NEWSLETTER

08/14

Zurich – Basel
Plant Science Center

UNI BASEL · Universität Zürich · ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

Editorial

The Zurich-Basel Plant Science Center (PSC) celebrates its 10th anniversary this year. Since it was founded, the PSC has grown to a vibrant network of over 700 plant scientists and, in recognition of its achievements and activities, the PSC has been awarded the title of "Competence Center" for the second time.

The excellent Master's and PhD student training programs of the PSC have been praised on many occasions. With more than 220 students involved and over 40 courses on offer, the programs support young scientists acquisition of the key competences required in a successful academic and professional career. In 2004, the PhD students formed their own association, the Plant Science Center PhD Students Association (PS)2A.

In March 2003, the foundation for successful research cooperation with Syngenta was laid. Twelve graduate research fellowships in multidisciplinary projects have received funds from Syngenta and several of these projects have resulted in highly commended publications.

Over the years, the PSC Symposia have become visionary events where PSC members and other international plant scientists discuss key topics in plant science. In particular, the "Dialog Grün" symposia organized with the Collegium Helveticum, have become very popular among scientists, journalists, policy makers, teachers and farmers, who need and want to know more about the technical and social risks associated with genetically modified plants and gain insights into ongoing research.

What are our future goals? It is clear that the current era is one of great political significance for plant scientists. Climate change, increasing food prices and loss of biodiversity are being urgently discussed in many countries. Governments are confronted with the need to formulate new policies and we scientists are faced with the challenge of providing the necessary scientific advice. The PSC offers a wide range of knowledge and concepts regarding these changes. The next step for us will be to engage in a public and political dialog and increase visibility and perception of our research on national as well as international floors.

Manuela Hase, Scientific coordinator of the PSC

Awards

Juan-Miguel Escobar-Restrepo PhD was awarded the 2008 annual University of Zürich Faculty of Science prize for his PhD thesis "The FERONIA receptor-like kinase mediates male-female interactions during pollen tube reception". His results make a significant contribution to elucidating molecular basic principles of communication between female and male partners in the reproduction of flowering plants. This mechanism is important for the conservation of species boundaries and offers insight into the origin of plant species. (Ueli Grossniklaus group)

Teresa Fitzpatrick PhD was awarded a Swiss National Science Foundation Research Professorship. (formerly in the Nikolaus Amrhein group)

Samuel Schmid won the DIVERSITAS Poster Award at the Swiss Global Change Day 2008 of the Swiss Academy of Sciences. (Nina Buchmann group)

News from the PSC coordination office

As of June 1, 2008, the team at the Zurich-Basel Plant Science Center has been reinforced by Manuela Hase, who will work as a scientific coordinator. Hence, the PSC coordination office is now fully staffed and ready to lead and support you in future challenges.

Area of education: Melanie Paschke PhD | Area of science and communications: Manuela Hase PhD | Coordination in Basel: Sylvia Martinez MSc

Retreat

PSC retreats are held every other year to generate new ideas and visions but also to look back and identify important milestones. This year's retreat will take place on Zurich's Uetliberg, at the Uto Kulm hotel on the 23rd and 24th of october. During the 2-day meeting, future interdisciplinary research projects, international collaborations, joint PhD courses and the 2009 PSC symposium will be planned.

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RESEARCH

Syngenta projects

The second round of a promising collaboration between the PSC and Syngenta started this year. Six additional Syngenta fellowships have been awarded to PhD students to perform studies in PSC laboratories.

In this section, we present results from a completed Syngenta project devoted to the study of constraints to plant tissue formation in the cold. The study was part of Yang Ping Lee's doctoral thesis completed under the joint supervision of Prof. Dr. Frederick Meins Jr. at the Friedrich Miescher Institute, Basel and Prof. Dr. Christian Körner at the Botanical Institute, University of Basel.

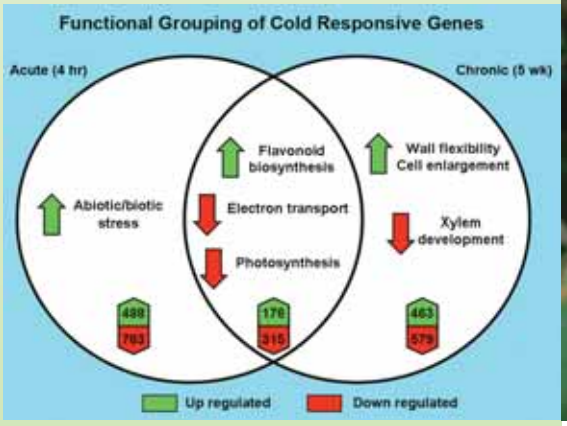
Effects of chronic cold treatment on root elongation and gene expression in *Arabidopsis thaliana*

Low temperature is a major limitation of plant growth. Therefore, cold adaptation is important for the survival and distribution of plant species at high elevations and high latitudes. Although a great deal is known about the molecular basis for cold acclimation and freezing tolerance triggered by acute cold treatment, the causes of growth limitation at low, non-freezing temperatures have remained largely unexplored. To better understand the mechanisms limiting plant growth in cold environments, Yang Ping Lee used microarray technology to examine global patterns of gene expression in *Arabidopsis thaliana* accessions from diverse habitats. Of the 24,000 genes surveyed, 11% showed 2-fold or larger effects at the mRNA level in response to acute-cold treatment (4h at 10°C) or chronic-cold treatment (6 weeks at 10°C). A substantial fraction of cold-responsive genes, 35%, responded specifically to chronic cold treatment, suggesting that there are fundamental differences in the response of plants to acute-cold treatment and growth at low, nonfreezing temperatures.

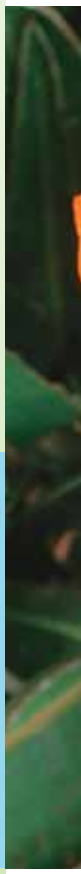
Several genes responsive primarily to chronic-cold treatment are likely to be relevant to sustained growth at low temperatures. For example, genes encoding primary wall constituents and enzymes concerned with cell enlargement and pectin metabolism were specifically induced by chronic-cold treatment, while genes important for secondary wall, fiber, and vascular tissue formation were specifically repressed. These findings led Yang Ping Lee to propose that chronic cold treatment increases the flexibility of roots and cell wall extensibility as part of a compensatory response to reduced root growth in the cold. These and several other functional groups of genes showing novel regulation by chronic cold treatment provide the starting point for future studies using informative mutants and biochemical profiling to establish causal relationships between gene expression and adaptations for growth in cold environments.

Major parts of this work have been published in:
Yang Ping Lee, Andrew J. Fleming, Christian Körner and Frederick Meins, Jr., 2008: Differential expression of CBF-pathway and cell cycle related genes in *Arabidopsis* accessions in response to chronic low temperature exposure. Plant Biology, in press.

Frederick Meins Jr., Friedrich Miescher Institut, Basel



Functional grouping of cold responsive genes



EDUCATION / EVENTS / $(PS)_2A$

PhD Program in Plant Sciences, Autumn 2008

- Scientific Writing Practice 1: Sept 19 and Oct 10, 2008
- Colloquium "Challenges in Plant Sciences": Sept 23 and Oct 27–28, 2008
- Radio-isotopes in Plant Nutrition: Oct 3, 17; Nov 7, 21; Dec 5, 12
- Elements of an Academic Career Strategy: Oct 13–14, 2008
- Functional Genomics: Introduction to transcriptional profiling and proteomics: Oct, 16–17, 2008
- Scientific Illustration: Oct 21 and 22, 2008
- Elements of Successful Self Marketing: Nov 13 and 14, 2008
- Scientific Communication: Nov 17 and 24, 2008
- Computational Biology: Dec 3–5, 2008
- Molecular Biology and Genomics of Plant-Pathogen Interactions: Jan, 26–27, 2009
- Contemporary Applied Statistics for Ecology (CASE): Jan, 19–22, 2009
- Introduction to Phylogenetic Analysis: Sept 16–Oct 08, 2008
- Current Topics in Grassland Sciences 2: Monday 15–17h
- Journal Club Systems Biology/Functional Genomics: every other week, 10:00–12:00

Responsible Conduct in Research, new course

Once in a while there a reports in the media about scientific misconduct – cases of fraud, error or negligence, or, sometimes simply a misinterpretation of scientific results by the public. With each new case the damage is done and the public looses its trust in research.

Consequently, awareness of the need to teach students responsible conduct in research has increased. The new PSC Module "Skills for Scientific Practice in Plant Sciences (SkriPS)" will be offered for the first time in spring 2009, as part of the "Master's Courses and Master's Studies in Plant Sciences".

This PSC Module includes training designed to increase the PSC Master's students knowledge of the specific rules, regulations and guidelines regarding responsible conduct in their research fields. Special attention will be paid to raising student's awareness of potential conflicts of interest, giving practical suggestions on how to react in cases of uncertainty for example on questions regading authorship, credits, and the handling and interpretation of data. Skills required for communicating responsibility with the public will also be taught. A case study approach will be applied, that is, teaching responsible conduct in research by discussing studies with a potential for conflict. Students will work in teams, discuss codes of conduct and values established in academia and apply them to case studies. The teams will have to agree on actions to be taken for each case. The effectiveness of the case-study approach for teaching responsible conduct in research has been proven: After such training, students' awareness of conflicts is raised and their knowledge of how to recognize, avoid, and respond to research misconduct is increased.

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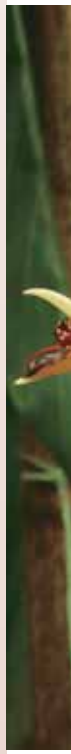
New Guidelines for the PSC PhD Program

At http://www.plantscience.ethz.ch/education/graduate_study, PSC students can find the guidelines for the PSC PhD Program in Plant Sciences.

The guidelines includes a detailed course catalogue of all courses offered and recommendations on which courses to visit at the beginning (basic level) or end (advanced level) of the PhD. The guidelines should help PhD students to plan their PhD education in advance and to tailor the course program to their needs. Students can decide in which key competencies they need training. The course program offers:

- Training in Research Skills and Techniques (e.g. in statistics, study design, methods in plant sciences)
- Understanding of the Research Environment and Scientific Community (e.g. understanding standards of good research practice and ethical standards, understanding funding and publication practices in research)
- Training in Research Management (e.g. project management in research)
- Training in Personal Effectiveness (e.g. time management)
- Training in Communication Skills (e.g. Scientific Writing, Scientific Communication Practice)
- Training in Career Management (e.g. career development in academia, self-promotion)



SCIENCE HIGHLIGHTS

Science 320, 5878: 938- 941 (2008)

Genome-scale proteomics reveals *Arabidopsis thaliana* gene models and proteome dynamics

Baerenfaller K, Grossmann J, Grobei MA, Hull R, Hirsch-Hoffmann M, Yalovsky S, Zimmermann P, Grossniklaus U, Gruissem W, and S Baginsky

Baerenfaller et al. have assembled a proteome map for *Arabidopsis thaliana* from high-density, organ-specific proteome catalogs that they generated for different organs, developmental stages, and undifferentiated cultured cells. They matched 86,456 unique peptides to 13,029 proteins and provide expression evidence for 57 gene models that are not represented in the TAIR7 protein database. Analysis of the proteome identified organ-specific biomarkers allowed them to compile an organ-specific set of proteotypic peptides for 4105 proteins to facilitate targeted quantitative proteomics surveys. Quantitative information on the proteins identified was used to establish correlations between transcript and protein accumulation in different plant organs. The *Arabidopsis* proteome map provides information about genome activity and proteome assembly and is available as a resource for plant systems biology at http://www.atproteome.ethz.ch.

Trends Cell Biol. 18:236-243 (2008)

Programming of gene expression by Polycomb group proteins

Köhler C and CBR Villar

Polycomb group (PcG) complexes maintain epigenetically repressed states that need to be reprogrammed when cells become committed to differentiation. In contrast to the previously held belief that PcG complexes regulate only a few selected genes, recent efforts have revealed hundreds of potential PcG targets in mammals, insects and plants. These results have changed the perception of PcG recruitment and function on chromatin. Both in animals and plants, evolutionarily conserved PcG complexes mark the chromatin of their target genes by methylation at histone H3 lysine 27. Surprisingly, however, both the proteins that recognize this mark and the mechanisms that cause gene repression differ between the animal ant plant kingdoms. This suggests that different developmental strategies used in plant and animal development entailed the evolution of different repressive maintenance mechanisms.

PLoS Biol 6(5): e122. doi:10.1371/journal.pbio.0060122 (2008)

Resource heterogeneity moderates the biodiversity-function relationship in real world ecosystems

Tylianakis JM, Rand TA, Kahmen A, Klein A-M, Buchmann N, Perner J, T Tscharntke

Numerous recent studies have tested the effects of plant, pollinator, and predator diversity on primary productivity, pollination, and consumption, respectively. Many have shown a positive relationship, particularly in controlled experiments, but variability in results has emphasized the context-dependency of these relationships. Complementary resource use may lead to a positive relationship between diversity and these processes, but only when a diverse array of niches is available to be partitioned among species. Therefore, the slope of the diversity-function relationship may change across differing levels of heterogeneity, but empirical evaluations of this pattern are lacking. In this study, Tylianakis et al. examined three important functions/properties in different real world (i.e., nonexperimental) ecosystems: plant biomass in German grasslands, parasitism rates across five habitat types in coastal Ecuador, and coffee pollination in agroforestry systems in Indonesia. They used general linear and structural equation modeling to demonstrate that the effect of diversity on these processes is context dependent, in such a way that the slope of this relationship increases in environments where limiting resources (soil nutrients, host insects, and coffee flowers, respectively) are spatially heterogeneous. These real world patterns, combined with previous experiments, suggest that biodiversity may have its greatest impact on the functioning of diverse, naturally heterogeneous ecosystems.

PSC MEMBERS

Professor Florian Schiestl
New PSC Member

Institute of Systematic Botany, University of Zürich. Chemical and evolutionary ecology of plant-insect interactions

Ophrys fusca pollinated by a sexually deceived male of the solitary bee *Andrena nigroaenea*

Plants interact with a vast array of insects in antagonistic and mutualistic associations. Among the various channels that mediate the communication between animals and plans, chemical signals are often of key importance, yet their ecological and molecular background is little understood. My research interests focus on plant-pollinator interactions, since pollinators determine mating patterns in plant populations and can thus greatly influence floral evolution in plants. Pollinators can also mediate reproductive isolation and speciation through assortative plant visitation. My interests relate to pollinator behavior, plant reproduction, and floral signals, including their molecular bases and patterns of variation. A fascinating phenomenon is the evolution of rewardless flowers that attract pollinators by imitating rewarding flowers (food deception) or female insects (sexual deception). In such mimetic systems, I am interested in the mechanisms and evolutionary consequences of floral mimicry (adaptive radiations) in different plant lineages. I use broad methodological approaches, involving analytical chemistry, electrophysiology, behavioral experiments, and candidate gene and genomic approaches coupled with functional characterization of scent genes.

Curriculum vitae

Florian Schiestl received his PhD in 1999 in Evolutionary Biology from the University of Vienna under the supervision of Manfred Ayasse. From 1999 to 2001 he was a Postdoctoral Fellow at the Australian National University in Canberra. In 2001, he was appointed group leader (Oberassistent) at the Geobotanical Institute, ETH Zürich, where he received his habilitation in 2005 in evolutionary ecology. Since 2007, he has worked as a professor with tenure track (Assistenzprofessor) at the University of Zürich.

Further information: www.systbot.uzh.ch

Overview of the Plant Science Center Members

The PSC currently comprises about 27 departments of research from 9 institutes of the ETH Zurich, University of Zurich and University of Basel, with a total of 700 staff. The PSC covers many fields of research, from Molecular Plant Biology to Environmental Sciences, from Systematic Botany to Agronomy. Since 1998, the interdisciplinary PSC network has brought together researchers from the various realms of plant sciences.

Detailed overview of the PSC members:
www.plantscience.ethz.ch/organisation/members

FOCUS

$(PS)_2A$: Plant + People, Symposium in personal retrospect

Frank Liebisch, ETH Zurich: With Plants + People, we look back on another successful PhD Symposium of the Zürich-Basel Plant Science Centre. Many presentations emphasized how important plant sciences are for our future. Fast-track breeding of *Artemisia annua* to increase the production of artemisin used in malaria therapy, or plants reporting phytopathogens (by Neal Stewart, photo), are two examples of frontier topics that were presented. Ecosystem services have become an important concept for biodiversity and ecosystem management, where conservation and sustainability often stand in opposition to market values or human land use, and our "varying views" of plants in science and society provoked lively discussions. Current efforts regarding the preservation of plant diversity, such as the Global Seed Vault in Spitzbergen and the Tìkapapa initiative in Peru, were presented. Advances in biotechnological use of plants such as the development of chloroplast derived vaccines, which have become as important as ethno botanical studies capturing the traditional use of plants for human health, were also discussed.

On behalf of the Plant Science PhD Student-Association (PS)2A, who organized the symposium, we would like to thank all volunteers who contributed to the success of this symposium.

Prof. Jaboury Ghazoul, ETH Zurich: The recent PhD symposium acknowledged the fact that we find ourselves engulfed by crises, in particular energy, food, biodiversity, water, and climate crises, but it also offered a variety of perspectives from plant scientists on these crises. Indeed, as plant scientists we are almost uniquely placed to offer solutions to all these challenges. For example, productive new crop varieties requiring less water have been engineered by plant geneticists. Plant biochemists are developing cellulose digestion to generate energy. Plant ecologists are improving land-use systems and conserving biodiversity on which ecosystem services may depend.

So, as plant scientists, we are uniquely placed to save the world from its current problems. Remarkable as we may be, we need to recognize that science is but one component of a larger societal structure in which both rational and irrational thinking shapes the acceptability of the applications of our science. Genetically engineered plants suffered from a failure to address public concerns. Biofuels, espoused as green fuels of the future by some, are considered an environmental disaster by others. We clearly need to look beyond our narrow academic boundaries in order to work with each other, but, more importantly, we need to ensure that the science we advance is discussed and debated also in terms of society's economic and cultural parameters. Recognition and uptake of our scientific outputs depend on our abilities to sympathise and engage with the complexities of public thinking.

Plant scientists are in the privileged position of being able to contribute substantial solutions to the world's plethora of crises but we can only do so if we look up from our microscopes, quadrats and gels, and interact with the wider world around us.

Impressum

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Manuela Hase, Sylvia Martinez, Melanie Paschke, Zurich–Basel Plant Science Center

Text Contributions
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