

NEWSLETTER

2013/23



Zürich – Basel
Plant Science Center

Editorial



Manuela Dahinden

Just recently the EU report on Monitoring Policy and Research Activities on Science in Society caught my attention. Its main message is: The role of scientists in society is changing! There are increased

expectations for scientists to be more reflective about their role and impact. Society is now less resigned about the consequences of science and potential risks and it expects more technology assessments and ethical reflection. The request for rational background information requires additional skills from scientists such as knowledge of assumptions, conditions of validity and uncertainties and not least, increased communication proficiency. Also, the increased number of stakeholders has challenged the role of science in society. An understanding of codes of conduct and customs is essential in the different circumstances in which scientists need to operate nowadays. The PSC offers a large array of courses and events introducing the above mentioned skills and tools to the future generation of plant scientists. The PhD Program Plant Science and Policy, for example, teaches how to transfer scientific knowledge into political action. In addition, the PSC is now pioneering postdoctoral education by offering a training program tailored to the needs of advanced researchers. Within the next weeks the first post docs will start the PLANT FELLOWS training program.

*Manuela Dahinden, PSC Managing Director –
Research & Communications*

Books



Nutzen und Risiken der Freisetzung gentechnisch veränderter Pflanzen – Chancen nutzen, Risiken vermeiden, Kompetenzen erhalten

Leitungsgruppe des Nationalen Forschungsprogramms NFP 59 (eds.) 2012. vdf Hochschulverlag AG an der ETH Zürich, Schweiz. 304 S., 38 CHF, ISBN 978-3-7281-3483-7



University of
Zürich ^{UZH}



ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zürich

Upcoming events

SPSW Networking with industry, 24 April 2013, Bern

International Fascination of Plants Day, 18 May 2013

Science & Policy Summer School – Governing the transition to a bio-based economy, 20–23 August 2013, Einsiedeln

Fachtagung zur Grünen Gentechnik, 6 September 2013, University of Zurich

PSC Syngenta Symposium, 26 September 2013, Stein

PLANT FELLOWS Annual Meeting, October 2013, Zurich

Plants in a Changing Climate – PSC Symposium, 8 Nov 2013, ETH Zurich

Awards

Simon Krattinger won a Grand Challenges Exploration award of the Bill & Melinda Gates Foundation for his project “Improvement of durable disease resistance in rice and sorghum: Can our knowledge of natural evolutionary events in ancient wheat landraces with broad-spectrum resistance be used to help farmers in developing countries?” (Beat Keller group).

Jeannine Klaiber received the Royal Entomological Society award for her excellent oral presentation at the RES Ento’12 Conference in July 2012 (Silvia Dorn group).

PLANT FELLOWS, third call

International Post doc Fellowship Programme in Plant Sciences

The third call will be open from 1 February until 30 April 2013.

Application templates and guidelines can be found on www.plantfellows.ch.

The PLANT FELLOWS postdoctoral-training program gets off to a good start

Eleven young scientists were chosen from the first call of the PLANT FELLOWS international Post doc fellowship program in plant sciences. The program, which is managed by the PSC, aims to provide transnational mobility, training and mentoring to Post doc candidates from around the world. The host organizations are universities, research institutes and industrial partners in Europe and across the globe. They were chosen for their excellence in research and education. As a Senior Scientific Expert I helped with the evaluation of candidates in the area of molecular biology. The first-call selection was very successful and I was impressed by the high quality of the research proposals and the excellent résumés of the applicants.

The program identified high-quality participants from Europe, the Middle East, Africa and East Asia. They will go to excellent host institutions that offer the Fellows good opportunities for scientific and career development. On a personal note, my experience with the PLANT FELLOWS program has been entirely positive. I want to commend especially Romy Kohlmann and her team in the PLANT FELLOWS program office. They were a great personal help and did a fine job coordinating the review process — everything ran smoothly and on time. This is an excellent start for a very special type of postdoctoral program.

Fred Meins, Emeritus Professor for Plant Developmental Biology at the University of Basel

Name & nationality	Project title	Moving from ... to ...	Project leader & host organisation
Dominique Arnaud, France	Unraveling the role of cytokinin in stomatal immunity	France to South Korea	Ildoo Hwang, Development Signaling Network Lab, Department of Life Sciences, Pohang University of Science and Technology (POSTECH)
Cornelia Eisenach, Germany	Regulation of vacuolar anion transport in stomatal response	United Kingdom to Switzerland	Enrico Martinoia, Institute of Plant Biology, University of Zurich
Gavin George, South Africa	Understanding how fluxes in carbohydrate metabolism control plant growth using an integrated, cross-species analysis	South Africa to Switzerland	Samuel Zeeman, Institute of Agricultural Sciences, Group of Plant Biochemistry, ETH Zurich
Ruben Gutzat, Germany	Stability of epigenetic information in the shoot apical meristem	Germany to Austria	Ortrun Mittelsten-Scheid, Gregor Mendel Institute of Molecular Plant Biology GmbH, Vienna
Heather Kirk, Canada	Evolution of floral signaling	Canada to Switzerland	Florian Schiestl, Institute of Systematic Botany, University of Zurich
Lars Götzenberger, Germany	Exploring the role of functional diversity in community assembly across scales	Estonia to Czech Republic	Jitka Klimesova, Department of Functional Ecology, Institute of Botany, Academy of Science
Ezequiel Lentz, Argentina	Molecular approaches to investigate and enhance drought tolerance in cassava	Argentina to Switzerland	Wilhelm Gruitens, Group of Plant Biotechnology, ETH Zurich
Daniela Liebsch, Germany	Cambial function of KNAT1 and STM	Germany to Sweden	Urs Fischer, Umeå Plant Science Centre
Javier Martin Sanchez, Spain	Molecular analysis of wheat disease resistance against powdery mildew and glume blotch	Spain to Switzerland	Beat Keller, Institute of Plant Biology, University of Zurich
Timothy Paape, USA	Whole genome sequencing, population genomics, gene expression and evolutionary rates in the allopolyploid species <i>Arabidopsis kamchatica</i>	USA to Switzerland	Kentaro Shimizu, Institute of Evolutionary Biology and Environmental Studies, University of Zurich
Firas Talas, Syria	Population genetics of fungicide resistance in the wheat head scab pathogen <i>Fusarium graminearum</i>	Germany to Switzerland	Bruce McDonald, Plant Pathology, Institute of Integrative Biology, ETH Zurich

EDUCATION

Spring PhD-courses 2013

- Web 2.0: How to make your research visible, 15 & 28 Feb
- Scientific writing practice II, 22 Feb & 22 Mar
- Introductory course to R, 25–27 Feb
- Plant Sciences & Policy: Communicating science, 5 Mar, 9 Apr
- Responsible conduct in research, 8 Mar & 3 May
- An introduction to data analysis using R, 18–20 Mar
- Insight into DNA barcoding, 10–12 Apr
- Transport processes in plants, 17 & 18 Apr
- Scientific presentation practice, 19 Apr, 17 May
- Dealing with the publication process, 16 & 24 May
- Next generation sequencing for model and non-model species, 28 & 29 May
- Innate immunity, 4–7 Jun
- Plant disease diagnostics, 11–13 Jun
- Conservation field course in Scotland, 6–14 Jul

Symposium

“Plants replacing fossil fuels?”

About a year ago, a group of ten PhD students from the ETH Zurich – started organizing the 2012 PSC PhD symposium. We chose a controversial topic “Plants Replacing Fossil Fuels?” since fossil sources account for 80 percent of today’s energy demand. Eleven renowned speakers from all over the world presented different aspects. David Tilman (University of Minnesota) gave a broad ecological introduction that was followed by talks from the fields of economics, ethics, technology and others. The event ended with a policy-oriented round-table plenary session. Among other issues, it was pointed out that the production of biofuels on arable land is highly problematic due to the competition with food production and the negative impacts on ecosystem functioning. Yet, the use of waste material (e.g. biogas, saw mill residues) remains an eco-friendly and sustainable option that should be taken into consideration. By the end of the day, we were amazed about how well the conference was able to illustrate the potential role plants can play in reducing anthropogenic greenhouse gas emissions and how plants can provide replacements for the continually diminishing supply of petroleum. The speakers, the atmosphere at the Auditorium Maximum, and the many questions from the large audience led to a very fruitful symposium. We thank the PSC and the sponsors (Schweizerische Universitätskonferenz, novozymes, BioConcept and Microsynth), the speakers and the moderators. The organizing committee is extremely proud of having organized the symposium.

Matthias Haeni & Sebastian Zielis, PhD students



Part of the conference organizing group

PSC website
www.plantsciences.ch

SCIENCE HIGHLIGHTS

Science 338, 116 (2012)

Natural Enemies Drive Geographic Variation in Plant Defenses

Züst T, Heichinger C, Grossniklaus U, Harrington R, Kliebenstein DJ, Turnbull LA

Plants defend themselves against attack by natural enemies, and these defenses vary widely across populations. However, whether communities of natural enemies are a sufficiently potent force to maintain polymorphisms in defensive traits is largely unknown. Here, we exploit the genetic resources of *Arabidopsis thaliana*, coupled with 39 years of field data on aphid abundance, to (i) demonstrate that geographic patterns in a polymorphic defense locus (GS-ELONG) are strongly correlated with changes in the relative abundance of two specialist aphids; and (ii) demonstrate differential selection by the two aphids on GS-ELONG, using a multigeneration selection experiment. We thereby show a causal link between variation in abundance of the two specialist aphids and the geographic pattern at GS-ELONG, which highlights the potency of natural enemies as selective forces.

Science 338, 1083 (2012)

Egg Cell-Secreted EC1 Triggers Sperm Cell Activation During Double Fertilization

Sprunck S, Rademacher S, Vogler F, Gheyselinck J, Grossniklaus U, Dresselhaus T

Double fertilization is the defining characteristic of flowering plants. However, the molecular mechanisms regulating the fusion of one sperm with the egg and the second sperm with the central cell are largely unknown. We show that gamete interactions in *Arabidopsis* depend on small cysteine-rich EC1 (EGG CELL 1) proteins accumulating in storage vesicles of the egg cell. Upon sperm arrival, EC1-containing vesicles are exocytosed. The sperm endomembrane system responds to exogenously applied EC1 peptides by redistributing the potential gamete fusogen HAP2/GCS1 (HAPLESS 2/GENERATIVE CELL SPECIFIC 1) to the cell surface. Furthermore, fertilization studies with *ec1* quintuple mutants show that successful male-female gamete interactions are necessary to prevent multiple-sperm cell delivery. Our findings provide evidence that mutual gamete activation, regulated exocytosis, and sperm plasma membrane modifications govern flowering plant gamete interactions.

Genome Research 22, 2455 (2012)

Computational Analysis and Characterization of UCE-like Elements (ULEs) in Plant Genomes

Kritsas K, Wuest SE, Hupaló D, Kern AD, Wicker T, Grossniklaus U

Ultraconserved elements (UCEs), stretches of DNA that are identical between distantly related species, are enigmatic genomic features whose function is not well understood. First identified and characterized in mammals, UCEs have been proposed to play important roles in gene regulation, RNA processing, and maintaining genome integrity. However, all of these functions can tolerate some sequence variation, not explaining their ultraconserved and ultraselected nature. We investigated whether there are highly conserved DNA elements without genic function in distantly related plant genomes. We compared the genomes of *Arabidopsis thaliana* and *Vitis vinifera*, species that diverged ~115 Mya. We identified 36 highly conserved elements with at least 85% similarity that are longer than 55 bp. Interestingly, these elements exhibit properties similar to mammalian UCEs, such that we named them UCE-like Elements (ULEs). ULEs are located in intergenic or intronic regions and are depleted from segmental duplications. Like UCEs, ULEs are under strong purifying selection, suggesting a functional role for these elements. As their mammalian counterparts, ULEs show a sharp drop of A+T content at their borders and are enriched close to genes encoding transcription factors and genes involved in development, the latter showing preferential expression in undifferentiated tissues. By comparing the genomes of *Brachypodium distachyon* and *Oryza sativa*, species that diverged ~50 Mya, we identified a different set of ULEs with similar properties in monocots. The identification of ULEs in plant genomes offers new opportunities to study their possible roles in genome function, integrity, and regulation.



PSC MEMBER

Professor Bruno Studer: new PSC member



Bruno Studer

The Forage Crop Genetics group at ETH Zurich mainly aims to develop genetic and genomic tools that can assist plant breeding. Recent technical advancements have enabled us to characterize the genetic diversity that is available for plant breeding at high resolution and allow more efficient selection based on single DNA markers or high-density genome profiles. This “molecular breeding” approach, a non-GMO strategy to increase breeding progress in crop species, is a sustainable way to improve plant productivity.

As a specific example, our efforts to characterize genetic mechanisms such as self-incompatibility or cytoplasmic male sterility increased our understanding of how to use these mechanisms as breeding tools to efficiently control pollination in forage crops. Management of these genetic mechanisms in practical breeding by means of molecular markers will help pave the way towards the implementation of more efficient hybrid breeding schemes in forage grass species. On a long-term perspective, our research will contribute to sustainable feed and food production on both the local and global level.

At the Institute of Agricultural Sciences, there is a very stimulating research atmosphere providing many interesting interactions, such as with the Crop Science group led by Professor Achim Walter. The phenotyping platforms Professor Walter is implementing offer excellent opportunities to combine crop genetics and genomics with accurate, automated and high throughput plant phenotyping. This is a very powerful combination with great potential for future plant breeding. Competence centers such as the Word Food System or the Plant Science Center are providing the necessary platforms for such interdisciplinary research... they are there, these interdisciplinary approaches, we just have to explore them!

Curriculum vitae

Bruno Studer is an Agronomist (Dipl. Ing.-Agr. ETH) educated from 1997 to 2002 at ETH Zurich. From 2003 to 2006, he was a doctoral student in Prof. Dr. Beat Keller's group at the Institute of Plant Biology, University of Zurich. His PhD project about the molecular characterization of disease resistance in Italian ryegrass (*Lolium multiflorum* Lam.) was supervised by Dr. Roland Kölliker from the Molecular Ecology group at Agroscope Reckenholz-Tänikon

Research Station (ART). After a short term at the State Plant Breeding Institute (LSA), at the University of Hohenheim, Stuttgart, Germany, he moved to Denmark. As postdoctoral scientist at the Institute of Molecular Biology and Genetics, Aarhus University from 2006 to 2012, he acquired profound skills in genetics and genomics of forage crop species. He was particularly interested in the development of genomics-assisted plant breeding tools, in close collaboration with the breeding company DLF Trifolium. In 2012, Bruno Studer was awarded the Swiss National Science Foundation Professorship and appointed SNF Assistant Professor for Forage Crop Genetics at ETH Zurich.

Prof. Dr. Bruno Studer

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Photos: Bruno Studer

Cross pollination of selected Italian ryegrass (*Lolium multiflorum*) genotypes in isolation fields.



Maintenance of Italian ryegrass (*Lolium multiflorum*) under controlled conditions in the glasshouse.



Three with one blow: Self study, seminar, and research display

A new set of online learning material for Master and PhD students in plant sciences is provided by the joint SPSW/PSC project “Sustainable Plant Systems”. The project has been carried out with the great support of 43 researchers and is available through the online learning and training platform OLAT.

Twelve focus topics of research groups from the Universities of Berne, Basel, Neuchâtel and Zurich cover four subject areas: Biotic interactions, Nutrient management, Plant breeding and Climate change. Each topic follows the didactical structure ECLASS (Engage, Clarify, Look, Act, Self assess, Summarize) and contains visualizations, reference links, glossary terms, assignments and quiz questions.

The material can be used as a self-study material by graduate students, e.g. for revising key terms and concepts and catching up with the respective literature. Also, individual topics can be used as supplementing content of a seminar or lecture. This use has already been tested during the 2012 fall term in three lectures and in a blended-learning seminar “Sustainable Plant Systems” offered by the PSC. A third application could be to use a topic to display a group’s research work on their website. Hence, prospective graduate students can read about it before applying for a position.

Course: <https://www.olat.uzh.ch/olat/url/RepositoryEntry/3604873218?guest=true&lang=en>

Contact: Anett.Hofmann@usys.ethz.ch

Join us for the Plant Science Expeditions



PLANT
SCIENCE
EXPEDITIONS

The aims of this new SNSF funded outreach program are to communicate “plant breeding for the future”, and “global changes in the Swiss Alps” to families with children aged 10–16.

The Expeditions will take place in different formats, such as a daylong or overnight excursion, but all will allow for a more sustained engagement with the research themes than a science fair or traditional lab open day provides. In order to offer in-depth coverage of the themes in a fun and engaging way we have developed workshops, which make plant science accessible to those with little or no previous knowledge. Activities such as identifying neophytes, or mapping alpine micro-climates with an infrared sensor. At Agroscope Wädenswil visitors will be guided through a simplified PCR process to see if the apple tree samples they collected have the gene for apple scab or fire-blight resistance. The expedition at the Institute of Plant Biology (UZH) and the Research Station Eschikon will take the participants on a journey from lab to field experiments and from basic to applied science, and they will be the first public to see the Field Phenotyping Platform under construction.

Not to be missed is the new plant science Geocaching Trail we are developing for the Furkapass expedition. It is a modern treasure hunt using GPS devices to hide and seek – in this case the treasure is knowledge.

The expeditions are a novel format in science communication, yet are based on informal science learning practice. We will keep you posted throughout the year.

Expedition program: <http://www.plantsciences.ch/expeditionen>

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