

NEWSLETTER

2010/17

Editorial

While I was completing my PhD on biodiversity effects on the stability of grasslands and the meta-analysis of 30 years of biodiversity experiments that I subsequently carried out as a postdoc at the University of Zürich, I became very interested in the implementation of scientific results in the political environment. This interest led to a four-year period working for a nonprofit organization, where I gained valuable insight into communicating with a range of different stakeholders. Now, as the coordinator of the new PhD Program “Plant Sciences and Policy”, I want to contribute to what is a challenging and novel platform for students, providing them with tools and opportunities that will enable them to experience communication and action at the interface of (plant) sciences and politics.



Photo Yannick Staedler

Andrea Pfisterer
Zürich–Basel Plant Science Center

Books

Biodiversity, Ecosystem Functioning, and Human Wellbeing – An Ecological and Economic Perspective



Edited by Naeem S, Bunker DE, Hector A, Loreau M, Perrings C (2009) Oxford University Press, Oxford, New York. 384 pages. ISBN 0199547955

How will biodiversity loss affect ecosystem functioning, ecosystem services, and human well-being? In an age of accelerating biodiversity loss, this volume summarizes recent advances in biodiversity–ecosystem functioning research and explores the economics of biodiversity and ecosystem services. The book includes a synthesis of the economics of ecosystem services and biodiversity, and the options open to policy-makers to address the failure of markets to account for the loss of ecosystem services. The ultimate conclusion is that biodiversity is an essential element of any strategy for sustainable development.



Zürich – Basel
Plant Science Center



Universität Zürich

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Upcoming events

Global food crisis: how can plant sciences contribute? PhD Summer School.
23–26 June 2010, Mürren BE

Plants Meeting Future Challenges – Food and Energy for the Society in a Changing Environment. Zürich–Basel Plant Science Center PhD Symposium.
10 September 2010, ETH Zentrum, Auditorium Maximum.

Awards

For the post-harvest project, **Silvia Dorn**, together with her research team, received the Swiss Forum for International Agriculture SFIAR Award for innovative agricultural research for development. – In recognition of his distinguished contributions to plant pathology, **Cesare Gessler** was elected as a Fellow of the American Phytopathological Society in 2009. – **Ueli Grossniklaus** and **Beat Keller** (both University of Zürich) each received one of the prestigious “ERC Advanced Investigator Research Grants” issued by the European Research Council. These grants allow exceptional established research leaders to pursue frontier research of their choice. – **Oleksandr Boyko** won the Innovation Challenge Award of the Natural Science and Engineering Research Council of Canada (Ueli Grossniklaus group). – **Fabienne Hatt** received the ETH medal for her excellent master thesis in applied entomology (Silvia Dorn group). – **Marilena Meloni** was awarded a two-year post-doctoral grant from the Marie Heim-Vögtlin program of the SNF to work on Mediterranean plants in Elena Conti’s group. – **Christoph Randin** received the Francesco di Castri Award for the young scientist’s best oral presentation at the DIVERSITAS OSC2 conference in October 2009 (Christian Körner group). – **Lucy Rist** was awarded the Alice Horsman Travelling Fellowship from Somerville College, Oxford University, UK, to disseminate the findings of her research on the sustainable management of non-timber forest products in India (Jaboury Ghazoul group). – **Stefano Torriani** received the ETH Medal for a top PhD dissertation and also won the best poster award at the annual meeting of the British Society of Plant Pathology (Bruce McDonald group). – **Simon Zeller** (Bernhard Schmid group), **Stefano Torriani** (Bruce McDonald group), and **Boris Börstler** (Dirk Redecker group) won the poster award at the 2009 PSC Symposium on Plant-Microbe Interactions held in Basel.

The web is starting to span plant sciences



Photo Sylvia Martínez

Continuous progress has been made in developing the Swiss Plant Science Web (SPSW) since the web's kick-off meeting in November 2009 in Basel. The SPSW website can now be accessed on www.swissplant-scienceweb.ch. It is an information and communication portal for researchers, PhD students and the public concerning research findings, education, events and news. In the research section, group leaders have the opportunity to present themselves and their field of research to the public, to decision makers and to the media with the aid of their research portfolios. These are meant as a showcase for plant sciences in Switzerland and will facilitate the search for expert knowledge.

Education and Training

In the education section, PhD students are informed about the PhD programs available in plant sciences as well as the summer school, the mentoring program and the mobility grants provided by the SPSW. The topic of the first SPSW summer school in 2010 will be: 'Global food crisis: how can plant sciences contribute?' It will be organized by Professor Brigitte Mauch-Mani from the University of Neuchâtel and take place on June 23–26 in Mürren, BE. The career planning program of the SPSW prepares PhD students for the time after their PhD, helping with career planning both in and outside academia by means of various courses and events. During the industry days on 14–15 September 2010, career opportunities in different fields will be presented at the University of Neuchâtel.

The SPSW mobility grants (maximum CHF 2000 per grant) are offered to PhD students to cover short research stays and travelling on a national scale (i.e. lab visits or PhD courses in another regional network).

Gateway to three technology platforms

In addition, the SPSW website serves as a gateway to three technology platforms: Bio-Molecular Analysis platform (BMA, Arc Lémanique), Chemical Analytical Service (CAS, BeNeFri) and Genetic Diversity Center (GDC, Zurich-Basel PSC). The CAS and GDC platforms are already up and running and are offering their services, and the BMA will be ready in spring 2010. The three platforms provide the most up-to-date analytical equipment and the necessary competence for the analysis of proteins and other biologically active compounds as well as the analysis of population genetic data. A shared interface and data management software will be in place by summer 2010 to increase synergies between the three platforms.

A dynamic network of research interactions and collaborations

Our vision is that the SPSW should not only be a virtual platform on the web or a technical platform but that it should also evolve into a dynamic network of interactions and collaborations between plant science researchers. To enhance the exchange between researchers in different fields, the SPSW plans a symposium for 2011, where principal investigators plus one or two researchers in their groups will present their current research. At the beginning of this symposium, a half-day retreat will serve as a think tank to develop and discuss new strategies for research in plant sciences in Switzerland.

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<http://www.swissplantscienceweb.ch>



EDUCATION / (PS)₂A

PhD Program in Plant Sciences, Spring 2010

- Science Communication Practice, Jan 18 & 25
- Online Publishing, Communicating and Creating a Web Presence, Feb 5 & 15
- The Key to Success: Knowing About My Competences, Feb 9–10
- Scientific Writing II, Feb 19 & Mar 12
- Responsible Conduct in Research for Plant Scientists, Feb 22 & May 7
- Introductory Course to R, Mar 8–10
- Scientific Presentation Practice, Mar 26 & Apr 16
- Project Management for Research, Apr 7, 8 & 22
- Application of Chlorophyll Fluorescence in Plant Biology, Apr 12–13
- Patenting in Life Sciences, May 31 & Jun 1
- Plant Disease Diagnostics, Jun 16–18
- Summer School: The Global Food Crisis, Jun 23–26
- Ecology of Alpine Plants, Jul 12–16

WiSch and SkriPS: PSC's Online Writing Platforms

The PSC has published two online writing platforms: WiSch – Wissenschaftliches Schreiben, and SkriPS – Scientific Writing Practice. They offer resources to support students learning the scientific writing process, from topic refinement to final revision, including: techniques for each stage of the process, self-study tutorials, plus reference documents for various text genres. As they begin university, then move from bachelors to masters and beyond, students learning scientific writing have different learning objectives. The WiSch and SkriPS writing platforms are based on this ramped model of objectives, with the material in WiSch differing in content and approach from that in SkriPS, and reflected in different learning objectives. WiSch is for bachelors students and is offered in German, while SkriPS is intended for masters students and is available in English.

Instructors can integrate SkriPS/WiSch with existing courses through simple links to the content in the writing platforms, or use the materials in class or as homework assignments. Alternatively, instructors can customize their own course-specific copy, and tailor it to their specific requirements. Customized copies also offer the possibility to incorporate peer or instructor review.

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courses/Scientific_Writing

(PS)₂A

PSC PhD Symposium 2010 “Plants Meeting Future Challenges – Food and Energy for the Society in a Changing Environment”

Climate change and global warming are facts and will cause an increasing number of problems for the growing human population. Just recently, the United Nations Climate Change Conference in Copenhagen did not find an agreement on how to limit greenhouse gas emissions in order to maintain increases in temperature within an acceptable range.

The PSC PhD Symposium 2010 “Plants Meeting Future Challenges” will focus on possible solutions that plant sciences might provide in the future. The extensive use of fossil fuels is one immediate cause of global warming. One predicted consequence is a global food crisis caused by either extensive periods of drought in areas that are currently semi-arid or a rise in sea levels in coastal regions.

Plant sciences and plant biotechnology offer a variety of promising solutions for both the causes and the consequences of global warming. Biofuels, drought- and pest-resistant crops and varieties of rice that are adapted to flooding are a few examples.

The symposium will highlight interesting recent findings in biofuel and food biotechnology research in respect to climate change. Possible social and environmental aspects of green biotechnology and biofuels will also be discussed.

Date: 10 September 2010

Venue: Auditorium Maximum, ETH Zentrum,
Rämistrasse 101, Zurich

Contact: Michael Raissig, mraissig@access.uzh.ch

Events

For more events within PSC visit our homepage

<http://www.plantscience.ethz.ch/>

<http://www.plantscience.uzh.ch/>

<http://www.plantscience.unibas.ch/>



SCIENCE HIGHLIGHTS

Nature 459:1136–1140 (2009)

ER-localized PIN5 auxin transporter mediates subcellular homeostasis of plant hormone auxin.

Mravec J, Skůpa P, Bailly A, Křeček P, Hoyerová K, Bielach A, Petrášek J, Zhang J, Gaykova V, Stierhof Y-D, Schwarzerová K, Rolčík J, Dobrev P, Seifertová D, Luschnig C, Benková E, Zažímalová E, Geisler M, Friml J

The plant signalling molecule auxin provides positional information in a variety of developmental processes by means of its differential distribution (gradients) within plant tissues. Thus, cellular auxin levels often determine the developmental output of auxin signalling. Conceptually, transmembrane transport and metabolic processes regulate the steady-state levels of auxin in any given cell. In particular, PIN auxin-efflux-carrier-mediated, directional transport between cells is crucial for generating auxin gradients. Here, we show that *Arabidopsis thaliana* PIN5, an atypical member of the PIN gene family, encodes a functional auxin transporter that is required for auxin-mediated development. PIN5 does not have a direct role in cell-to-cell transport but regulates intracellular auxin homeostasis and metabolism. Unlike other characterized plasma membrane PIN proteins, PIN5 localizes to endoplasmic reticulum (ER), presumably mediating auxin flow from the cytosol to the lumen of the ER. The ER localization of other PIN5-like transporters (including the moss PIN) indicates that the diversification of PIN protein functions in mediating auxin homeostasis at the ER, and cell-to-cell auxin transport at the plasma membrane, represent an ancient event during the evolution of land plants.

TREE 24:431–438 (2009)

Designer landscapes for sustainable biofuels

Koh LP, Levang P, Ghazoul J

Oil palm is one of the most extensively cultivated biodiesel feedstocks worldwide, and the expansion of its cultivation poses a significant threat to ecosystems, biodiversity and potentially the global climate. We evaluate the prospects of land sparing and wildlife-friendly farming, two contrasting approaches for reducing the impacts of oil palm agriculture. We draw on concepts from both approaches to suggest more sustainable production systems and argue that landscapes under threat from oil palm expansion need to be designed in recognition of biodiver-

sity, economic and livelihood needs. Specifically, we advocate agroforestry zones between high conservation value areas and intensive oil palm plantations to create a more heterogeneous landscape benefiting both biodiversity and rural communities. Similar principles could apply to biofuel systems elsewhere.

Genome Research 19:1786–1800 (2009)

Deterministic protein inference for shotgun proteomics data provides new insights into *Arabidopsis* pollen development and function

Grobei MA, Qeli E, Brunner E, Rehrauer H, Zhang R, Roschitzki B, Basler K, Ahrens CH, Grossniklaus U Pollen, the male gametophyte of flowering plants, represents an ideal biological system to study developmental processes, such as cell polarity, tip growth, and morphogenesis. Upon hydration, the metabolically quiescent pollen rapidly switches to an active state, exhibiting extremely fast growth. This rapid switch requires relevant proteins to be stored in the mature pollen, where they have to retain functionality in a desiccated environment. Using a shotgun proteomics approach, we unambiguously identified ~3500 proteins in *Arabidopsis* pollen, including 537 proteins that were not identified in genetic or transcriptomic studies. To generate this comprehensive reference data set, which extends the previously reported pollen proteome by a factor of 13, we developed a novel deterministic peptide classification scheme for protein inference. This generally applicable approach considers the gene model–protein sequence–protein accession relationships. It allowed us to classify and eliminate ambiguities inherently associated with any shotgun proteomics data set, to report a conservative list of protein identifications, and to seamlessly integrate data from previous transcriptomics studies. Manual validation of proteins unambiguously identified by a single, information-rich peptide enabled us to significantly reduce the false discovery rate, while keeping valuable identifications of shorter and lower abundant proteins. Bioinformatic analyses revealed a higher stability of pollen proteins when compared with those of other tissues and implied a protein family of previously unknown function in vesicle trafficking. Interestingly, the pollen proteome is most similar to that of seeds, indicating physiological similarities between these developmentally distinct tissues.



PSC MEMBER

In this section, we present group leaders. Through their creative research and involvement in teaching, group leaders make a substantial contribution to the success of the Zurich–Basel Plant Science Center.

PD Dr. Markus Geisler: group leader



Photo Aurélien Bailly

In recent years, work in my lab in Zurich has focused on the characterization of individual roles and routes of transporters of the hormone-like compound, auxin. This is currently a hot spot in plant research because the development and physiology of plants is widely controlled by a unique, plant specific process: the cell-to-cell or polar auxin transport (PAT). PAT is controlled on the efflux level, and therefore, our focus is auxin exporters, especially their functional interaction and their posttranscriptional regulation.

The starting point of our work was the finding that loss-of-function mutants lacking the immunophilin-like FKBP42, TWISTED DWARF1 (TWD1), showed a challenging, pleiotropic dwarf phenotype that resembles auxin transport deficiencies. We knew that TWD1 physically interacts with two members of the B subfamily of ABC transporters, ABCB1 and ABCB19, and mutants showed overlapping phenotypes (Fig. 1). Consequently, using a variety of non-plant and plant expression systems, we were among the firsts to demonstrate auxin transport activities, first for ABCBs and subsequently also for several members of a second exporter family, called PINs.

Key findings

Although ABCB- and PIN-mediated auxin efflux can apparently function independently, ABCBs and PINs are able to interactively and coordinately transport auxin. The current model is that multilaterally expressed ABCBs minimize apoplastic reflux, while polar ABCB-PIN interactions provide the basis for specific, vectorial auxin streams. Interestingly, an evolutionary analysis suggests that ABCBs are ancient auxin transporters, while PINs appeared with the origin of land plants. Meanwhile, we have characterized TWD1 as a central regulator of ABCB-catalyzed auxin transport by means of protein–protein interaction. Using BRET technology, we have demonstrated disruption of ABCB-TWD1 interaction and thus auxin flows by the diagnostic auxin efflux inhibitor, NPA.

Current and future work

Recent work has identified flavonols as endogenous modulators of auxin transport by inhibiting ABCBs and promoting asymmetric PIN shifts in the root

(Fig. 2). Moreover, we have started a functional interactomics analysis of auxin transport complexes. We have spent nearly the last 10 years on understanding the dwarfism aspect of what we call the twisted syndrome; the next decade is dedicated to the twist.

Curriculum vitae

Markus Geisler received his PhD (Dr. rer. nat.) in 1996 from the Heinrich-Heine University of Düsseldorf. From 1996 to 1998 and 1999 to 2002, he was a post-doctoral fellow at the Universities of Copenhagen and Neuchâtel. In 2002, he was appointed group leader (Oberassistent) at the Institute of Plant Biology of the UZH, where in 2009 he received his *venia legendi* (habilitation) in plant biochemistry and cell biology. He has 2 daughters and lives in Zurich.

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Photo Aurélien Bailly

Photo Michael Sauer

Fig. 1 (above): Growth phenotypes of *Arabidopsis thaliana* mutant plants showing a correlation of reduced auxin transport capacities and height. Note widely overlapping dwarf phenotypes between *abcb1 abcb19* and *twd1* mutants but a unique, helical orientation of nearly all *twd1* organs shown here for a silique (inset).

Fig. 2: Asymmetric PIN1 (red) shifts at the lower root tip side (indicated by triangles) are promoted by quercetin treatment resulting in intact auxin reflux (green).



New PhD Program “Plant Sciences and Policy”

A newly created PSC PhD Program offers students the opportunity to carry out research in plant sciences. This work will be complemented with specific training to understand and manage issues at the intersection of scientific development, policy and the public.

Our vision: The future (plant) scientists will know how to integrate the interests of the public and of stakeholder groups in their research and in the communication of their output. They will engage actively with national and international governmental and nongovernmental organizations to promote the policy-relevant aspects of their research. They will contribute to sustainable solutions to pressing challenges such as food security, biodiversity and climate change.

Good communicators

This new PhD program supports young scientists in becoming good communicators and interpreters of scientific progress for policy-makers and the public. Students will choose one of a selection of lectures relating to political science and will follow several workshops to obtain the skills needed for policy work (total 12 ECTS). They will help to organize policy-relevant sessions at PSC symposia.

Course structure

The first workshop will take place in September 2010 and will be on “Evidence-based Policy-making in Plant Sciences”. It consists of one day of introductory lectures, literature self-study and case-study work, one day of guided group work (discussion of case studies) and a one-day workshop for the discussion and presentation of the case studies together with senior scientists and policy-makers. The courses will also be open to registered students of the PSC PhD Program in Plant Sciences, and credit points will be transferred. Application is part of the regular course registration and opens in May 2010. The course is limited to 20 students, and preference will be given to PhD students of the PSC “Plant Sciences and Policy” doctoral program.

Transfer to this program is possible

PhD students wishing to transfer from the PSC PhD Program in Plant Sciences to the specialized PhD Program in Plant Sciences & Policy can do so in 2010. Together with their request, they are asked to hand in a letter of motivation (by July 1, 2010). They will be interviewed by the admission committee in the first week of September. Once accepted, attendance of the whole curriculum is compulsory.

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Impressum

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