Schweizer Klub für Wissenschaftsjournalismus
Association suisse du journalisme scientifique
Swiss Association of Science Journalism

The Chance of a Lifetime: Study Trip to Switzerland, March 19 – 21, 2014

Highlighting: → exclusive field-test through the new Gotthard Base railway tunnel
→ laboratory incubator for blood vessels and organs
→ brain imaging techniques for psychiatric treatment

The Swiss Association of Science Journalism gladly plays host to 35 European science journalists during an extraordinary study trip to Zurich, Gotthard tunnel and Lugano. Free accommodation and transport in Switzerland

Deadline for application: January 31, 2014

Wed, March 19	**Disney Research**, ETH Zurich
Thurs, March 20	**World Food System Center**, ETH Zurich, **Regenerative Medicine** and **Mechanobiology**, ETH & University Zurich **Translational Neuromodeling Unit**, ETH & University Zurich **Bombardier Transportation Switzerland**, Zurich-Oerlikon
Fri, March 21	**Gotthard Base Tunnel Infrastructure**, Alptransit Gotthard **Swiss National Super Computing Centre CSCS**, Lugano

Where there was smoke, there is Disney computer animation

***Prof. Dr Markus Gross**, ETH Zurich, Director of Disney Research Zurich,*

Disney Research Zurich has strong ties to the Computer Graphics Lab at the ETH Zurich under Prof. Dr. Markus Gross, whose software for smoke simulation, designed together with Cornell University, has had a great impact on the Hollywood film industry. Disney Research started its own lab in Zurich in 2008, appointing Gross as its director in 2008. Recent research includes accurate face modelling encompassing the modelling of sparse facial hair; further 2D and 3D animation; and video retargeting, which allows images to be presented on a variety of display media.

Where there's smoke, there's fire, so the proverb claims. But the smoke simulation software named *Wavelet Turbulence,* developed by Markus Gross and his colleagues at Cornell University in 2008, first kindled a fire in the film industry. *Wavelet Turbulence* became popular among studios and was used in productions such as *Avatar, Kung fu Panda, Monsters vs. Aliens* etc., winning a "Tech Oscar" from the Academy of Motion and Picture Arts and Sciences (AMPAS) in 2013.

At present, 45 researchers conduct over 70 distinct research projects in the fields of graphics, computer animation, face modelling, video processing, stereo 3D, computational materials, and wireless communication. In his talk, Markus Gross will outline some of the ongoing research, highlight the scientific challenges and explain the potential of the results for the various Disney business units. His examples will include facial modelling, 2D and 3D animation, video retargeting, stereo 3D processing, and the 3D reproduction of materials

Just recently, Disney Research lab developed a new method of high-quality face modelling using only the image of a consumer binocular camera as a reference basis. Another challenge was to combine face modelling with the modelling of facial hair, which one has so far not been able to include in motion capture. Moreover, by using a special wrap-analysis software which leaves the proportions of salient areas like faces and objects unchanged, Disney Research has attained a video retargeting method that enables people to watch films on a variety of display media.

In collaboration with the ETH Institute of Robotics and Intelligent System, Disney Research lab has also developed a collision-avoiding software program for multiple robots. Additional research includes wireless networking and computational materials.

Scheduled for Wed, March 19, evening followed by a welcome dinner and welcome address of the ETH Zurich

Sustainable Ways to Solve the Nutrition Problem

Dr Martijn Sonnevelt *,Agri-food & Agri-environmental Economics Group, Institute for Environmental Decisions, ETH Zurich*
Béatrice Conde-Petit*, Senior Expert Food Science & Technology, Bühler AG*
Dr Diego Moretti*, Laboratory of Human Nutrition, ETH Zurich*

In the search for new solutions to the question of how to feed the world, the World Food System Center of the ETH Zurich focuses on areas such as sustainable production, food for health, resource efficiency and connecting to markets. The following topics are presented: The grain-value-chains – namely how food security can be obtained in the next 40 years in the face of enormous population growth and social changes. The delivering nutrition through solutions for sustainable value chains as well as the role of fortified nutrition, using as example iron-fortified rice, whose benefit the ETH has studied in China and Kenya.

The question of how to feed the world while taking human health, the environment and social well-being into consideration is one of the defining challenges of our time. In order to play a key role in addressing this challenge, the ETH Zurich established the *World Food System Center* (WFSC) in 2011. The centre coordinates the activities of seven departments of the ETH. *The Global Grain Value Chain* of Dr Martijn Sonnevelt is one of the three presentations to be outlined to the journalists. The method of the analysis and some case studies will be presented. A predominant example might be the case of soya, a crop amply produced in China. Due to growing meat consumption increasing demand for soya, however, China needs to import soya from Brazil, now the second-largest exporter of this crop. How does this demand influence the global grain value chain and what are the key variables? Moreover, what measures should be taken to guarantee that food crises can be overcome?

The second presentation expands on the collaboration of the multidisciplinary group within the WFSC including leading companies from the agri-food industry such as Bühler, a global market leader in the supply of flour production plants and founding member of the WFSC. Béatrice Conde-Petit will explain why rice processing typically involves stripping away the nutrient-rich bran layer, which is later corrected through micronutrient fortification. Moreover, she will outline why Indian Chapatti bread stands for favourable wholegrain nutrition and at the same time for a technological step change in milling. There will be a discussion on the challenge and opportunities of grains for nutrition in a global market of today and tomorrow. Connecting science and technology to consumers and markets might be the key to make sustainable nutrition happen.

The third project concerns the role of fortified nutrition to combat vitamin and mineral deficiencies, which are ranked among the top causes of poor health and disability in the world. It has been demonstrated that food fortification can be a sustainable, cost-effective approach to reducing vitamin and mineral deficiency. Rice is a major staple food worldwide, but is a poor source of dietary iron when it is milled and refined. Rice-eating populations are, therefore, at risk of iron deficiency and iron deficiency anaemia (IDA). In the early years of this century, the *Laboratory of Human Nutrition* of the ETH investigated rice fortification. In collaboration with the Center for Advanced Food Technology, Rutgers University, New Jersey, and St John's Medical College in Bangalore, India, the Laboratory of Human Nutrition was able to demonstrate for the first time that iron-fortified rice results in acceptable food products. These rice products can be regularly consumed in school feeding programs and are effective in reducing iron deficiency in vulnerable populations. Journalists will learn the results of the most recent studies carried out in Brazil and Cambodia and get to know how fortified rice technologies are about to scale up to industrial production.

Scheduled for Thurs, March 20, morning

Regenerative Medicine and Mechanobiolgy as its Premise

Prof. Dr med Simon Hoerstrup, *Swiss Center for Regenerative Medicine, University Hospital and University Zurich, Switzerland.*
Prof. Dr Viola Vogel, *Laboratory of Applied Mechanobiology, Department of Health Sciences and Technology, ETH Zurich, Switzerland.*

Regenerative medicine is about to achieve a breakthrough. Approval to carry out the clinical pilot study of tissue-engineered vascular-grafts grown from patient's own cells was recently given to the Swiss Center for Regenerative Medicine at the University Hospital Zurich. Prof. Simon P. Hoerstrup and his team had previously demonstrated that the growing of arteries and heart-valves from stem or progenitor cells depends greatly on a favourable environment whereby not only the appropriate scaffold but also the adequate biomechanical stress plays a crucial part. How cells exploit mechanical forces to communicate with their environment is the chosen field of Prof. Viola Vogel. In her Laboratory of Applied Mechanobiology at the ETH Zurich, she has developed new techniques to investigate how cells translate the feedback received from their environment as they pull on it to regulate their functions and tissue regeneration processes.

A fundamental problem related to the healing of most degenerative tissue damage or traumatic injury is fibrosis. Fibrosis and scarring process, though, prevent functional regeneration and result in dysfunctional repair. The same holds true with regard to the body's response to novel tissue engineered implants and cell-based regenerative therapies. Our collaborative goal is to generate a better understanding of the biological mechanisms involved in regeneration and to translate this knowledge into bioengineering solutions.

Investigations as to how the extra-cellular microenvironment directs cell fate and tissue repair have gained major momentum only very recently. Viola Vogel has discovered various mechanisms regarding how the stretching of proteins can switch the structure-function relationship of extra-cellular proteins and how cells thereby exploit mechanical forces to sense and communicate with their environments. With nano- and micro-engineered tools, she investigates how cells recognize materials, how extra-cellular matrix and connective tissue is assembled and repaired, and how defined microenvironments regulate (stem) cell functions. A new picture is emerging regarding how mechanobiological mechanisms regulate various cell functions.

Clinically relevant cell and tissue engineering technologies comprising *de novo tissue engineering* of living neo-tissues as replacements of diseased structures such as heart valves, laboratory grown skin and *cell-based therapies* of damaged tissues such as in myocardial infarction are fundamentally dependent on human autologous cells as a living starter material. Simon Hoerstrup has pioneered novel technologies to tissue engineer living replacements (heart valves and blood vessels) made of the patient's own cells and with his or her repair, regeneration and growth capacity. Based on this work, a first-in-man clinical pilot trial with growing arteries was recently approved. Small children in particular will benefit from living replacements, because the replaced heart valves or skin keep up with their adolescence.

Journalist will get an introduction to the concept of tissue engineering and its foundations. They will visit the laboratory where the tissues grow in bioreactors and will be introduced to the high demands of good manufacturing practicing of tissue engineering.

Scheduled for Thurs, March 20, late morning

Brain Imaging Techniques for Improved Psychiatric Treatments

Prof. Dr Klaas Enno Stephan *and* ***Prof. Dr. Klaas Paul Prüssmann***
Translational Neuromodeling Unit & MR Technology Group, Institute of Biomedical Engineering, ETH Zurich & University of Zurich

The "Translational Neuromodeling Unit" (TNU) was founded as a division of the Institute of Biomedical Technology (IBT) in 2012. It combines computational modeling with non-invasive imaging technologies, such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG), in order to improve diagnosis and treatment prediction for mental illnesses such as schizophrenia or depression.

As indicated by the term "translational", the Translational Neuromodeling Unit aims at utilizing computational modeling of non-invasive brain imaging data to improve the diagnosis of psychiatric and neurological disorders and to make more accurate and verifiable treatment predictions. Critically, in order to validate the computational models in patient studies, the TNU assembles mathematical modelers, psychologists, and clinicians under one roof and operates its own research clinic with custom-designed facilities.

As an expert in computational neuroscience and medical doctor, *Klaas Enno Stephan* has joined forces with *Klaas Paul Prüssmann*, an expert in magnetic resonance imaging. While *Stephan* has been developing novel mathematical analysis tools for studying neural systems, *Prüssmann* has made pioneering advances in improving the quality of MRI data acquisition. Together, these theoretical and practical advances have laid a foundation for model-based diagnoses of neural mechanisms underlying mental illnesses such as schizophrenia or depression.

The scientists of the TNU will demonstrate how computational models applied to brain imaging data may allow for more objective and quantitative diagnoses of disease processes and may help to predict individual treatment. In particular, they will explain why translational neuromodeling promises to fill the gap left by the failure of genetics and other biological approaches to provide clinically useful procedures for psychiatry.

Scheduled for Thurs, March 20, afternoon

Bombardier high-speed transportation with roots in Oerlikon

Stéphane Wettstein*, Managing Director of Bombardier Transport Switzerland*

Bombardier, the Canadian manufacturer of planes and trains, is certainly a global leader in the rail industry. When it comes to transportation, responsibility for the development, engineering and project management of electric locomotives and their propulsion and control systems is centred in Zurich-Oerlikon, the site of the famous Swiss locomotive manufacturing, which goes back to the late 19th century.

Bombardier Transportation – the rail branch of the company – consists of 6 production and engineering sites in 37 countries. Its rolling stock amounts to over 100,000 vehicles and locomotives around the world, produced and maintained by over 36,000 employees. When in 2001, Bombardier acquired Switzerland's leading locomotive industry, which was operating under the umbrella of Adtranz at that time, the well-respected engineering experience of the former Schweizerische Lokomotiv- und Maschinenfabrik (SLM) and the electric propulsion technology of ABB, formerly Brown Boveri Company (BBC), was incorporated as well. Given this history, it is quite logical that Bombardier handed their responsibility for the development, engineering and project management of electric locomotives and of propulsion and control systems for locomotives and high speed trains over to the Swiss headquarters in

Zurich-Oerlikon. It is where the first locomotive factory, Maschinenfabrik Oerlikon (MFO), opened in 1876 and where the founder of BBC used to work.

Whereas the original MFO building has remained intact and was relocated 60 metres westward in a spectacular manoeuvre in May 2012 to make space for the local train station, the actual site of Bombardier Transportation Zurich with 900 employees in Switzerland, is a modern building 200 metres nearby. It incorporates facilities for constructing prototypes for the entire portfolio of the new Modular Integrated Traction Systems (Mitrac) and houses the company's financial services

The journalists will be able to see actual testing activities at the new MITRAC Powerlab test laboratory, which opened 2009. Bombardier Transportation Switzerland Managing Director Stéphane Wettstein will inform journalists about the new propulsion technology, which enables Bombardier to be competent in Arctic areas high up north as well as Far East in China and India in the east. Before integrating the Swiss technology into Bombardier, Wettstein used to work as an engineer at BBC, and later on at ABB. Journalists will cast an eye on the Twindexx. Swiss Express motor train composition. At present, 59 compositions worth CVHF 1,9bn are in production with options for more than 100 trains.

Scheduled for Thurs, March 20, late afternoon

A field-test to gauge the Gotthard Base Tunnel's infrastructure

***Ambros Zgraggen**, Head of Media Relations, Alp Transit*

Expected to become operational at the end of 2016, the 35-mile (57-km) Gotthard Base Tunnel will be the longest rail tunnel in the world. Since the breakthrough of the tunnel in the autumn of 2010 workers and engineers from AlpTransit have been installing the railway line and rail signalling solutions. EUSJA journalists will participate in one of the tunnel field test, which will start in 2014.

To participate in a field test of the Gotthard Base Tunnel is the chance of a lifetime European science journalists belonging to EUSJA will kindly be given this chance at the very first opportunity, as the test cycles start early in 2014. Once the Gotthard Base Tunnel is given over to transalpine rail traffic at the end of 2016, there will be no chance to take a closer look at its demanding infrastructure, since every day more than 300 trains will pass in two separate tubes of 57 km in length at speeds up to 250 km per hour. The journey in the tunnel will last 17 minutes and will be no exciting experience, offering simply a view of darkness..

Participation in a field test will enable the journalists to assess the tunnel's sophisticated infrastructure, including its safety installations. Upon arrival in Biasca at the south side of the Gottard by train, the journalists will be guided to the railway control centre in Pollegio, which monitors every train manoeuvre. The rescue concept of the Gotthard Base Tunnel, including two emergency stopping places in Faido and Sedrun, will be explained. During the subsequent test ride, journalists will follow the inspection of the electronic installations of the tunnel, which function in 2400 cabinets interconnected by optical fibres. The tests include, above all, the practicality of the installed signalling solutions of the European Train Control System (ETCS) level 2 and the Global System for Mobile Communications – Railway (GSM-R), which allows the system to inform the control centre of the exact positions of the trains in real time.

The Gottard Base tunnel will definitely change transalpine traffic and, it is hoped, move the transportation of cargo from road to rail, since it knocks 1 hour off the current transit time between Zurich and Milan of 3 hours and 40 minutes.

Scheduled for Fri, March 21, morning and afternoon

Driving innovation in computational research in Switzerland

Prof. Dr Thomas Schulthess, *Director of CSCS;* ***William Sawyer****, Computational Scientist at CSCS;*
Prof. Dr Rolf Krause, *Director Institute of Computational Science , Università della Svizzera Italiana(USI)*

The Swiss National Supercomputing Centre CSCS, a unit of the ETH Zurich, provides the supercomputers and expertise that help keep Swiss science at the forefront of developments worldwide. With them, researchers can demonstrate science that was never possible with theory and experimentation alone. Computational Scientist William Sawyer explains the tools how to predict and foreshadow the global climate change and Prof. Dr. Rolf Krause demonstrates the "virtual heart" which favours electrical activation and can be used as a virtual microscope.

The Swiss National Supercomputing Centre CSCS – which originally stands for Centro Svizzero di Calcolo Scientifico – is as an autonomous unit of the ETH and the partner for Swiss universities and research institutions in the field of high-performance computing (HPC). Its basic task is to provide scientists with the computing infrastructure and expertise they need for their research. To do this, CSCS operates the very latest supercomputers and has an international 50-person team to offer its users all the expertise and efficient support they need with HPC.

HPC has gained enormously in importance over the last ten years. The methods and algorithms that have been developed by computational scientists are of great benefit to the pharmaceutical industry in developing new drugs (by simulating complex molecules and chemical reactions) and in the energy sector in producing efficient solar cells. Climate researchers use HPC in their climate forecasts, and MeteoSwiss works out its daily weather forecasts on CSCS computers. In his demonstration, Computational Scientist William Sawyer will show new software to foreshadow the gathering storm of climate change.

In order to better understand the cause of abnormalities causing heart diseases and to develop new therapies, Prof. Dr Rolf Krause hosts a "virtual heart" at the Institute of Computational Science of the Università della Svizzera italiana (USI). Based on a mathematical model for the electrical activation of the human heart, numerical simulations are carried out which allow for a detailed and deep insight into the processes ongoing in the heart muscle of the affected patients, which could not be obtained otherwise. The simulations turn the supercomputers at the CSCS into a "virtual microscope", which allows for looking into the heart down to the cellular level without touching the patient. This has several advantages: the high level of detail of these simulations can provide a better and improved diagnosis. Moreover, therapies can be tested and optimized before they are applied to the patients.

The demonstrations include the visit of the innovative new CSCS plant with the lake water cooling system and the machine room of 2,000 m^2.

Scheduled for Fri, March 21, late afternoon

The organisation of this press study trip has been made possible with the help of:
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