious diseases and often used in combination, making this a particularly relevant example. We will extend these studies to cover other model organisms and a broad range of different signals.

› Optimality has been suggested to be a key design principle of biological systems. But to what extent are cellular responses optimized for a functional goal? To address this question, we systematically measure and synthetically manipulate gene expression responses. We currently focus on single-celled bacteria and fungi where the maximization of cell survival and growth is a plausible, clearly defined, and experimentally accessible functional goal.

› We are further interested in cell differentiation, communication between cells by secreted signaling molecules, and other key processes in the development of animals such as fruit flies, mice, and fish. Our work employs quantitative data analysis and theoretical descriptions of developmental mechanisms to understand the key properties and limitations of these mechanisms. We collaborate with developmental biology groups at IST Austria and elsewhere to quantify the key parameters of animal development and thus improve our understanding of these fascinating phenomena.
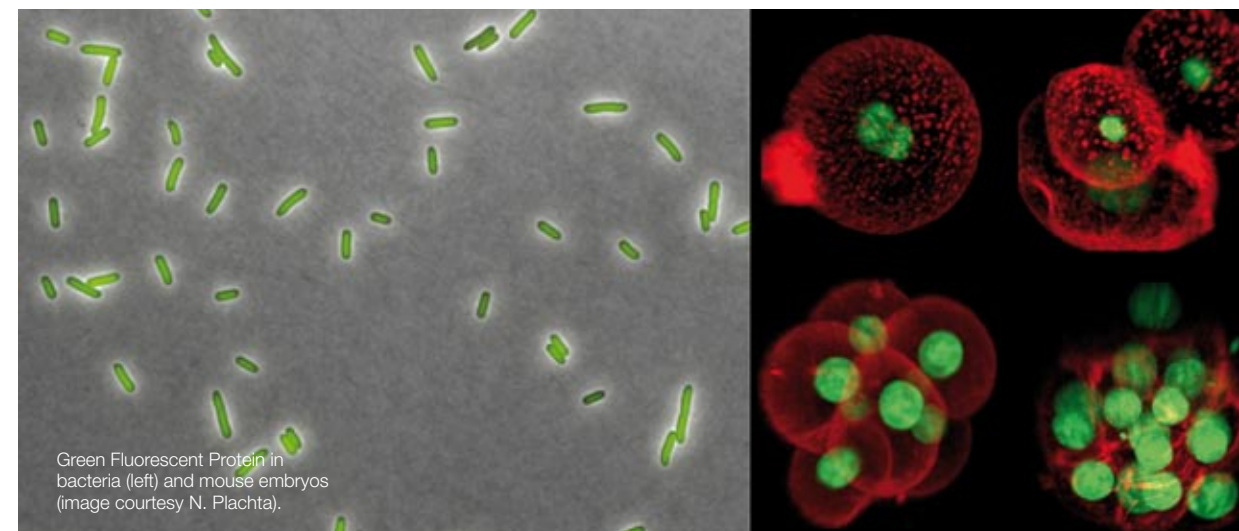
Green Fluorescent Protein in bacteria (left) and mouse embryos (image courtesy N. Plachta).

CV

CAREER
2010 Assistant Professor, IST Austria
2006–2010 Postdoc, Department of Systems Biology, Harvard Medical School, Boston, USA
2005–2006 Postdoc, Max-Planck Institute, Dresden, Germany
2005 Guest scientist, University of Tokyo, Japan
2005 PhD, Max-Planck Institute, Dresden, Germany

SELECTED DISTINCTIONS
2007–2009 Feodor Lynen Fellowship, Alexander von Humboldt-Foundation
2005 REES Fellowship, Japan International Science and Technology Exchange Center
2000–2005 Student and PhD Fellowships, German National Scholarship Foundation

P

SELECTED PUBLICATIONS
1. Bollenbach T, Quan S, Chait R, Kishony R. 2009. Nonoptimal microbial response to antibiotics underlies suppressive drug interactions. Cell 139: 707-718.
2. Bollenbach T*, Pantazis P*, Kicheva A*, Bökel C, González-Gaitán M, Jülicher F. 2008. Precision of the Dpp gradient. Development 135: 1137-1146.
3. Kicheva A*, Pantazis P*, Bollenbach T*, Kalaidzidis Y, Bittig T, Jülicher F, González-Gaitán M. 2007. Kinetics of morphogen gradient formation. Science 315: 521-525.
*equal contribution

KRISHNENDU CHATTERJEE
COMPUTER-AIDED VERIFICATION, GAME THEORY

Life is a game – at least in theory. This has a number of implications for the verification of software but also on the trustworthiness of Wikipedia articles. The Chatterjee Group contributes to the comprehension of the theoretical foundations of central questions in Computer Science.

Our main research interest is in the theoretical foundations of formal verification and game theory. Our current research focuses on stochastic game theory, probabilistic model checking, logic and automata theory, and quantitative theories of verification. In addition, we are also interested in algorithms for developing robust reputation and trust management systems for Wikipedia.

Current Projects

Game Theory in Verification
This project involves the algorithmic analysis of various forms of games played on graphs. Automatically obtaining correct systems from specifications (synthesis) as well as many important questions in computer science can be analyzed effectively in the broad framework of games on graphs. In this project we work on theoretical aspects for the better understanding of games, developing new algorithms, as well as practical applications of game solving. The results present the theoretical foundations for the formal verification of systems. Last year we obtained several important results: for example, we have established optimal complexity results for one-player stochastic games with partial information, and improved the algorithms related to probabilistic verification and we now have the fastest algorithms for the verification of probabilistic systems with omega-regular specifications.

Quantitative Verification
The classical Boolean theory of verification has a wide range of applications. However, there are a lot of applications where a more quantitative approach is necessary. For example in the case of embedded systems, along with the Boolean specification, a quantitative specification related to resource constraints must be satisfied. In this work we have been developing a framework to specify quantitative properties and to answer the quantitative questions related to the classical Boolean theory of verification. The results of this project are useful for the design of correct and robust systems, and present a new theoretical framework for the formal verification of systems. Last year we have obtained results that show that there exists a class of quantitative specification language that is robust and also decidable.

Reputation and Trust Management Systems
In this work we study how to design robust algorithms for automatically computing the reputation of authors and the trust of text of an article in Wikipedia. Our algorithms are based on the content evolution of Wikipedia articles, and are completely automatic. The algorithms we have developed are now implemented and soon our results will be available as a tool that can be used in Wikipedia.

Software
Several new efficient algorithms that we have developed have also been implemented by us to obtain research tools like ALPAGA and GIST for the study of

CV

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

SELECTED DISTINCTIONS
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

P

SELECTED PUBLICATIONS
1. Chatterjee K., Henzinger, M. 2011 (To appear) Faster and dynamic algorithms for maximal end-component decomposition and related graph problems in probabilistic verification. ACM Symposium on Discrete Algorithms (SODA).
2. Chatterjee K. 2007. Concurrent games with tail objectives. Theoretical Computer Science 388:181-198.
3. Chatterjee K. 2005. Two-player non-zero sum omega-regular games. Concurrency Theory Lecture Notes in Computer Science 3653. Springer, 413-427.

T

TEAM
Mathieu Tracol, Postdoc
Johannes Reiter, PhD student

SYLVIA CREMER COOPERATIVE DISEASE DEFENSE IN INSECT SOCIETIES

Ants live together in high densities tightly cramped together. Even if this lifestyle should favour disease spread, ants rarely fall ill. If one ant contracts an infection, others take care of it and a breakout of the disease is prevented. The Cremer Group uses an Evolutionary Biology perspective to investigate this Social Immunity in ants and its general impact on disease management in societies.

Ant networks.
Drawing by Eva Sixt

Like other societies, the colonies of social insects also face the problem of a high risk of disease transmission among the members of their social group. This is due to their close social interactions and high densities they live in. Despite this risk, epidemics occur extremely rarely in the colonies of social insects (e.g. bees, ants, termites), as they have evolved cooperative anti-pathogen defenses that complement the individual immune systems of group members. This "social immunity" comprises a) hygiene behaviors, such as mutual allogrooming, b) joint physiological defenses, as the production and application of antimicrobial substances, and c) the modulation of interaction types and frequencies upon exposure of group members to pathogens. In my group, we study all aspects of social immune defenses in ants to learn more about disease management in societies.

Current Projects

Social Vaccination

When individual ants get sick, their nestmates take care of them. We found that these helpers do not necessarily run the risk of contracting the disease themselves, but can even receive an immune protection by "social vaccination". We currently try to understand both the molecular mechanisms and the effects for the society structure of this social vaccination.

Pathogen Detection Abilities

Ants show the amazing feature of being able to detect the presence of pathogens in their colonies even before these could implement an infection. We study the pathogen detection abilities of ants and determine how these are affected by reduction in the genetic diversity of colonies by e.g. inbreeding effects.

Host-Parasite Coevolution

Parasites and pathogens can quickly adapt to their hosts, which–on the other hand–develop better defense strategies. We are interested in the dynamics of these coevolutionary arms races in social hosts such as ants.

Epidemiology

Disease spread occurs along routes of high numbers of interactions and can thus be modeled by e.g. traffic networks. We use the social interaction networks of ants to both apply and further develop epidemiological models of disease spread. This joint approach combining experimental work and theoretical modeling is used to gain insight into disease spread in societies.

CV

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

SELECTED DISTINCTIONS
2010 Habilitation
2009 ERC Starting Grant
2008 Member, German Young Academy of Sciences Leopoldina and Berlin Brandenburg
2004–2006 Marie Curie Intra-European Fellowship and Reintegration Grant
2003–2004 Feodor Lynen Fellowship, Alexander von Humboldt Foundation
2000 Diploma thesis award, German Life Sciences Association

P

SELECTED PUBLICATIONS
1. Ugelvig LV, Kronauer DJC, Schrempf A, Heinze J, Cremer S. 2010. Rapid anti-pathogen response in ant societies relies on high genetic diversity. Proceedings of the Royal Society B: Biological Sciences, 277: 2821-2828.
2. Ugelvig LV , Cremer S. 2007. Social prophylaxis: group interaction promotes collective immunity in ant colonies. Current Biology 17: 1967-1971.
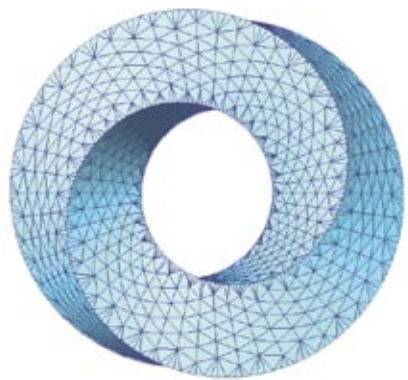**3.** Cremer S, Armitage SAO, Schmid-Hempel P. 2007. Social Immunity. Current Biology 17: R693-R702.

T

TEAM
Matthias Konrad, PhD student
Barbara Mitteregger, Technical assistant
Miriam Stock, PhD student
Simon Tragust, PhD student
Line V. Ugelvig, Postdoc
Meghan Vyleta, Postdoc

HERBERT EDELSBRUNNER
ALGORITHMS, COMPUTATIONAL GEOMETRY AND TOPOLOGY

Finding the needle in a haystack seems, in comparison, an easy mission. 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.

CV

CAREER

2009	Professor, IST Austria
2007–2008	Visiting Professor, Berlin Mathematical School, Germany
2007	Visiting Professor, Ecole Normale Supérieure, Paris, France
2006	Moore Distinguished Scholar, Caltech, Pasadena, USA
2004–	Professor for Mathematics, Duke University, Durham, USA
2002	Visiting Professor, Lawrence Livermore National Laboratory, USA
1999–	Professor for Computer Science, Duke University, Durham, USA
1996–	Founder, Principal, and Director, Raindrop Geomagic
1994–1995	Visiting Professor, Hong Kong University of Science and Technology
1985–1999	Assistant, Associate, and Full Professor, University of Illinois, Urbana-Champaign, USA
1981–1985	Assistant, Graz University of Technology, Austria
1982	PhD, Graz University of Technology, Austria

SELECTED DISTINCTIONS

	ISI Highly Cited Researcher
2010	ERC Advanced Grant
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

P

SELECTED PUBLICATIONS
1. Edelsbrunner H, Harer JL. 2010. Computational Topology. An Introduction. American Mathematical Society, Providence, Rhode Island.
2. Edelsbrunner H. 2001. Geometry and Topology for Mesh Generation. Cambridge University Press, Cambridge, England.
3. Edelsbrunner H. 1987. Algorithms in Combinatorial Geometry. Springer-Verlag, Heidelberg, Germany.

T

TEAM
Paul Bendich, Postdoc
Chao Chen, Postdoc
Brittany Fasy, PhD student
Michael Kerber, Postdoc
Ying Zheng, PhD student

A small selection from the 180 triangulated tubes created as a first application of the Geomagic Wrap software in 1996.

The core of our research is a combination of mathematics and computer science, always driven by relevant questions in applications. During a past shift from geometry to topology (which are related subjects without clear separation), we noticed an increase in relevant application questions we could address. These include questions in scientific visualization, structural molecular biology, systems biology, but also geometry processing, medical imaging, and orthodontics. The common theme is the importance of shape and the recognition, matching, and classification of shape. Topology is the area within mathematics whose methods most directly speak to that need. Algorithms and computer software are needed to make mathematical insights useful in applications, which is the motivation to study in topology and also geometry from a computational point of view.

Current Projects
› Genome-wide analysis of root traits. This NSF-funded project, lead by Philip Benfey, aims at relating the phenotypes of agricultural root systems with their genotypes. The work in our group focuses on capturing and describing phenotypes. The challenging steps are the reconstruction of the shape of a root system from 2D images, the development of geometric and topological descriptors that characterize the intrinsic and extrinsic shape of roots, and the exploration of changes through growth.

Software
› We developed the 3D Alpha Shapes software some 20 years ago, and see it now as the origin of a number of different developments, in industry as well as in academic research. The software takes as input a finite set of points with x-, y-, and z-coordinates, and produces a multi-scale description of the shape the points sample.
› A productive branch of development took alpha shapes into the world of molecular structures, in particular proteins and nucleic acids. The alpha shapes provide the mathematical and computational foundation for the fastest and most accurate volume, area, and derivative computations we have today.
› Another development leads from alpha shapes to persistent homology, which is the most important innovation that has yet emerged from the young field of computational topology. Indeed, the pervasive concept of a filtration was first perceived as a nested sequence of alpha shapes.
› In industry, the Geomagic Wrap software was motivated by the Alpha Shape software but needed a major new idea to lead to reliable surface reconstruction, a problem that arises in many areas of manufacturing and medical modeling. That new idea is a discrete geometric flow on a simplicial complex, an idea that combines geometric and topological aspects and is eminently computable.

CĂLIN GUET SYSTEMS AND SYNTHETIC BIOLOGY OF GENETIC NETWORKS

Networking is important on any level and in any environment – genes and proteins do it in bacteria. But which rules, if at all, do they follow? The Guet Group explores these questions of Systems and Synthetic Biology by analyzing natural and synthetic networks.

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

CV

CAREER
2010 Assistant Professor, IST Austria
2009 Postdoc, Harvard University, Cambridge, USA
2005 Postdoc, University of Chicago, USA
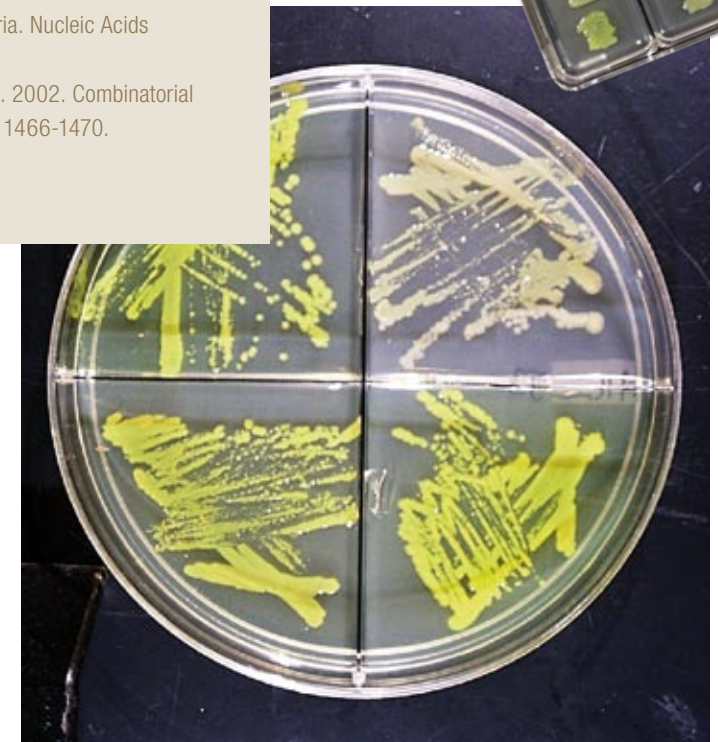**2004** PhD, Princeton University, USA

SELECTED DISTINCTIONS
2005-2007 Yen Fellow, Institute for Biophysical Dynamics, University of Chicago, USA
1997 Sigma XI Membership

P

SELECTED PUBLICATIONS
1. Kinkhabwala A, Guet CC. 2008. Uncovering *cis* regulatory codes using synthetic promoter shuffling. PLoS ONE 3: e2030.
2. Guet CC, Bruneaux L, Min TL, Siegal-Gaskins D, Figueroa I, Emonet T, Cluzel P. 2008. Minimally invasive determination of mRNA concentration in single living bacteria. Nucleic Acids Research 36: e73.
3. Guet CC, Elowitz MB, Hsing WH, Leibler S. 2002. Combinatorial synthesis of genetic networks. Science 296: 1466-1470.

Our scientific curiosity is centered on understanding systems of interacting genes and proteins that constitute themselves into genetic networks in bacteria. These bio-molecular networks are involved in a constant process of decision-making and computation that takes place over various time scales: from seconds to the division time of an organism and beyond.

By studying existing networks or by constructing networks de novo in living cells using synthetic biology approaches, we aim to uncover universal rules that govern biological genetic networks.

We use Escherichia coli as our favorite model system and are generally interested in microbial genetic systems given their relative simplicity and powerful experimental genetic tools available. An emphasis is placed on understanding the molecular biology and physiology of the single cell, since often population level measurements mask the behavior of the individual cell.

To this end we use and develop in vivo techniques that are minimally invasive in order to quantitatively characterize the temporal dynamics of gene expression.

Current Projects

Information Processing at Complex Promoters

Promoters perform very basic information processing: physiological information from diverse cellular sources is integrated at the promoter level in order to produce a mostly binary response: gene activation or gene repression. Natural promoters have been shaped by evolutionary processes and reveal only a subset of all possible information processing capabilities. By building synthetic promoters we aim to understand the constraints imposed by the molecular hardware on the information processing potential of bacterial promoters.

Systems Biology of the Mar Regulon

The multiple antibiotic resistance or mar operon, as the name suggests, is an important genetic locus responsible for multiple antibiotic resistance in gram-negative bacteria. Several genes that are components of the wider mar regulon integrate a variety of intra- and extracellular signals. We are interested in a systems-level description of the mar regulon at the level of the single cell, in order to gain a deeper understanding of how resistance towards a variety of different chemicals emerges in natural settings.

CARL-PHILIPP HEISENBERG
MORPHOGENESIS IN DEVELOPMENT

Why do fish develop fins? And not arms? Understanding the transformation of a bunch of cells into a highly structured embryo is a core problem of Cell and Developmental Biology – and a central task of the Heisenberg Group.

A: Surface cells of an ectoderm explant with Actin (red) and plasma membrane (green) **B:** Confocal section through the germ ring margin of a gastrulating zebrafish embryo. Cells are labelles with membrane-anchored and cytoplasmic GFP **C:** Gastrulating zebrafish embryo containing transplanted donor cells labelled in red and blue. The non-transplanted cells are labelled in green (GFP).

CV

CAREER
2010 Professor, IST Austria
2001–2010 Group Leader, Max-Planck Institute, Dresden, Germany
1997–2000 Postdoc, University College London, UK
1993–1996 PhD, Max-Planck Institute, Tübingen, Germany

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

P SELECTED PUBLICATIONS
1. Diz-Muñoz A, Krieg M, Bergert M, Ibarlucea-Benitez I, Muller D, Paluch E, Heisenberg CP. 2010. Control of directed cell migration in vivo by membrane-to-cortex attachment. PLoS Biology, 8(11), e1000544.
2. Krieg M, Arboleda-Estudillo Y, Puech PH, Käfer J, Graner F, Müller DJ, Heisenberg CP. 2008. Tensile forces govern germ-layer organization in zebrafish. Nature Cell Biology 10(4): 429-436.
3. Heisenberg CP, Tada M, Rauch GJ, Saúde L, Concha ML, Geisler R, Stemple DL, Smith JC, Wilson SW. 2000. Silberblick/Wnt11 mediates convergent extension movements during zebrafish gastrulation. Nature 405(6782): 76-81.

T TEAM
Vanessa Barone, PhD student
Martin Behrndt, PhD student
Pedro Campinho, PhD student
Julien Compagnon, Postdoc
Ines Cristo, PhD student
Gabby Krens, Postdoc
Jean-Leon Maitre, PhD student
Keisuke Sako, Postdoc
Philipp Schmalhorst, Postdoc
Michael Smutny, Postdoc
Ruby Tandon, PhD student

We are studying the molecular and cellular mechanisms by which vertebrate embryos take shape. To obtain insights into critical processes in vertebrate morphogenesis, such as cell adhesion, migration, and polarization, we focus on gastrulation movements in zebrafish. Gastrulation is a highly conserved morphogenetic process describing the transformation of a seemingly unstructured blastula into a highly organized gastrula-stage embryo composed of the three germ layers ectoderm, mesoderm and endoderm. Zebrafish is an ideal organism to study gastrulation movements as embryos develop ex-utero and are easily accessible for both experimental and genetic manipulations. To analyze gastrulation movements, we have chosen a multi-disciplinary approach employing a combination of genetic, cell

biological, biochemical and biophysical techniques. Utilizing these different experimental tools, we are deciphering key effector mechanisms mediating the processes by which vertebrate embryos take shape.

Current Projects
Cell Adhesion
The ability of cells to adhere to each other is a central feature in the development of all multi-cellular organisms. We are studying the role of cell adhesion in gastrulation by a reductionist approach. We first analyze the molecular and cellular processes determining adhesion of individual primary cells taken from different parts of the gastrulating embryo with a combination of genetic, molecular, and biophysical/imaging techniques. We then use the information gained from

those experiments to study more complex adhesive cell interactions taking place in primary cell/tissue culture and the gastrulating embryo.
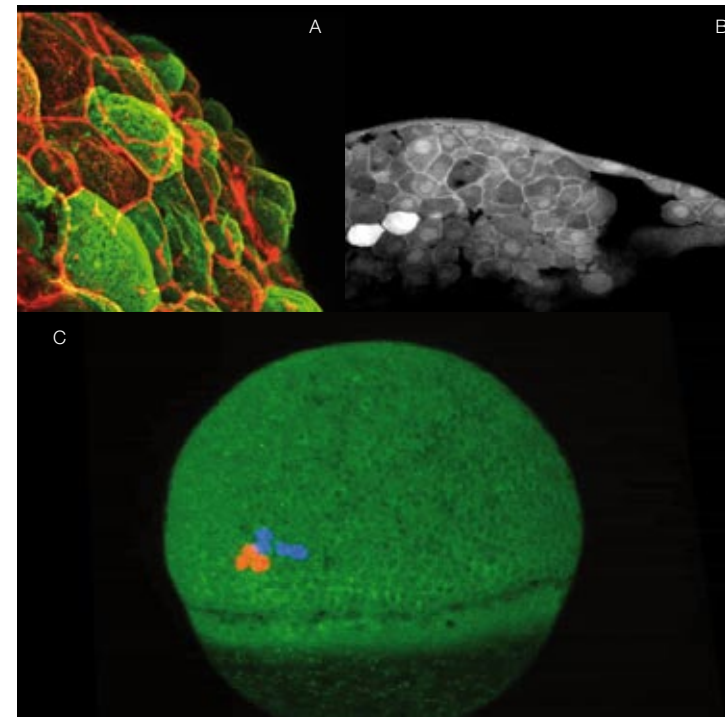
Cell Movements
The movement of cells is an integral part of embryo morphogenesis. Cells can move individually (single cell migration), or as part of larger groups of cells (cell intercalation, collective cell migration). We are studying the role of these different cell movement modes in embryo morphogenesis during gastrulation. In particular, we are analyzing how the interplay between autonomous and non-autonomous cell properties influences the movement of cell groups and tissues. To address this interplay we have developed different cell movement assays and use a combination of genetic, molecular,

and biophysical/imaging tools to alter and analyze cell properties implicated in migration, such as cell adhesion, polarization, and motility.

Cell Polarization
The generation of embryo polarity (e.g. head-to-tail) depends on the ability of individual cells to polarize. Cell polarization influences the way cells move, interact and assemble into tissues. We study the role of cell polarization in tissue morphogenesis during gastrulation. Specifically, we analyze how cell polarization influences cell adhesion, movement, and proliferation. We address the function of cell polarization in these processes by using genetic and molecular techniques to alter cell polarity and high resolution microscopy to characterize the effects of polarity changes on tissue morphogenesis during gastrulation.

THOMAS A. HENZINGER DESIGN AND ANALYSIS OF CONCURRENT AND EMBEDDED SYSTEMS

Humans and computers can be surprisingly similar: Interaction between two actors can be simple but gets more complex with every actor added. With more and more things controlled by software in our everyday life, this fact has an enormous impact on computers – and on humans. The Henzinger Group strives to solve this problem with the methods of Computer Science.

My group is interested in mathematical methods for improving the quality of software. More and more aspects of our lives are controlled by software and over 90 % of the computing power is in places you wouldn't expect, such as cell phones, kitchen appliances, and pacemakers. Computer software has, at the same time, become one of the most complicated artifacts produced by man. It is therefore unavoidable that software contains bugs, and dealing with these bugs is a major technical challenge.

We focus on concurrent software and on embedded software. A concurrent system consists of many parallel processes that interact with one another, whether in a global network or on a single chip. Hardware manufacturers pack an ever increasing number of microprocessors on one chip, generating massive parallelism inside each computer. These systems are difficult to program, creating one of the biggest

challenges of computer science today. Concurrent software is extremely error-prone because of the very large number of different interactions that are possible between parallel processes. They cannot be exhausted by testing the system, and concurrency bugs sometimes show up after many years of flawless operation of the system.
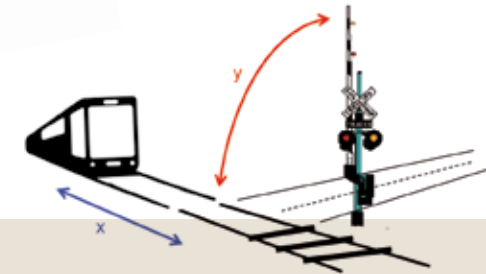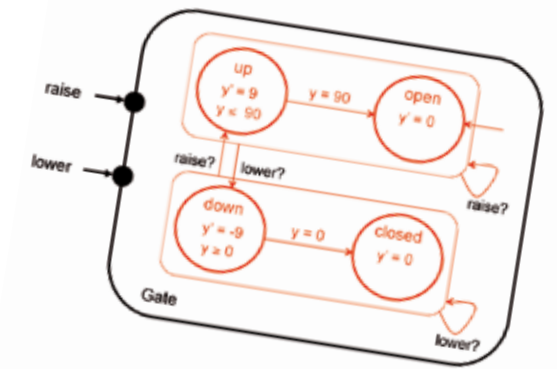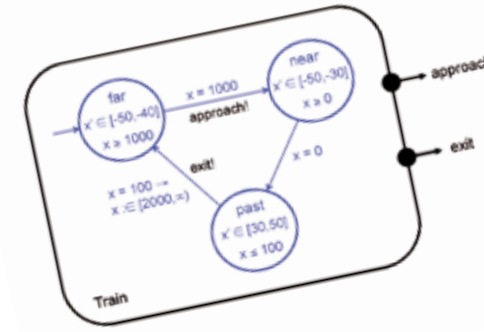
An embedded system is a software system that interacts with the physical world, such as the electronic components in a car or aircraft. For such embedded systems, the main technical challenge is to get the software to react in real time. For a flight control system it is not only critical that the software computes the right results, but also that it does so sufficiently fast.

Our tools for building more reliable software are mathematical logic, automata theory, and models of computation.

Some of these models can be used also to mimic certain biological systems, making the field inherently interdisciplinary. Computational models of, say, a living cell are different from mathematical equations as they can be executed on a computer and used to study the causal relationships between different events in the cell. This new field of research has been dubbed "Executable Biology."

Current Projects
› Quantitative modeling and analysis of reactive systems
› Interfaces and contracts for component-based hardware and software design
› Predictability and robustness for real-time and embedded systems
› Modern concurrency paradigms such as software transactional memory and cloud computing
› Model checking biochemical reaction networks

P SELECTED PUBLICATIONS
1. Guerraoui R, Henzinger TA, Singh V. 2010. Model checking transactional memories. Distributed Computing 22:129-145.
2. Henzinger TA. 2008. Two challenges in embedded systems design: Predictability and robustness. Philosophical Transactions of the Royal Society A 366:3727-3736.
3. Fisher J, Henzinger TA. 2007. Executable cell biology. Nature Biotechnology 25:1239-1249.
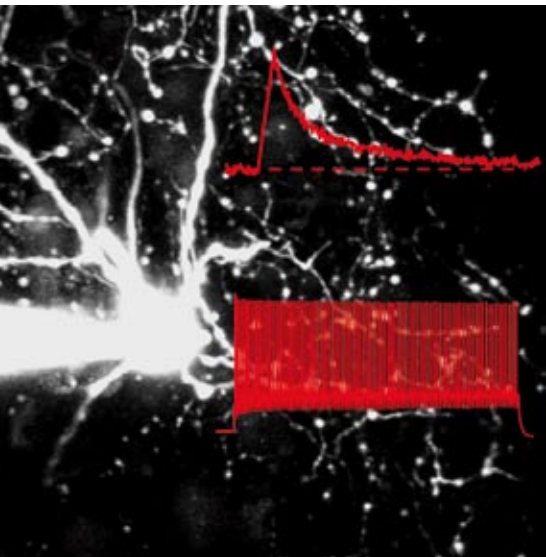
T TEAM
Pavol Cerny, Postdoc
Dejan Nickovic, Postdoc
Arjun Radhakrishna, PhD student
Ali Sezgin, Postdoc
Vasu Singh, Postdoc
Anmol Tomar, PhD student
Thomas Wies, Postdoc
Damien Zufferey, PhD student

CV CAREER
2009	Professor, IST Austria
2005–	Adjunct Professor, University of California, Berkeley, USA
2004–2009	Professor, EPFL, Lausanne, Switzerland
1999–2000	Director, Max-Planck Institute, Saarbrücken, Germany
1998–2005	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 of Grenoble, France
1991	PhD, Stanford University, Palo Alto, USA

SELECTED DISTINCTIONS
	ISI Highly Cited Researcher
2010	ERC Advanced Grant
2009	Corresponding Member, Austrian Academy of Sciences
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

PETER JONAS SYNAPTIC TRANSMISSION IN HIPPOCAMPAL MICROCIRCUITS

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

CV

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

SELECTED DISTINCTIONS
2010   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
1992   Habilitation

P

SELECTED PUBLICATIONS
1. Nörenberg A, Hu H, Vida I, Bartos M, Jonas P. 2010. Distinct non-uniform cable properties optimize rapid and efficient activation of fast-spiking GABAergic interneurons. Proceedings of the National Academy of Sciences USA 107: 894-899.
2. Bucurenciu I, Bischofberger J, Jonas P. 2010. A small number of open Ca^{2+} channels trigger transmitter release at a central GABAergic synapse. Nature Neuroscience 13: 19-21.
3. Hu H, Martina M, Jonas P. 2010. Dendritic mechanisms underlying rapid synaptic activation of fast-spiking hippocampal interneurons. Science 327: 52-58.

T

TEAM
Itaru Arai, Postdoc
Jian Gan, Postdoc
Sarit Goswami, PhD student
Jose Guzman, Postdoc
Sooyun Kim, PhD student
Janina Kowalski, Postdoc
Florian Marr, Technical assistant
Rajiv Mishra, PhD student
Alejandro Pernía-Andrade, Postdoc
Yvonne Stickler, Postdoc
Nicholas Vyleta, Postdoc

Combined patch-clamp recording and presynaptic Ca^{2+} imaging from a fast-spiking GABAergic interneuron.

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 billions of neurons, which communicate with each other at a huge number (~10^{15}) of specialized sites. These sites of contact and communication between neurons are termed synapses. Very broadly, synapses in the brain fall into two categories: excitatory synapses releasing the transmitter glutamate and inhibitory synapses releasing the transmitter γ-aminobutyric acid (GABA). My research team wants to quantitatively address the mechanisms of synaptic signaling at these highly specialized synaptic sites in the brain. To achieve this, we will use multiple-cell recording, subcellular patch-clamp techniques, Ca^{2+} imaging, and modeling.

Current Projects
Nanophysiology of Fast-spiking, GABAergic Interneurons
The goal is to completely map the distribution of ion channels at soma, dendrites, and presynaptic terminals of this key type of GABAergic interneuron, and to directly analyze the resulting functional properties. To achieve this goal, we will use cutting-edge subcellular patch-clamp recording techniques pioneered in my lab. As fast-spiking, GABAergic interneurons play a key role in the control of the stability of the network and the generation of rhythmic activity in the brain, the results will provide insight into the mechanisms underlying dynamic activity of neuronal networks in health and disease.

Functional Analysis of Glutamatergic Synaptic Connections between Hippocampal Pyramidal Neurons
In this project, we will record from ensembles of hippocampal CA3 pyramidal neurons and examine the properties of glutamatergic synaptic connections. In particular, we want to determine the induction rules of synaptic plasticity, including long-term potentiation and depression. As the synapses between CA3 pyramidal neurons play a key role in

learning and memory, the results will be important to understand the mechanisms underlying the processing and storage of information in the hippocampus.

Development of Realistic Network Models of Hippocampal Microcircuits
Our ultimate goal is to understand how synaptic properties shape complex network functions. To reach this goal, we will develop computational models of neuronal networks based on our experimental findings. Beyond reproducing experimental observations, we anticipate that modeling will make specific predictions, which can be tested experimentally. The interdisciplinary research platform of IST Austria, in particular the presence of several computer science groups, will greatly facilitate our modeling efforts.

CHRISTOPH LAMPERT
COMPUTER VISION AND MACHINE LEARNING

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 explores these problems with the tools of Computer Vision and Machine Learning.

We study and develop statistical machine learning algorithms for computer vision applications, in particular for the task of natural image understanding. Machine learning enables automatic systems to analyze large amounts of high dimensional data with significant between-feature correlations. This makes it particularly suitable for computer vision problems, such as the analysis of digital images with respect to their contents. In the long run, we are 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 images? Where are they located? How do they interact?

Current Projects
Efficient Objects and Action Localization
The tasks of identifying and locating objects in natural images are crucial components for any automatic image understanding system, and they are inherently linked. We work on developing fast learning and inference techniques

for object localization based on formulating the problem as a regression task between structured spaces instead of a sequence of classification tasks. This allows the use of global optimization techniques, such as branch-and-bound, instead of the exhaustive search used by currently dominating sliding window approaches.

Attribute-Enabled Representations
Image understanding on a semantic level requires knowledge not only about the presence and location of objects,

but also about their properties. We work on extending existing image and object representations by attributes. These are characteristic properties of a scene or an object category that can be predicted from the image information, but also have a semantic interpretation. Our goal is to show that attribute-enabled representations can achieve higher classification accuracy than purely object-centric ones, that they require less training data and that they allow solving new image-related prediction tasks, for example for making decisions about the importance of objects in a scene.

Structured Prediction and Learning
We are working on extending and improving existing techniques for the prediction of structured objects using machine learning techniques, in particular graph labeling problems. Treating these in a framework of empirical risk minimization allows us to develop algorithms that can learn prediction functions that are tailored to the specific prediction tasks and thereby achieve higher prediction accuracy. In particular, we work on developing techniques for handling the cases of ambiguous input and outputs.

Object recognition in natural images: learning-based computer vision techniques can detect objects and describe them semantically.

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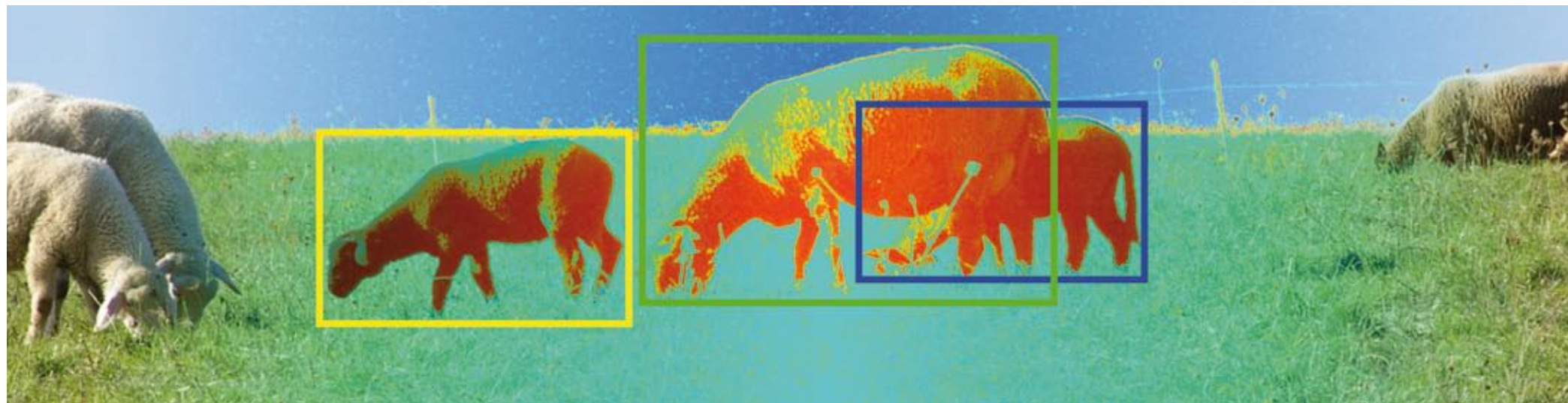
CAREER
2010 Assistant Professor, IST Austria
2007–2010 Senior Research Scientist, Max-Planck Institute, Tübingen, Germany
2004–2007 Senior Researcher, German Research Center for Artificial Intelligence, Kaiserslautern, Germany
2003 PhD, University of Bonn, Germany

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

P **SELECTED PUBLICATIONS**
1. 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.
2. 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.
3. Blaschko MB, Lampert CH. 2008. Learning to localize objects with structured output regression. European Conference on Computer Vision (ECCV), 2–15.

T **TEAM**
Novi Quadrianto, Research intern
Viktoriia Sharmaska, PhD student
Elena Tretyak, Research intern

MICHAEL SIXT MOLECULAR MECHANICS OF IMMUNE CELLS

Every answer gives room to new, fascinating questions: How does a cell change its form? And what impact does it have on the surrounding tissue, which is formed by its likes? The Sixt Group investigates these problems of Cell Biology and Immunology.

The image shows a snapshot of a video sequence capturing dendritic cells that are about to enter a lymphatic vessel in the skin. Dendritic cells are labeled in red and position in close vicinity of the basement membrane of the lymphatic vessel that is labeled in white.

The laboratory investigates morphodynamic processes both at the cellular and at the tissue level. We mainly focus on the immune system and try to understand the molecular and mechanical principles underlying leukocyte dynamics during processes such as migration and intercellular communication. We work at the interface of cell biology, immunology and biophysics and currently investigate how the cytoskeleton generates force to deform the cell body, how this force is transduced to the extracellular environment and how the cells are polarized and guided within tissues. To obtain a holistic view of the process we are also studying tissue architecture as well as the distribution and presentation of guidance cues (chemokines) within these tissues. We developed a number of in vitro tools that allow us to observe cytoskeletal dynamics in real time using different life cell imaging approaches. These are all based on advanced light microscopy like total internal reflection, fast confocal and multiphoton technology. We combine these approaches with genetic and pharmacological interference as well as substrate manipulations like surface micropatterning and microflui-

dics. A general aim of the lab is to test in vitro findings also in the context of living tissues. To this end we also developed ex vivo (tissue explant) and in vivo imaging setups that allow us to monitor leukocytes together with their physiological environment. Finally we are also interested in testing the implications of our findings for physiological immune responses.

Current Projects

› Environmental control of leukocyte migration: We are investigating how different extracellular constraints like the form of chemokine presentation, mechanical forces and the geometry and molecular composition of the extracellular substrate, affect leukocyte locomotion.
› Cellular force generation and transduction: We ask how cytoskeletal activity is translated into actual locomotion. This includes transmembrane force coupling receptors but also locomotion by other means like physical deformation of the cell body.
› Invasion of tissue barriers: How do leukocytes traverse tissue boundaries like endothelial / epithelial layers and extracellular matrix barriers like basement membranes?

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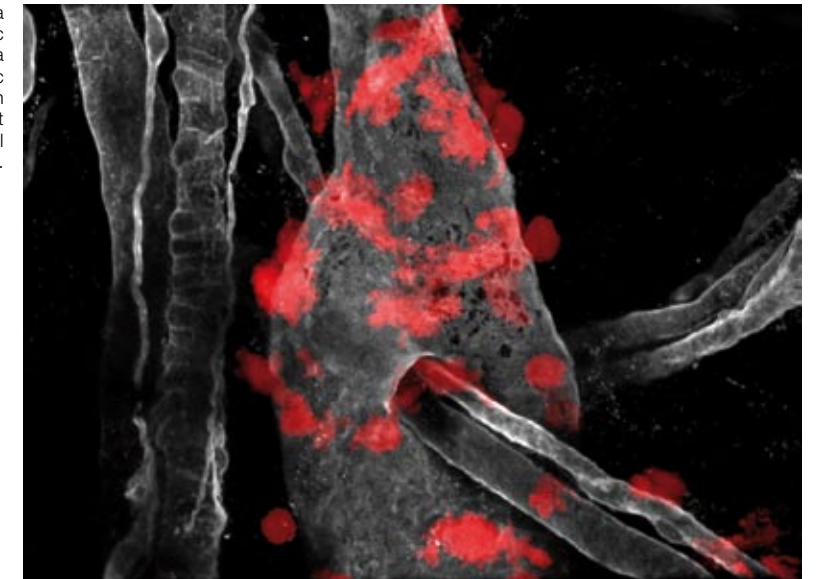
CAREER
2010 Assistant Professor, IST Austria
2008–2010 Endowed Professor, Peter Hans Hofschneider Foundation for Experimental Biomedicine
2005–2010 Group Leader, Max-Planck Institute, Martinsried, Germany
2003–2005 Postdoc, Institute for Experimental Pathology, Lund, Sweden
2003 MD, University of Erlangen,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

T

TEAM
Alexander Eichner, PhD student
Michele Weber, Postoc
Ingrid de Vries, Technical assistant

P

SELECTED PUBLICATIONS
1. 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.
2. Renkawitz J, Schumann K, Weber M, Lämmermann T, Pflicke H, Polleux J, Spatz JP, Sixt M. 2009. Adaptive force transmission in amoeboid cell migration. Nature Cell Biology 11(12): 1438-1443.
3. 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.

IST AUSTRIA PROFESSORS
Starting in 2011

Applications and nominations
2'286

Evaluated by international experts
304

Invited to campus
117

Offers made
28

Offers accepted
16

Jozsef Csicsvari

Jozsef Csicsvari graduated with an MS in informatics from the Technical University of Budapest in 1993. He received a PhD in neuroscience under the supervision of Gyorgy Buzsaki at Rutgers University, where he finished his thesis in 1999 and continued as a postdoctoral fellow until 2002. In 2003 he became a group leader at the MRC Anatomical Neuropharmacology Unit in Oxford. Jozsef's main research interest lies in the field of systems neuroscience. He explores neural cell assembly activities in the hippocampus, a brain region that plays important roles in long-term memory and spatial navigation. Coming from a computer background, he pioneered methodologies allowing large-scale cell assembly recordings and their computer analysis. Jozsef will join IST Austria as Professor in July 2011.

Harald Janovjak

Harald Janovjak works at the interface of biophysics and cell biology. He studied molecular biology in Basel, received a PhD from the TU Dresden in 2005, and worked as a postdoc in the group of Ehud Isacoff at the University of California in Berkeley. Harald developed new techniques to study the folding and unfolding of single membrane proteins using atomic force microscopy. Later he concentrated on the manipulation of ion channels using light and established a new method for the light-induced inhibition of nerve cell activity. Such combinations of optical and genetic techniques, called optogenetics, are of increasing importance for understanding

information processing in the brain. Harald will join IST Austria as Assistant Professor in March 2011.

Gašper Tkačik

Gašper Tkačik is a theoretical physicist studying information processing in living systems. He studied mathematical physics at the University of Ljubljana and received a PhD in the group of William Bialek at Princeton University. Since 2008 he has been a postdoc at the University of Pennsylvania. Gašper uses tools from the statistical physics of disordered systems and from information theory to study biological systems such as networks of neurons or genes. The unifying hypothesis driving his research is that information processing networks have evolved or adapted to maximize the information transmitted from their inputs to their outputs, given the biophysical noise and resource constraints. Gašper will join IST Austria as Assistant Professor in March 2011.

Chris Wojtan

Chris Wojtan received a BS in computer science in 2004 from the University of Illinois in Urbana-Champaign. He then moved to the Georgia Institute of Technology for his PhD studies. Chris' research is in computer graphics, with a special focus on the realistic simulation of physical systems. Using numerical techniques, he creates computer animations of physical phenomena like fluids, deformable bodies, or cloth. He combines mathematical methods from computational physics with geometric techniques from computer graphics. Chris will join IST Austria as Assistant Professor in 2011.

FACULTY RECRUITING
at IST Austria

The scientific fields of IST Austria are chosen on the basis of the availability of outstanding scientists. The Institute will not enter into any field of research unless it can attract professors who compete internationally at the forefront of their discipline, and unless it can provide them with an environment that allows the scientists to perform at the highest level. The overall recruiting process requires a coordinated strategy of identifying the best available faculty candidates while, at the same time, avoiding the dangers of scientific isolation, by creating networks of research groups in related fields and around intellectual connections between different disciplines.

IST Austria advertises open positions internationally and invites both applications and nominations of candidates. The Institute also tries to actively identify and approach potential candidates, for example, by tracking Austrian scientists abroad. IST Austria is committed to equality and diversity in hiring. Female scientists, in particular, are encouraged to apply and the Institute actively supports their careers.

The complete recruiting statistics is shown in the in the figure. Until December 31, 2010, IST Austria received 2'286 applications and nominations. Thereof, 55 % were considered as candidates for Assistant Professor, 45 % for Professor; 14 % of the candidates were female; 55 % of the candidates worked in the physical, mathematical, and engineering sciences, 45 % in the life sciences; 81 % of the candidates applied, 19 % were nominated. The candidates worked in 74 countries: 51 % in Europe, 39 % in North America, and 10 % on other continents.

After an initial screening, the most promising candidates are evaluated in detail by collecting reviews from leading international scientists. Fewer than 10 % of the candidates have been invited to campus to give a scientific lecture and be interviewed by the professors of the Institute. Less than 2 % of all candidates have received an offer from IST Austria, and 59 % of the offers have been accepted. Given that the best scientists are sought after all over the world, similar success rates are seen even at some of the most prestigious institutions.

PUBLICATIONS AND RESEARCH GRANTS 2010

Publications by IST Members accepted in 2010 (joint publications involving several groups are listed multiple times)

BARTON GROUP

› Barton, N.H., 2010. The role of natural selection in speciation. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 365(1547), 1825-1840.
› Barton, N.H., 2010. Mutation and the evolution of recombination. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 365(1544), 1281-1294.
› Barton, N.H., 2010. Estimating multilocus linkage disequilibria. In: *Heredity*, 84 (Pt 3), 373-389.
› Barton, N.H., 2010. Understanding adaptation in large populations. In: *PLoS Genetics*, 6(6), e1000987-e1000987.
› Barton, N.H., 2010. Genetic linkage and natural selection. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 365(1552), 2559-2569.
› Palero, F., Abelló, P., Macpherson, E., Matthee, C. & Pascual, M., 2010. Genetic diversity levels in fishery-exploited Palinurus spiny lobsters (Decapoda: Achelata). *Journal of Crustacean Biology*, 30(4), 658-663.
› Palero, F., González-Candelas, F. & Pascual, M., 2010. MICROSATELIGHT – Pipeline to Expedite Microsatellite Analysis. *Journal of Heredity*, in press.
› Palero, F., Guerao G., Clark P.F, & Abelló, P., 2010. Scyllarus arctus (Crustacea: Decapoda: Scyllaridae) final stage phyllosoma identified by DNA analysis, with morphological description. *Journal of the Marine Biological Association of the United Kingdom*, in press.
› Rosas, U., Barton, N.H., Copsey, L., Barbier de Reuille, P. & Coen, E., 2010. Cryptic variation between species and the basis of hybrid performance. *PLoS Biology*, 8(7), e1000429-e1000429.
› Senn, H.V., Swanson, G.M., Goodman, S.J., Barton, N.H. & Pemberton, J.M., 2010. Phenotypic correlates of hybridisation between red and sika deer (genus Cervus). *Journal of Animal Ecology*, 79(2), 414-425.
› de Vladar, H.P. & Barton, N.H., 2010. The statistical mechanics of a polygenic character under stabilizing selection, mutation and drift. *Journal of the Royal Society Interface*, in press.
› de Vladar, H.P. & Chela-Flores, J., 2010. Can Multicellularity be anticipated in the exploration of the solar system?. In: *A. Hanslmeier, S. Kempe, & J. Seckbach. Cellular Origin and Life in Extreme Habitats and Astrobiology. Life in the Universe From the Miller Experiment To the Search For Life on Other Worlds*, 83-87.

BOLLBACK GROUP

› Hollatz, C., Vilaca, S., Redondo, R., Marmontel, M., Baker, C. & Santos, F., 2010. The Amazon River as an ecological barrier to Pink Dolphin (Inia geoffrensis) marginal populations. *Biological Journal of the Linnean Society*, in press.
› Kûpczok, J., 2010. Consequences of different null models on the tree shape bias of supertree methods. Systematic Biology, in press.
› Pavan, A., Martins, F., Santos, F., Ditchfield, A. & Redondo, R., 2010. Patterns of diversification in two species of short-tailed bats (Carollia Gray, 1838): the effects of historical fragmentation of Brazilian rainforests. *Biological Journal of the Linnean Society*, in press.

CHATTERJEE GROUP

› Berwanger, D., Chatterjee, K., De Wulf, M., Doyen, L. & Henzinger, T.A., 2010. Strategy construction for parity games with imperfect information. *Information and Computation*, 208(10), 1206-1220.
› Bloem, R., Chatterjee, K., Greimel, K., Henzinger, T.A. & Jobstmann, B., 2010. Robustness in the Presence of Liveness. In: Lecture Notes in Computer Science 6174. *CAV: Computer-Aided Verification*. Springer, 410-424.
› Chatterjee, K. & Doyen, L., 2010. Energy Parity Games. In: Lecture Notes in Computer Science 6199. *ICALP: Automata, Languages and Programming*. Springer, 599-610.
› Chatterjee, K. & Doyen, L., 2010. The Complexity of Partial-Observation Parity Games. In: *LPAR: Logic For Programming, Artificial Intelligence, and Reasoning*. Springer, 1-14.

EDELSBRUNNER GROUP

› Bendich, P. & Harer, J., 2010. Persistent Intersection Homology. *Foundations of Computational Mathematics*, in press.
› Bendich, P., Edelsbrunner, H., Kerber, M. & Patel, A., 2010. Persistent Homology under Non-uniform Error. In: Lecture Notes in Computer Science 6281. *MFCS: Mathematical Foundations of Computer Science*. Springer, 12-23.

› Chatterjee, K. & Henzinger, M., 2010. Faster and Dynamic Algorithms For Maximal End-Component Decomposition And Related Graph Problems In Probabilistic *Verification. In: SODA: Symposium on Discrete Algorithm*. Association for Computing Machinery, in press.
› Chatterjee, K. & Henzinger, T.A., 2010. A survey of stochastic omega-regular games. *Journal of Computer and System Sciences*, in press.
› Chatterjee, K. & Henzinger, T.A. (editors), 2010. *FORMATS: Formal Modeling and Analysis of Timed Systems*. Lecture Notes in Computer Science 6246. Springer.
› Chatterjee, K. & Henzinger, T.A., 2010. Probabilistic Automata on Infinite Words: Decidability and Undecidability Results. In: Lecture Notes in Computer Science 6252. *ATVA: Automated Technology For Verification and Analysis*. Springer, 1-16.
› Chatterjee, K. & Majumdar, R., 2010. Discounting in Games across Time Scales. In: Electronic Proceedings in Theoretical Computer Science. *GandALF: Games, Automata, Logic, and Formal Verification 2010*. EPTCS.
› Chatterjee, K., Alfaro, L.D. & Henzinger, T.A., 2010. Qualitative concurrent parity games. *ACM Transactions on Computational Logic*, in press.
› Chatterjee, K., de Alfaro, L., Majumdar, R. & Raman, V., 2010. Algorithms for Game Metrics. *Logical Methods in Computer Science*, 6(3:13), 1-27.
› Chatterjee, K., de Alfaro, L., Raman, V. & Sanchez, C., 2010. Analyzing the Impact of Change in Multi-threaded Programs. In: Lecture Notes in Computer Science 6013. *FASE: Fundamental Approaches To Software Engineering*. Springer, 293-307.
› Chatterjee, K., Doyen, L. & Henzinger, T.A., 2010. Expressiveness and closure properties for quantitative languages. *Logical Methods in Computer Science*, 6(3:10), 1-23.
› Chatterjee, K., Doyen, L. & Henzinger, T.A., 2010. Qualitative Analysis of Partially-Observable Markov Decision Processes. In: Lecture Notes in Computer Science 6281. *MFCS: Mathematical Foundations of Computer Science*. Springer, 258-269.
› Chatterjee, K., Doyen, L. & Henzinger, T.A., 2010. Quantitative Languages. *ACM Transactions on Computational Logic*, 11(4:23), 1-38.
› Chatterjee, K., Doyen, L., Edelsbrunner, H., Henzinger, T.A. & Rannou, P., 2010. Mean-Payoff Automaton Expressions. In: Lecture Notes in Computer Science 6269. *CONCUR: Concurrency Theory*. Springer, 269-283.
› Chatterjee, K., Doyen, L., Gimbert, H. & Henzinger, T.A., 2010. Randomness for Free. In: Lecture Notes in Computer Science 6281. *MFCS: Mathematical Foundations of Computer Science*. Springer, 246-257.
› Chatterjee, K., Doyen, L., Henzinger, T.A. & Raskin, J., 2010. Generalized Mean-payoff and Energy Games. In: Leibniz International Proceedings in Informatics. *FSTTCS: Foundations of Software Technology and Theoretical Computer Science*. Springer, in press.
› Chatterjee, K., Henzinger, T.A. & Piterman, N., 2010. Strategy logic. *Information and Computation*, 208(6), 677-693.
› Chatterjee, K., Henzinger, T.A., Jobstmann, B. & Radhakrishna, A., 2010. Gist: A Solver for Probabilistic Games. In: Lecture Notes in Computer Science 6174. *CAV: Computer-Aided Verification*. Springer, 665-669.
› Chatterjee, K., Henzinger, T.A., Jobstmann, B. & Singh, R., 2010. Measuring and Synthesizing Systems in Probabilistic Environments. In: Lecture Notes in Computer Science 6174. *CAV: Computer-Aided Verification*. Springer, 380-395.
› Chatterjee, K., Horn, F. & Löding, C., 2010. Obliging Games. In: Lecture Notes in Computer Science 6269. *CONCUR: Concurrency Theory*. Springer.
› Chatterjee, K., Horn, F. & Loeding, C., 2010. Obligingness Games. In: Lecture Notes in Computer Science 6269. *CONCUR: Concurrency Theory*. Springer, 284-296.

EDELSBRUNNER GROUP

› Bendich, P., Edelsbrunner, H., Morozov, D. & Patel, A., 2010. Robustness of Level Sets. In: Lecture Notes in Computer Science 6346. *ESA: European Symposium on Algorithms*. Springer, 1-10.
› Berberich, E., Halperin, D., Kerber, M. & Pogalnikova, R., 2010. Polygonal Reconstruction from Approximate Offsets. In: *Eurocg European Workshop on Computational Geometry*. TU Dortmund, 12-23.
› Chatterjee, K., Doyen, L., Edelsbrunner, H., Henzinger, T.A. & Rannou, P., 2010. Mean-Payoff Automaton Expressions. In: Lecture Notes in Computer Science 6269. *CONCUR: Concurrency Theory*. Springer, 269-283.
› Chen, C. & Freedman, D., 2010. Topology noise removal for curve and surface evolution. In: *MCV: Medical Computer Vision*. in press.
› Edelsbrunner, H., Michael Kerber, & Paul Bendich,, 2010. Computing Robustness and Persistence for Images. In: *VIS: IEEE Conference on Visualization*, 16(6). IEEE, 1251-1260.
› Edelsbrunner, H., Morozov, D. & Patel, A.K., 2010. The stability of the apparent contour of an orientable 2-manifold. In: Mathematics and Visualization. *Topological Data Analysis and Visualization: Theory, Algorithms and Applications*. Springer, 27-42.
› Fasy, B., 2010. The difference in length of curves in R^n.. *Acta Sci. Math*. Szeged, in press.
› Kerber, M. & Edelsbrunner, H., 2010. Covering and packing with spheres by diagonal distortion in R^n. In: *Rainbow of Computer Science*. Springer, in print.
› Kerber, M. & Sagraloff, M., 2010. A Note on the Complexity of Real Algebraic Hypersurfaces. *Graphs and Combinatorics*, in press.

HEISENBERG GROUP

› Heisenberg, C. & Krens, G., 2010. Cell sorting in development. In: *Current Topics in Developmental Biology*, in press.
› Diz-Muñoz, A., Krieg, M., Bergert, M., Ibarlucea-Benitez, I., Muller, D., Paluch, E. & Heisenberg, C., 2010. Control of directed cell migration in vivo by membrane-to-cortex attachment. In: *PLoS Biology*, 8(11), e1000544.
› Quesada-Hernández, E., Caneparo, L., Schneider, S., Winkler, S., Liebling, M., Fraser, S. & Heisenberg, C., 2010. Stereotypical cell division orientation controls neural rod midline formation in zebrafish. In: *Current biology*, 21(20), 1966-1972.
› Klopper, A., Krens, G., Grill, S. & Heisenberg, C., 2010. Finite-size corrections to scaling behavior in sorted cell aggregates. In: *The European Physical Journal E - Soft Matter and Biological Physics*, 33(2), 99-103.
› Papusheva, E. & Heisenberg, C.P., 2010. Spatial organization of adhesion: force-dependent regulation and function in tissue morphogenesis. In: *EMBO Journal*, 29(16), 2753-2768.
› Carvalho, L. & Heisenberg, C., 2010. The yolk syncytial layer in early, zebrafish development. In: *Trends In Cell Biology*, 20(10), 586-592.

HENZINGER GROUP

› Berwanger, D., Chatterjee, K., De Wulf, M., Doyen, L. & Henzinger, T.A., 2010. Strategy construction for parity games with imperfect information. *Information and Computation*, 208(10), 1206-1220.
› Beyer, D., Henzinger, T.A., Théoduloz, G. & Zufferey, D., 2010. Shape Refinement through Explicit Heap Analysis. In: Lecture Notes in Computer Science 6013. *FASE: Fundamental Approaches To Software Engineering*. Springer, 263-377.
› Blanc, R., Henzinger, T.A., Hottelier, T. & Kovacs, L., 2010. ABC: Algebraic bound computation for loops. In: Lecture Notes in Computer Science 6355. *LPAR: Logic for Programming, Artificial Intelligence, and Reasoning*. Springer, 103-118.
› Bloem, R., Chatterjee, K., Greimel, K., Henzinger, T.A. & Jobstmann, B., 2010. Robustness in the Presence of Liveness. In: Lecture Notes in Computer Science 6174. *CAV: Computer Aided Verification*. Springer, 410-424.
› Burckhardt, S., Musuvathi, M. & Singh, V., 2010. Verifying Local Transformations on Relaxed Memory Models. In: Lecture Notes in Computer Science 6011. *CC: Compiler Construction*. Springer, 104-123.

› Černý, P., Henzinger, T.A. & Radhakrishna, A., 2010. Quantitative Simulation Games. In: Lecture Notes in Computer Science 6200. *Time For Verification: Essays in Memory of Amir Pnueli*. Springer, 42-60.
› Černý, P., Henzinger, T.A. & Radhakrishna, A., 2010. Simulation Distances. In: Lecture Notes in Computer Science 6269. *CONCUR: Concurrency Theory*. Springer, 42-60.
› Černý, P., Radhakrishna, A., Zufferey, D., Chaudhuri, S. & Alur, R., 2010. Model Checking of Linearizability of Concurrent List Implementations. In: Lecture Notes in Computer Science 6174. *CAV: Computer-Aided Verification*. Springer, 465-479.
› Chatterjee, K. & Henzinger, T.A., 2010. A survey of stochastic omega-regular games. *Journal of Computer and System Sciences*, in press.
› Chatterjee, K. & Henzinger, T.A. (editors), 2010. *FORMATS: Formal Modeling and Analysis of Timed Systems*. Lecture Notes in Computer Science 6246. Springer.
› Chatterjee, K. & Henzinger, T.A., 2010. Probabilistic Automata on Infinite Words: Decidability and Undecidability Results. In: Lecture Notes in Computer Science 6252. *ATVA: Automated Technology For Verification and Analysis*. Springer, 1-16.
› Chatterjee, K., Alfaro, L.D. & Henzinger, T.A., 2010. Qualitative concurrent parity games. *ACM Transactions on Computational Logic*, in press.
› Chatterjee, K., Doyen, L. & Henzinger, T.A., 2010. Expressiveness and closure properties for quantitative languages. *Logical Methods in Computer Science*, 6(3:10), 1-23.
› Chatterjee, K., Doyen, L. & Henzinger, T.A., 2010. Qualitative Analysis of Partially-Observable Markov Decision Processes. In: Lecture Notes in Computer Science 6281. *MFCS: Mathematical Foundations of Computer Science*. Springer, 258-269.
› Chatterjee, K., Doyen, L. & Henzinger, T.A., 2010. Quantitative Languages. *ACM Transactions on Computational Logic*, 11(4:23), 1-38.
› Chatterjee, K., Doyen, L., Edelsbrunner, H., Henzinger, T.A. & Rannou, P., 2010. Mean-Payoff Automaton Expressions. In: Lecture Notes in Computer Science 6269. *CONCUR: Concurrency Theory*. Springer, 269-283.
› Chatterjee, K., Doyen, L., Gimbert, H. & Henzinger, T.A., 2010. Randomness for Free. In: Lecture Notes in Computer Science 6281. *MFCS: Mathematical Foundations of Computer Science*. Springer, 246-257.
› Chatterjee, K., Doyen, L., Henzinger, T.A. & Raskin, J., 2010. Generalized Mean-payoff and Energy Games. In: Leibniz International Proceedings in Informatics. *FSTTCS: Foundations of Software Technology and Theoretical Computer Science*. Springer, in press.
› Chatterjee, K., Henzinger, T.A. & Piterman, N., 2010. Strategy logic. *Information and Computation*, 208(6), 677-693.
› Chatterjee, K., Henzinger, T.A., Jobstmann, B. & Radhakrishna, A., 2010. Gist: A Solver for Probabilistic Games. In: Lecture Notes in Computer Science 6174. *CAV: Computer-Aided Verification*. Springer, 665-669.
› Chatterjee, K., Henzinger, T.A., Jobstmann, B. & Singh, R., 2010. Measuring and Synthesizing Systems in Probabilistic Environments. In: Lecture Notes in Computer Science 6174. *CAV: Computer-Aided Verification*. Springer, 380-395.
› Chatterjee, K., Henzinger, T.A. & Prabhu, V.S., 2010. Timed parity games: Complexity and robustness. *Logical Methods in Computer Science*, in press.
› Didier, F., Henzinger, T.A., Mateescu, M. & Wolf, V., 2010. Approximation of event probabilities in noisy cellular processes. *Theoretical Computer Science*, in press.
› Didier, F., Mateescu, M., Wolf, V. & Henzinger, T.A., 2010. Sabre: A tool for the stochastic analysis of biochemical reaction networks. In: *QEST: Quantitative Evaluation of Systems*. IEEE, 193-194.
› Doyen, L., Henzinger, T., Legay, A. & Nickovic, D., 2010. Robustness of Sequential Circuits. In: *ACSD: Application of Concurrency To System Design*. IEEE Computer Society, 77-84.
› Feret, J., Henzinger, T.A., Koeppl, H. & Petrov, T., 2010. Lumpability abstractions of rule-based systems. In: Electronic Proceedings in Theoretical Computer Science. *MECBIC: Membrane Computing and Biologically Inspired Process Calculi*. Open Publishing Association, 137-156.

› Ghosal, A., Iercan, D., Kirsch, C.M., Henzinger, T.A. & Sangiovanni-Vincentelli, A., 2010. Separate compilation of hierarchical real-time programs into linear-bounded embedded machine code. *Science of Computer Programming*, in press.
› Guerraoui, R., Henzinger, T.A. & Singh, V., 2010. Model checking transactional memories. In: *Distributed Computing*. Springer, 129-145.
› Guerraoui, R., Henzinger, T.A., Kapalka, M. & Singh, V., 2010. Transactions in the Jungle. In: *SPAA: Parallel Algorithms and Architectures*. Association for Computing Machinery, 263-272.
› Henzinger, T.A., 2010. From boolean to quantitative notions of correctness. In: *POPL: Principles of Programming Languages*. Association for Computing Machinery, 157-158.
› Henzinger, T.A., Hottelier, T. & Kovács, L., 2010. Aligators for arrays. In: Lecture Notes in Computer Science 6397. *LPAR: Logic For Programming, Artificial Intelligence, and Reasoning*. Springer, 348-356.
› Henzinger, T.A., Hottelier, T.B., Kovács, L. & Voronkov, A., 2010. Invariant and type inference for matrices. In: *Lecture Notes in Computer Science 5944*. VMCAI: Verification, Model Checking, and Abstract Interpretation. Springer, 163-179.
› Henzinger, T.A., Jobstmann, B. & Wolf, V., 2010. Formalisms for specifying Markovian population models. *International Journal of Foundations of Computer Science*, in press.
› Henzinger, T.A., Mateescu, M., Mikeev, L. & Wolf, V., 2010. Hybrid numerical solution of the chemical master equation. In: Lecture Notes in Bioinformatics. *CMSB: Computational Methods in Systems Biology*. Springer, in press.
› Henzinger, T.A., Singh, A.V., Singh, V., Wies, T. & Zufferey, D., 2010. A Marketplace for Cloud Resources. In: *EMSOFT: Embedded Software*. Association for Computing Machinery, 1-8.
› Henzinger, T.A., Singh, A.V., Singh, V., Wies, T. & Zufferey, D., 2010. FlexPRICE: Flexible Provisioning of Resources in a Cloud Environment. In: *CLOUD: Cloud Computing*. IEEE, 83-90.
› Jones, K.D., Konrad, V. & Nickovic, D., 2010. Analog property checkers: a DDR2 case study. *Formal Methods in System Design*, 36(2), 114-130.
› Kuncak, V., Piskac, R., Suter, P. & Wies, T., 2010. Building a Calculus of Data Structures. In: Lecture Notes in Computer Science 5944. *VMCAI: Verification, Model Checking, and Abstract Interpretation*. Springer, 26-44.
› Mateescu, M., Wolf, V., Didier, F. & Henzinger, T.A., 2010. Fast adaptive uniformization of the chemical master equation. *IET Systems Biology*, 4(6), 441-452.
› Nickovic, D. & Piterman, N., 2010. From MTL to Deterministic Timed Automata. In: Lecture Notes in Computer Science 6246. *FORMATS: Formal Modeling and Analysis of Timed Systems*. Springer, 152-167.
› Podelski, A. & Wies, T., 2010. Counterexample-guided focus. In: *POPL: Principles of Programming Languages. Association for Computing Machinery*, 249-260.
› Singh, V., 2010. Runtime Verification of Transactional Memories. In: *Lecture Notes in Computer Science 6418*. Rv International Conference on Runtime Verification. Springer, 421-435.
› Wies, T., Zufferey, D. & Henzinger, T.A., 2010. Forward Analysis of Depth-Bounded Processes. In: Lecture Notes in Computer Science 6014 . *FOSSACS: Foundations of Software Science and Computation Structures*. Springer, 94-108.
› Wolf, V., Goel, R., Mateescu, M. & Henzinger, T.A., 2010. Solving the chemical master equation using sliding windows. *BMC Systems Biology*, 4:42, 1-19.

JONAS GROUP

› Guzman, S.J. & Jonas, P., 2010. Beyond TARPs: the growing list of auxiliary AMPAR subunits (Review). *Neuron*, 66(1), 8-10.
› Guzman, S.J., Schmidt, H., Franke, H., Krügel, U., Eilers, J., Illes, P. & Gerevich, Z., 2010. P2Y1 receptors inhibit long-term depression in the prefrontal cortex. *Neuropharmacology*, 59(6), 406-415.
› Jonas, P. & Hefft, S., 2010. GABA release at terminals of CCK-interneurons: synchrony, asynchrony and modulation by cannabinoid receptors (commentary on Ali & Todorova). *The European Journal of Neuroscience*, 31(7), 1194-1195.

LAMPERT GROUP

› Lampert, C.H. & Krömer, O., 2010. Weakly-Paired Maximum Covariance Analysis for Multimodal Dimensionality Reduction and Transfer Learning. In: Lecture Notes in Computer Science 6311. *ECCV: European Conference on Computer Vision*. Springer, 566-579.
› Lampert, C.H. & Peters, J., 2010. Real-Time Detection of Colored Objects In Multiple Camera Streams With Off-the-Shelf Hardware Components. *Journal of Real-Time Image Processing, Epub ahead*, 1-11.
› Nowozin, S., Gehler, P. & Lampert, C.H., 2010. Learning in CRF-based Approaches to Object Class Image Segmentation. In: Lecture Notes in Computer Science 6316. *ECCV: European Conference on Computer Vision*. Springer, 98-111.

ADMINISTRATION

› Bergmann, J. & Danowski, P., 2010. Ist Bibliothek 2.0 überhaupt noch relevant? – Eine Einleitung in das Handbuch. In: *Handbuch Bibliothek 2.0*, 5-20.
› Bergmann, J. & Danowski, P., 2010. *Handbuch Bibliothek 2.0*. Bibliothekspraxis. deGruyter.
› Sabeti-Aschraf, M., Gonano, C., Nemecek, E., Cichocki, L. & Schueller-Weidekamm, C., 2010. Intra-operative ultrasound facilitates the localization of the calcific deposit during arthroscopic treatment of calcifying tendinitis. *Medicine Knee Surgery Sports Traumatology Arthroscopy*, 18(12), 1792-1794-1794.

Peer-reviewed Research Grants acquired or active in 2010

BARTON GROUP

› Limits to selection in biology and in evolutionary computation, ERC, € 1'975'000, 7/2010 – 6/2015.

CHATTERJEE GROUP

› RiSE - Rigorous Systems Engineering, FWF, € 450'000, 3/2011 – 2/2015.

CREMER GROUP

› Social Vaccines - Social Vaccination in Ant Colonies: from Individual Mechanisms to Society Effects, ERC, € 1'375'000, 11/2010 – 3/2015.
› Host-Parasite Coévolution, DFG, € 95'000, 11/2010 –12/2011.

EDELSBRUNNER GROUP

› Roots Grant, NSF, $ 160'000 , 9/2010 – 12/2011.

HEISENBERG GROUP

› SPP, DFG, € 45'000, 2/2010.
› ZF Cancer, EC-FP7, € 138'000, 4/2008 – 3/2011.
› SFRH/BD/60401/2009, FCT-PT, € 12'000, 11/2010.

HENZINGER GROUP

› Combest. EC-FP7, € 107'000, 1/2008 – 12/2010.
› Artist Design, EC-FP7, € 63'000, 1/2007 –12/2011.
› RiSE - Rigorous Systems Engineering, FWF, € 450'000, 3/2011 – 2/2015.
› Quantitative Reactive Modeling (QUAREM), ERC, € 2'300'000, 9/2011– 8/2016.

JONAS GROUP

› DFG/780, DFG/FWF, € 46'000.
› Nanophysiology of fast-spiking, parvalbumin-expressing GABAergic interneurons, ERC, € 2'500'000, 7/2011–6/2016.

SIXT GROUP

› Zytoskelettdynamik und Kraftgenerierung wandernder Leukozyten, DFG, € 110'000, 11/2010 4/2012.
› Einfluss der Chemokinpräsentation auf das Reaktionsmuster von Leukozyten, DFG, € 117'000, 1/2011 –12/2012.
› Role of the WAVE-complex in the haematopoietic System, DFG, € 70'000, 11/2010 – 12/2011.

BOARDS of IST Austria

ADMINISTRATION

In 2010 the most important milestone of campus development was the opening of the Bertalanffy Foundation Building. On the same day, October 13, the groundbreaking ceremony for the second laboratory building took place. We expect the second laboratory building to open in the fall of 2012; it will provide space for an additional 12 experimental research groups.

Over the past year the ratio of administrative personnel to scientists has changed noticeably. Our main task has shifted from setting up administrative structures to providing service to the scientists. Much of this service is being bundled within Scientific Service Units, the first of which are currently being set up. In the future the Scientific Service Units and the support staff for scientists (technicians, administrative assistants) will grow in parallel with the growth of the research personnel, while the administration of the Institute will grow only moderately.

Our most important goal remains providing the best possible and most efficient support for creating a prospering scientific environment. I would like to thank all administrative employees for their efforts and achievements and look forward to our further collaboration at IST Austria.

Gerald Murauer, Managing Director

SCIENTIFIC SERVICE UNITS
Supporting the Scientists
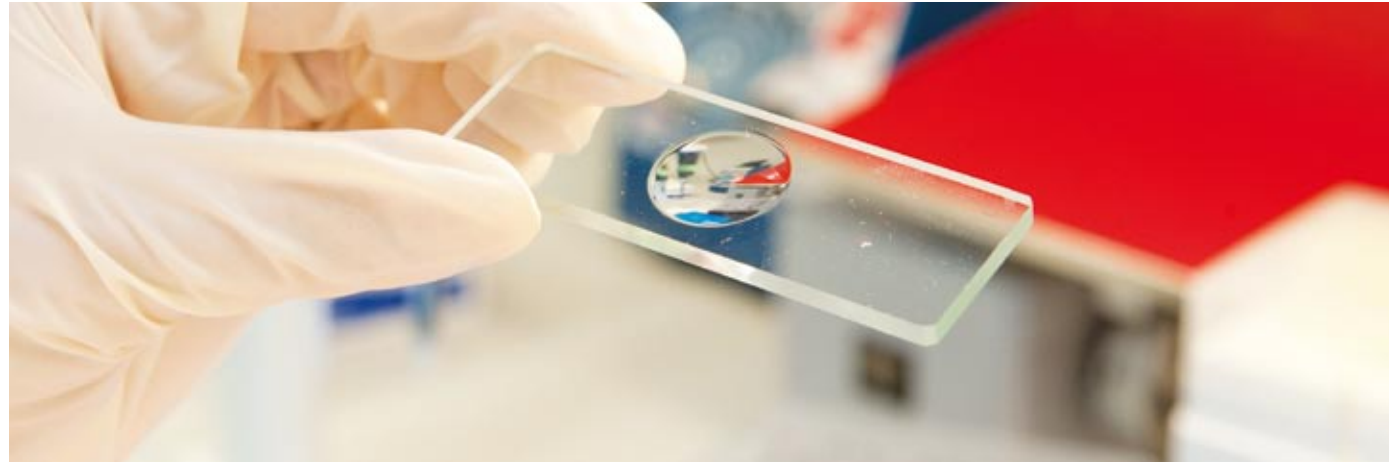
SCIENTIFIC SERVICE UNITS

Bioimaging Facility: Ekaterina Papusheva (Facility Manager; 1), Robert Hauschild

Information Technology: Franz Schäfer (Facility Manager; 2), Michael Adletzberger, Michael Brandstätter, Alois Schlögl

Library: Patrick Danowski (3)

Life Sciences Facility: Matthias Nowak (Facility Manager; 4), Michael Schunn (Facility Manager; 5), Cornelia Kohl, Günther Reiterer, Eva Schlegl, Melanie Sedlacek, Renate Srsek, Mersija Smailagic

Machine Shop: Todor Asenov, Mathias Wascher

A major challenge in 2010 was the establishment of several Scientific Service Units, whose purpose is to provide the scientists with the cutting-edge equipment and professional services that allow them to perform research at an internationally competitive level. The philosophy of IST Austria is to maximize the sharing of equipment and services among multiple research groups, in order to avoid a duplication of efforts and expenses within different groups. The Scientific Service Units of IST Austria are central core facilities that can be used by all scientists of the Institute.

The following Scientific Service Units are currently being set up:
› **Bioimaging Facility:** A number of state-of-the-art microscopes support the work of the cell biologists. Currently the facility includes two confocal microscopes, an atomic-force microscope, a fluorescent stereo microscope, and a multi-photon microscope.
› **Information Technology:** In addition to standard IT services we offer a cluster of machines for scientific computation as well as programmers to support the scientists in their software needs.
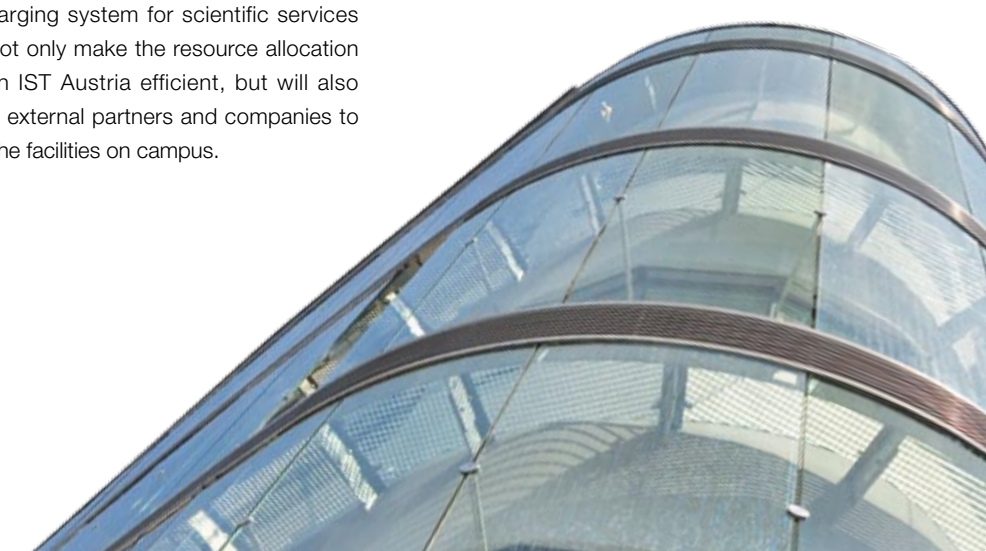
› **Library:** The library of IST Austria is designed as a predominantly electronic library, providing electronic access to scholarly journals, conference proceedings, and books.
› **Life Sciences Facility:** In addition to standard research infrastructure for biology, such as laminar flow hoods, autoclaves, centrifuges, and fridges, a media kitchen, a FACS machine, and services for the neuroscientists are part of the facility.
› **Machine Shop:** A milling machine, a turning machine, a grinding and buffing machine, and several smaller pieces of equipment support our scientists in fabricating customized laboratory set-ups.

A charging system for scientific services will not only make the resource allocation within IST Austria efficient, but will also allow external partners and companies to use the facilities on campus.

IST LECTURES Presenting
Distinguished Scientists

IST Austria actively seeks to educate the public about the importance and impact of basic science–through the IST Lecture series, where renowned international scientists are invited to give public talks on campus, and through the annual Open Campus Day and Science-Industry Talk.

The IST Lectures are targeted towards a general audience interested in current developments in science. The speakers are asked to provide sufficient background information for non-experts and, at the same time, go into detailed explanations of a recent scientific topic. Each talk is followed by a Questions and Answers session. The events are concluded by a social get-together offering further possibilities for conversations with the speaker. Special public transportation from and to Vienna is usually provided.

IST Lecture 1: Martin Nowak

Martin Nowak inaugurated the IST Lecture series on November 27, 2009. Nowak, a native of Austria, is professor of biology and of mathematics at Harvard University and director of Harvard's program for Evolutionary Dynamics. His research focuses on the mathematical description of evolutionary processes, including the evolution of cooperation and human language, and the dynamics of virus infections and human cancer. In his lecture Nowak, who is also a member of the Scientific Board of IST Austria, started by giving an explanation of Darwin's achievements. From this, he led the audience to one of his current research topics, the "Evolution of Cooperation: From Selfish Genes to Supercooperators."

IST Lecture 2: Ada Yonath

As part of a series of events on the occasion of the Institute's first anniversary, Ada Yonath visited IST Austria on June 16, 2010, to give the second IST Lecture. Yonath, one of the 2009 Nobel laureates for Chemistry, is the Martin S. and Helen Kimmel Professor of Structural Biology at the Weizmann Institute in Israel. On this first visit to Austria after being awarded the Nobel Prize, Yonath lectured about "The Amazing Ribosome, its Origin and its Tiny Enemies, the Antibiotics". In the talk she related her personal story of how she got to focus on the mechanism of protein biosynthesis by investigating the structures and functions of ribosomes–the translators from RNA to proteins. Yonath's insights contributed decisively to our better understanding of these molecular engines and to the development of antibiotics targeting ribosomal structures.

IST Lecture 3: Jeannette Wing

In the third IST Lecture on September 27, 2010, Jeanette Wing introduced the audience to her concept of "Computational Thinking". Wing, who recently headed the Computer and Information Science and Engineering Directorate at the US National Science Foundation, is the President's Professor of Computer Science and head of the Computer Science Department at Carnegie-Mellon University in Pittsburgh. Her research focuses on the areas of trustworthy computing, programming languages, and software engineering. Wing summarizes her vision for the twenty-first century as follows: "Computational thinking will be a fundamental skill used by everyone in the world. To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability. Teaching computational thinking can not only inspire future generations to enter the field of computer science but benefit people in all fields."

The IST Lecture series will continue in 2011. The next lecture, –on March 10, 2011–will be given by Angelika Amon, Professor of Biology at the Massachusetts Institute of Technology and member of the Scientific Board of IST Austria. For forthcoming events, please visit the Institute's website: **www.ist.ac.at**.

1 Martin Nowak gives the first IST Lecture in the Raiffeisen Lecture Hall.

2 Martin Nowak, Professor of Biology and Mathematics at Harvard University, USA

3 Ada Yonath speaking about ribosomal structure and antibiotics.

4 Audience enjoys refreshments.

5 Ada Yonath, Martin S. and Helen Kimmel Professor of Structural Biology at the Weizmann Institute, Rehovot, Israel

6 Jeannette Wing, President's Professor of Computer Science, Head of the Computer Science Department at the Carnegie-Mellon University, Pittsburgh, USA

7 IST Austria President Tom Henzinger and Jeannette Wing

COMMUNICATING
Science

IST Austria friends and neighbors at the Open Campus Day

Communicating science is a central mission of IST Austria–to many kinds of different audiences, be it to fellow researchers from other institutions within the relative privacy of a seminar room, or to children and their parents at the Open Campus Day on the lawn next to the pond. The Institute has developed a set of different formats in order to satisfy the information demands of very distinct target groups interested in the activities of the Institute.

Open Campus Day and School Competition
The biggest event is the annual Open Campus Day on a weekend in late May or early June, celebrating the anniversary of the Institute's inauguration on June 1, 2009. In 2010 approximately 750 visitors came to the Open Campus Day, enjoying public lectures by faculty members Sylvia Cremer, Carl-Philipp Heisenberg, and Thomas Henzinger, a paper plane competition, a science tour for kids, and a BBQ for parents.

A central activity at each Open Campus Day is the award ceremony for a school science competition aimed, in three different age categories, at elementary and high school students from the Klosterneuburg region. In 2010 IST Austria invited participants from 6 to 19 years to "Show us your world of numbers – mathematics in everyday life". The contributors were asked for creative ideas on where to find mathematical concepts–apart from the math lessons in school. With such competitions the Institute wants to instill and deepen in children of all ages a fascination with science and with the role of science in everyday life. The large number of entries showed a remarkable enthusiasm of children and teachers alike.

Meeting our Neighbors
Frequent Neighborhood Talks aim at satisfying the curiosity of the local community about the latest developments at IST Austria. Members of the administration regularly inform regional clubs and associations about the progress at the Institute, and in particular, about physical changes on campus.

Science-Industry Talk
The Science-Industry Talk is an annual event with the goal to foster the interaction between the basic research community–which includes IST Austria–and the business world. The event is organized jointly by the Federation of Austrian Industry (IV) and IST Austria. In 2010 the event was devoted to the question "What kind of research is needed in Austria?" After words of welcome by the Federal Minister of Science and Research, Beatrix Karl, and the President of the Vienna chapter of the IV and chairman of the Kapsch AG, Georg Kapsch, the panel members Thomas Henzinger (IST Austria), Christian Schilling (CEO, Boehringer Ingelheim RCV GmbH), Edeltraud Stiftinger (Head of Corporate Technology CEE, Siemens AG Österreich), and Georg Winckler (Rector, University of Vienna) discussed many different aspects of the multifaceted relationship between science and industry.

Scientific Symposia, Conferences, and Talks
Scientific symposia, conferences, and summer schools are platforms for researchers to meet and exchange ideas. In 2010 IST Austria hosted four symposia ("Biology meets Physics" in January, "Reactive Modeling in Science and Engineering" in April, "Neuroscience: From Molecules to Code" in June, and "Condensed Matter Physics and Optics" in December). In September 2010 the Institute hosted the eighth annual international conference on "Formal Modeling and Analysis of Timed Systems", which brought together computer scientists from the whole world who study real-time computation. The workshop on "Evolutionary Genetics" held in the same month offered graduate students from 18 countries the opportunity to meet some of the leading researchers in that domain.

Throughout the year seminar talks link IST Austria to the scientific community, both locally and globally. The lectures cover not only research topics represented at the Institute, but also bring scientists in new fields to the Institute. Over the course of the year 72 talks by external scientists were held on campus. Sometimes the speakers might be known only to their fellow experts. But this can change abruptly. On March 23 Konstantin Novoselov (School of Physics and Astronomy, University of Manchester) presented his findings on "Graphene and its Chemical Derivatives" in room number 3 of the Mondi Seminar Center in the Central Building of IST Austria. On October 5 Novoselov was named Nobel Laureate in physics – the youngest Nobel Prize winner in 37 years.

SCIENTIFIC EVENTS

January 25, 2010
Biology meets Physics

May 6–7, 2010
Reactive Modeling in Science and Engineering

June 22, 2010
Neuroscience: From Molecules to Code

September 8–10, 2010
Formal Modeling and Analysis of Timed Systems (FORMATS)

September 28–October 1, 2010
Introduction to Evolutionary Genetics

November 27, 2010
Open Day for Prospective Students

December 20, 2010
Condensed Matter Physics and Optics

PUBLIC EVENTS

May 29, 2010
Open Campus

June 16, 2010
IST Lecture Ada Yonath

June 21, 2010
Science-Industry Talk: What Kind of Research is Needed in Austria?

September 27, 2010
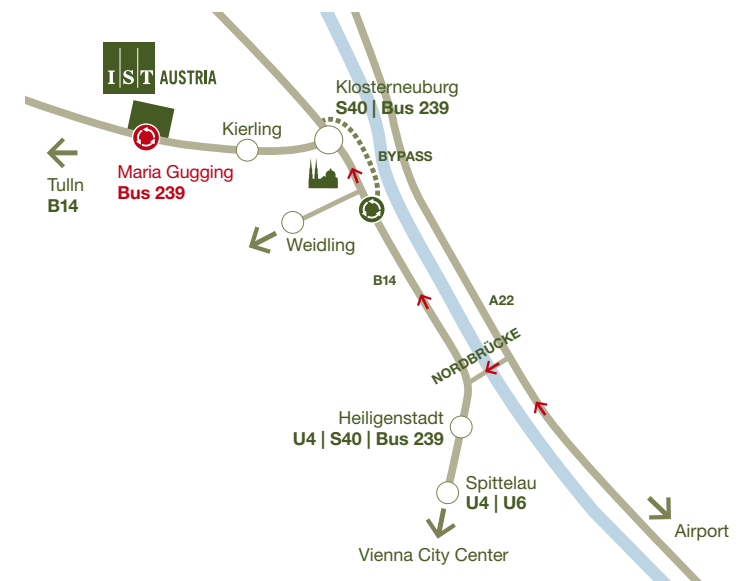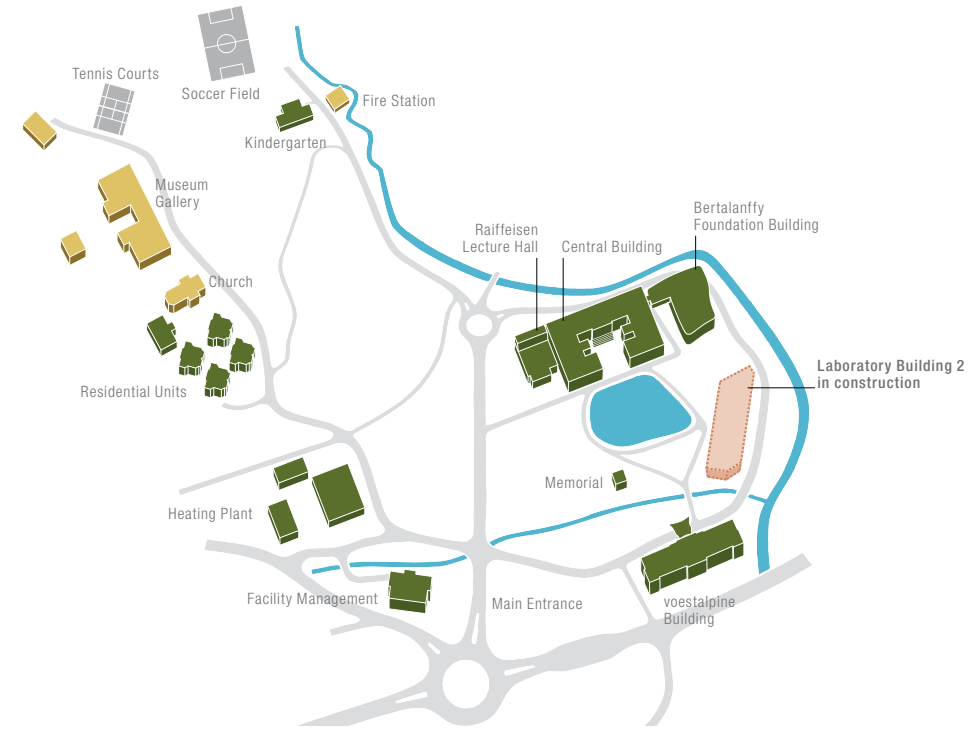IST Lecture Jeannette Wing

SPEAKERS AT IST AUSTRIA IN 2010 Almut Arneth, Lund, SWE ∣ Michalis Averof, Crete, GRE ∣ Nathalie Q. Balaban, Jerusalem, ISR ∣ Claudia Bank, Vienna, AUT ∣ Jiri Barnat/David Safranek, Brno, CZE ∣ Udi Boker, Jerusalem, ISR ∣ Radu Ioan Bot, Chemnitz, GER ∣ Frank Bradke, Martinsried, GER ∣ Brona Brejova, Bratislava, SVK ∣ Pinaki Chakraborty, Urbana-Champaign, USA ∣ Enrico Cœn, Colney/Norwich, UK ∣ Otto Cordero, Cambridge, USA ∣ Jozsef Csicsvari, Oxford, UK ∣ Tal Dagan, Düsseldorf, GER ∣ Benoit Delahaye, Cachan, FR ∣ Alexander DeLuna, Cinvestav, MEX ∣ Martin Depken, Amsterdam, NED ∣ Francesco Dinuzzo, Pavia, ITA ∣ Laurent Doyen, Cachan, FR ∣ Santiago F. Elena, València, ESP ∣ Jan Engelstædter, Zurich, SUI ∣ Dmitry Feichtner-Kozlov, Bremen, GER ∣ Jasmin Fisher, Cambridge, UK ∣ Matthias Fuegger, Vienna, AUT ∣ Carsten Grashoff, Charlottesville, USA ∣ George Haller, Montreal, CAN ∣ Michael Häusser, London, UK ∣ Juergen Heinze, Regensburg, GER ∣ Gerhard Hummer, Bethesda, USA ∣ Harald Janovjak, Berkeley, USA ∣ Fedor Jelezko, Stuttgart, GER ∣ Felicity Jones, Palo Alto, USA ∣ Paul Joyce, Moscow, USA ∣ Satish Babu Korada, Palo Alto, USA ∣ Laura Kovacs, Vienna, AUT ∣ Daniel Krœning, Oxford, UK ∣ Daniel Kronauer, Cambridge, USA ∣ Leslie Lamport, Mountain View, USA ∣ Georg Langs, Cambrigde, USA ∣ Julian McAuley, Canberra, AUS ∣ Dmitri Miroshnychenko, Vienna, AUT ∣ Thomas Moscibroda, Redmond, USA ∣ Konstantin S. Novoselov, Manchester, UK ∣ Pleuni S. Pennings, Cambridge, USA ∣ Peter Rabl, Innsbruck, AUT ∣ Friederike Range, Vienna, AUT ∣ Jean-Francois Raskin, Bruxelles, BEL ∣ Jochen C. Rink, Salt Lake City, USA ∣ Denis Roze, Edinburgh, UK ∣ Andrey Rybalchenko, Munich, GER ∣ Paul Schmid-Hempel, Zurich, SUI ∣ Hinrich Schulenburg, Kiel, GER ∣ Peter Schurtenberger, Fribourg, SUI ∣ Olivier Serre, Paris, FR ∣ Ali Sezgin, Istanbul, TUR ∣ Ana Sokolova, Salzburg, AUT ∣ Federico Sukno, Barcelona, ESP ∣ Sorin Tanase-Nicola, Atlanta, USA ∣ Michael Tautschnig, Vienna, AUT ∣ Gasper Tkacik, Philadelphia, USA ∣ Enrico Tronci, Rome, ITA ∣ Rien van de Weygaert, Groningen, NED ∣ Jerœn S. van Zon, Cambrigde, USA ∣ Alipasha Vaziri, Chevy Chase, USA ∣ Zhikun Wang, Tübingen, GER ∣ Daniel Weissman, Klosterneuburg, AUT ∣ Thomas Wies, Klosterneuburg, AUT ∣ Claus O. Wilke, Austin, USA ∣ Chris Wojtan, Atlanta, USA ∣ Florian Wolschin, Tempe, USA ∣ Yuen-Tsu Yu, Bloomington, USA ∣ Florian Zuleger, Vienna, AUT

LOCATION
and Directions

Prague • Brno
Klosterneuburg
◄ Linz
IST Austria
Bratislava ►
River Danube
Vienna
Budapest ►
Graz
Schwechat

The city of Klosterneuburg is known for its high quality of living. The location between the river Danube and the rolling hills of the Vienna Woods, with its vineyards, pastures, and forests, provides an exceptional environment that is both tranquil and stimulating for studying and recreation. The city offers educational, medical, social, and cultural facilities of the highest standard.

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

Tennis Courts, Soccer Field, Fire Station, Kindergarten, Museum Gallery, Raiffeisen Lecture Hall, Central Building, Bertalanffy Foundation Building, Church, Laboratory Building 2 in construction, Residential Units, Memorial, Heating Plant, Facility Management, Main Entrance, voestalpine Building

IST AUSTRIA, Kierling, Klosterneuburg S40 | Bus 239, Maria Gugging Bus 239, Tulln B14, BYPASS, Weidling, B14, A22, NORDBRÜCKE, Heiligenstadt U4 | S40 | Bus 239, Spittelau U4 | U6, Vienna City Center, Airport