

NEWSLETTER

2009/16

Editorial

The Swiss plant science research community is about to form its own web! The Zurich-Basel Plant Science Center (PSC) has received generous financial support from the Rectors' Conference of the Swiss Universities (CRUS) to establish a network of all Swiss plant scientists. The "Swiss Plant Science Web", will establish firm links between Swiss universities, both in research and teaching, in all fields of plant science, and will promote public understanding of the importance of plant sciences in Switzerland.

I also would like to draw your attention to this year's PSC Symposium, dedicated to Plant-Microbe Interactions, which will take place on November 13 in Basel. The conference committee has invited leading scientists from Switzerland and abroad to present their newest findings to you. We hope you will take the opportunity to present a poster, and perhaps win one of the three PSC poster awards.

Thomas Boller
University of Basel

Awards

Bernhard Schmid has been awarded a guest professorship at the Peking University (June 2009–June 2011).

Frank Liebisch won a poster award at the 2009 Annual Meeting of the German Society of Plant Nutrition in Osnabrück, Germany (Emmanuel Frossard group).

Deborah Vogt received an award for the best talk at the 2009 conference of the Plant Population Biology Section of the Ecological Society of Germany, Switzerland and Austria (GfÖ) held in Bern (Peter Stoll group).



Photo Beat Ernst Basel

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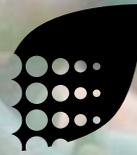
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Zurich – Basel
Plant Science Center



Universität Zürich

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Upcoming events

Koexistenz und Forschungsfreiheit als Nagelprobe für die Grüne Gentechnologie. Fachtagung zur Grünen Gentechnik

4. September 2009, ETH Zürich, Semper Aula

Plant-Microbe Interactions – PSC Symposium 2009

13 November 2009, University of Basel, Kollegienhaus, Main Auditorium, Petersplatz 1

Books



Strasburger – Lehrbuch der Botanik

Bresinsky A, Körner C, Kadereit JW, Neuhaus G, Sonnewald U (2008), 36th ed., 1176 pages. ISBN: 978-3-8274-1455-7

The Strasburger is a unique text book for students of biological, environmental and agricultural sciences. It is also a reliable reference book for lecturers and scientists. For 115 years its excellence has been based on the well-balanced representation of all plant science areas. In order to keep the Strasburger's knowledge base up to date, two new members joined the author team for the 36th edition.



Alpine plant life – Functional Plant Ecology of High Mountain Ecosystems. Körner C (2008), Georgian edition, Ilia Chavchavadze, State University Publishing, Tbilisi

Alpine plant life – Functional Plant Ecology of High Mountain Ecosystems. Körner C (2008), Chinese edition, Science Press, Beijing



Generations of plant scientists have been fascinated by alpine plant life – with the exposure of organisms to dramatic climatic gradients over a very short distance. This comprehensive text treats a wide range of topics: alpine climate and soils, plant distribution and the treeline phenomenon, the physiological ecology of water-, nutritional- and carbon relations of alpine plants, plant stress and plant development, aspects of reproductive biology, and human impacts on alpine vegetation. Geographically the book covers all parts of the world including the tropics. The book has been translated into Georgian and Chinese.

RESEARCH

Syngenta projects

This section presents results from a project devoted to the study of tonoplast proteins funded by Syngenta. The research was part of Anne Endler's doctoral thesis conducted under the supervision of Prof. Enrico Martinoia at the Institute of Plant Biology of the University of Zürich and PD Dr. Sacha Baginsky, Institute of Plant Sciences ETH Zurich.

Identification and Characterisation of Tonoplast Proteins by Proteomic Approaches

The central vacuole is important for various cellular processes such as energy management, accumulation of reserves and nutrients, regulation of the turgor pressure, detoxification, and maintenance of the cytosolic ion and metabolite homeostasis. To fulfil these functions, different inorganic and organic solutes have to be transported across the tonoplast (vacuolar membrane). While a limited number of vacuolar membrane proteins, such as V-type H⁺-ATPases and H⁺-pyrophosphatases, are well characterised, the majority of vacuolar transporters are still unidentified, among them the transporter(s) responsible for vacuolar sucrose (Suc) uptake and release. In order to search for novel vacuolar membrane proteins, we used a proteomic approach. Vacuolar proteomic studies are usually restricted by the isolation of highly purified vacuolar membranes in a sufficient amount. We were able to overcome this limitation by the efficient purification of vacuoles from barley (*Hordeum vulgare*, Hv) mesophyll protoplasts. Using LC-ESI-MS/MS, 101 proteins were identified in the barley tonoplast, including numerous integral membrane proteins previously not reported. Among these membrane proteins, we detected the Suc transporter (SUT) HvSUT₂, the closest homolog of the *Arabidopsis thaliana* Suc transporter AtSUT₄. Previous publications demonstrated that HvSUT₂ and AtSUT₄ catalyse a Suc/H⁺ symport across the plasma membrane when heterologously expressed in yeast. However, *in planta* tonoplast localisation of both transporters could be confirmed by transient expression of the corresponding GFP-fusion proteins in *Arabidopsis* and onion epidermal cells (see figure). Suc uptake experiments with vacuoles, isolated from wild-type and T-DNA insertion mutants of AtSUT₄, suggest an export of vacuolar Suc via AtSUT₄.

In addition, a phosphoproteomic approach was developed to search for *in vivo* phosphorylation sites of barley tonoplast proteins. Although protein phosphorylations are known to play a central role in controlling thousands of biological processes, little is known about the regulation of tonoplast transporters and channels via protein phosphorylations. In total, 65 phosphopeptides of 27 known vacuolar membrane proteins were identified, including the two vacuolar proton pumps, aquaporins and other known vacuolar transporters mediating the transfer of sodium, calcium, potassium, sugars, sulphate and malate. Future investigations will focus on the functional analysis of the identified phosphorylation sites and on the identification of protein kinases responsible for the phosphorylation of tonoplast proteins.

Anne Endler & Enrico Martinoia, Institute of Plant Biology, University of Zurich and Zurich-Basel Plant Science Center

Relevant publications:

Reiland S, Messerli G, Baerenfaller K, Gerrits B, Endler A, Grossmann J, Gruissem W, Baginsky S. Large-scale *Arabidopsis* phosphoproteome profiling reveals novel chloroplast kinase substrates and phosphorylation networks. *Plant Physiol.* 2009 Jun; 150(2):889-903. Epub 2009 Apr 17.

Endler A, Reiland S, Gerrits B, Schmidt UG, Baginsky S, Martinoia E. In vivo phosphorylation sites of barley tonoplast proteins identified by a phosphoproteomic approach. *Proteomics.* 2009 Jan; 9(2):310-21.

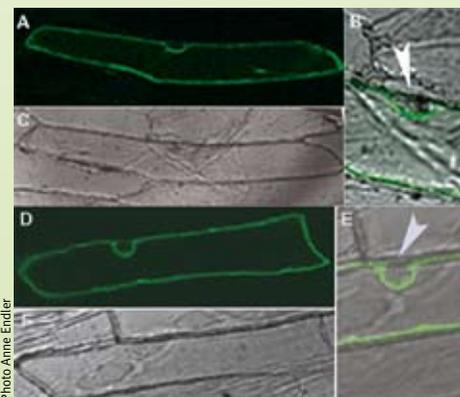


Photo Anne Endler

HvSUT₂-GFP (A-C) and AtSUT₄-GFP (D-F) are located at the tonoplast when transiently expressed in onion epidermal cells. Nuclei are indicated by arrowheads.

EDUCATION / (PS)₂A

PhD Program in Plant Sciences, Autumn 2009

- **Functional Genomics: Introduction to Transcriptional Profiling and Proteomics**, September 9–10, 2009
- **Scientific Writing Practice 1**, September 25 & October 9, 2009
- **Colloquium “Challenges in Plant Sciences”**, September 22 & October 26–27, 2009
- **Radio-isotopes in Plant Nutrition**, Six Friday mornings in the fall semester 2009
- **Self-marketing Skills – Indispensable to Boost Your Career**, October 5–6, 2009
- **Statistical Methods in Molecular Biology**, October 21–23, 2009
- **Elements of an Academic Career Strategy**, November 9–10, 2009
- **Modeling Approach in Plant Sciences**, November 5–6, 2009
- **Analysis and Diversity of Plant Non-structural Carbohydrates**, September 30 & October 7, 2009
- **Discussion in Genomics and Systems Biology**, November 2, 9 & 10, 2009, 1pm–5pm
- **Computational Biology**, December 2–4, 2009
- **Scientific Illustration Practice in R**, January 27–28, 2009
- **Molecular Ecology and Phylogeny of Mycorrhizal Fungi**, Date to be announced
- **Molecular Evolution and Phylogenetics**, September 15–October 7, 2009
- **PSC Module Integrative Plant Sciences**, September 22, November 11 & December 11, 2009

Events

For more events visit the PSC website

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

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

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

(PS)₂A

News from the Plant Science PhD Students Association

During our information apéros held in March and April, we met many interested students from the Universities of Zurich and Basel and the ETH Zurich. A few new students got involved in the (PS)₂A Association afterwards. Since some of the present board members are about to finish their PhD and the organizing committee for the next PSC PhD Symposium in 2010 is now being formed, we are urgently looking for new participants.

The main aim of our (PS)₂A Association is to represent the PhD students within the PSC. By organizing scientific and social events (e.g. symposia and excursions) with and for the PSC PhD students, we aim to help students to identify with the PSC and bridge the gap between the various PSC member institutes. By getting actively involved with the (PS)₂A Association, you will not only gain experience in project management and make lots of contacts, but also receive credit points for being a member of the board or of an organization committee.

Our next meeting will be held at ETH Zurich on September 22nd at 17:30h after the PSC Colloquium “Challenges in Plant Sciences”. Please come along if you are interested in joining the (PS)₂A Association or in helping to organize the next PSC PhD Symposium. We look forward to meeting you.

Your PhD student Association

Contact: frank.liebisch@ipw.agrl.ethz.ch.



SCIENCE HIGHLIGHTS

Science 324: 742–3 (2009)

Innate Immunity in Plants: An Arms Race between Pattern Recognition Receptors in Plants and Effectors in Microbial Pathogens

Boller T and Sy H

For many years, research on plant defense responses triggered by exposure to general microbial elicitors was underappreciated, for a good reason: There had been no critical experimental demonstration of their importance in mediating plant resistance during pathogen infection. Today, these microbial elicitors are named pathogen- or microbe-associated molecular patterns (PAMPs or MAMPs) and the plant responses are known as PAMP-triggered immunity (PTI). Recent studies provide an elegant explanation for the difficulty of demonstrating the role of PTI in plant disease resistance. It turns out that the important contribution of PTI to disease resistance is masked by pathogen virulence effectors that have evolved to suppress it. DOI: 10.1126/science.1166453

Science 323:1360–3 (2009)

A Putative ABC Transporter Confers Durable Resistance to Multiple Fungal Pathogens in Wheat.

Krattinger SG, Lagudah ES, Spielmeyer W, Singh RP, Huerta-Espino J, McFadden H, Bossolini E, Selter LL and Keller B

Agricultural crops benefit from resistance to pathogens that endure for generations of both the pest and crop. Durable disease resistance, partial or complete, can be controlled by several genes. Some of the most devastating fungal pathogens in wheat are leaf rust, stripe rust, and powdery mildew. The wheat gene *Lr34* has supported resistance to these pathogens for more than 50 years and is now shared by wheat cultivars around the world. Here, we show that the *LR34* protein resembles adenosine triphosphate-binding cassette transporters of the pleiotropic drug resistance subfamily. Alleles of *Lr34* conferring resistance or susceptibility differ by three genetic polymorphisms. The *Lr34* gene, which functions in the adult plant, stimulates senescence-like processes in the flag leaf tips and edges. DOI: 10.1126/science.1166453

Science 324:636–8 (2009)

Competition for Light Causes Plant Biodiversity Loss Following Eutrophication

Hautier Y, Niklaus PA and Hector A

Human activities have increased the availability of nutrients in terrestrial and aquatic ecosystems. In grasslands, this eutrophication causes loss of plant species diversity, but the mechanism of this loss has been difficult to determine. Using experimental grassland plant communities, we found that addition of light to the grassland understory prevented the loss of biodiversity caused by eutrophication. There was no detectable role for competition for soil resources in diversity loss. Thus, competition for light is a major mechanism of plant diversity loss after eutrophication and explains the particular threat of eutrophication to plant diversity. Our conclusions have implications for grassland management and conservation policy and underscore the need to control nutrient enrichment if plant diversity is to be preserved. DOI: 10.1126/science.1169640

Nature, 458:754–5 (2009)

Phylogenetic Biome Conservatism on a Global Scale

Crisp MD, Arroyo MTK, Cook LG, Gandolfo MA, Jordan GJ, McGlone MS, Weston PH, Westoby M, Wilf P and Linder HP

The distribution of organisms has long intrigued evolutionary biologists. The tendency for species to retain their ancestral ecology has been demonstrated in distributions on local and regional scales, but the extent of ecological conservatism over time and across continents has not been assessed. By inferring ancestral biomes for an ecologically diverse sample exceeding 11,000 plant species from around the Southern Hemisphere, we show that biome stasis at speciation has outweighed biome shifts by a ratio of more than 25:1. Stasis was also prevalent in transoceanic colonizations. Availability of a suitable biome and the rarity of dispersal events may have substantially influenced which lineages establish on more than one landmass. Conversely, the taxonomic composition of biomes has probably been strongly influenced by the rarity of species' transitions between biomes. This study has implications for the future because if clades have inherently limited capacity to shift biomes, their evolutionary potential could be strongly compromised by biome contraction as climate changes. DOI: 10.1038/nature07764



Swiss Networking in Plant Sciences – Launching the Swiss Plant Science Web

Initiated by Prof. Thomas Boller (University of Basel) and Dr. Melanie Paschke (PSC coordination office), a proposal with the aim of creating a Swiss network in plant sciences was recently submitted to the Rector's Conference of the Swiss Universities (CRUS). We are proud to announce that the CRUS approved the project with financial support of CHF 4.7 million. Together with the Universities of Bern, Neuchâtel, Fribourg, Geneva and Lausanne, we will now establish a Swiss Plant Science Web linking the competences of three regional clusters – the PSC, BeNeFri and Arc Lemanique. By joining forces, we wish to advance research and education efforts in Switzerland, and enhance the visibility of plant science and its benefits to society. Dr. Luca Wacker will be the national coordinator of the Swiss Plant Science Web and will coordinate the member services of three integrated technology platforms, the Genetic Diversity Center (ETH Zurich), the Chemical Analytical Services (University of Neuchâtel) and the Bio-Molecular Analysis platform (University of Geneva).

Contact: M. Paschke, T. Boller

Prolongation of PSC-Syngenta Research Collaboration

After 6 years of successful collaboration with Syngenta, the PSC is happy to announce the signing of a three-year prolongation agreement. In September 2009, we will announce the next call for research projects for PhD students and post-docs. Submissions will be evaluated by an Advisory Committee in October/November. The Advisory Committee is composed of Prof. Ueli Grossniklaus (University of Zurich), Prof. Sam Zeeman (ETH Zurich) and Prof. Christian Körner (University of Basel). Syngenta will be represented by Dr. Alain Gaume, who studied agronomy at the ETH Zurich and has recently joined Syngenta as the group leader for Seed Care Research, based at Stein AG. Approved research projects can expect to start in spring 2010.

Contact: M. Dahinden, U. Grossniklaus

New PhD Program in Plant Sciences and Policy

The PSC has received financial approval from the SNSF to establish a new PhD Program in "Plant Sciences and Policy", initiated by Prof. Ueli Grossniklaus (University of Zurich) and Dr. Manuela Dahinden (PSC coordination office). The Program allows talented young scientists to do their PhD research in plant sciences while training them to engage in a political dialog. The new PhD Program will start in October 2009 and will be open to PhD students whose supervisor is a member of the PSC. Overall, 10 PhD Fellowships are available to PSC members (applications can be submitted to the SNSF under the rubric "ProDoc Research Module", by October 1, 2009 and March 1, 2010). PD Dr Lars Henning was one of the first successful applicants, having received a PhD Fellowship for the research topic "Mechanisms of vernalization".

Contact: M. Dahinden and M. Paschke



SYMPOSIUM



PSC Symposium 2009: Plant-Microbe Interactions

November 13, 2009

Venue: University of Basel, Kollegiengebäude (Main Auditorium),
Petersplatz 1, Basel

http://www.plantscience.ethz.ch/symposia/Symposium_09

08.45–08.50 **Opening and Welcome** by Thomas Boller, University of Basel

Session I: Thomas Boller, University of Basel, chair

08:50–09:25 Martin Parniske, Ludwig-Maximilians Universität München,
Germany

Signal transduction in plant root symbiosis

09:25–09:45 Tatiana Giraud, Université Paris-Sud XI, France

Mechanisms of speciation by host specialization in the anther smut fungi

09:45–10:05 Adrian Leuchtman, ETH Zurich, Switzerland

Epichloë endophytes – an intriguing association between fungi, grasses and *Botanophila* flies

10.05–10:35 Coffee and Poster Session

10.35–11.10 Francis Martin, INRA-Nancy, France

Symbiont inventions – Genomes of the basidiomycete *Laccaria bicolor* and the ascomycete *Tuber melanosporum* reveal evolutionary insights into my- corrhizal symbiosis

11.10–11.30 Jean-Pierre Métraux, Université de Fribourg, Switzerland

***Botrytis cinerea* and *Arabidopsis thaliana*: more refinements than expected**

11.30–13.30 Lunch and Poster Session

Session II: Bruce McDonald, ETH Zurich, chair

13.30–14.05 Michael F. Allen, USA, University of California Riverside, USA

Understanding mycorrhizae as a dynamic system: observations from sensor and imaging technologies in the field

14.05–14.25 Christoph Keel, Université de Lausanne, Switzerland

Molecular analysis of plant protection by root-colonizing *Pseudomonas* bacteria

14.25–14.45 Julia Vorholt, ETH Zurich, Switzerland

Microbial life of leaf surfaces

14.45–15.15 Coffee and Poster Session

15.15–15.50 Joy Bergelson, University of Chicago, USA

Disentangling the coevolution of a plant pathogen system

15.50–16.10 Delphine Chinchilla, University of Basel, Switzerland

Flagellin perception: a paradigm for innate immunity in plants

16.10–16.25 **Poster awards and concluding remarks** by Ueli Grossniklaus,
University of Zurich, PSC chair

16.25–17.15 Apéro and Poster Session

Conference participations is free of charge.

Online poster registration:

http://botserv1.uzh.ch/public/Poster_Eingabe.php

Deadline: 18 October 2009

Organizing Committee: Thomas Boller (University of Basel), Jan Jansa (ETH Zurich), Sylvia Martínez (PSC), Bruce McDonald (ETH Zurich), Kentaro Shimizu (University of Zurich), Laure Weisskopf (University of Zurich).

Impressum

Plant Science Newsletter, no. 16/Autumn 2009
The newsletter of the Zurich–Basel Plant Science Center
appears twice a year. It can be obtained in printed form
from sylvia.martinez@unibas.ch or as a pdf-file
(www.plantscience.uzh.ch, www.plantscience.ethz.ch,
www.plantscience.unibas.ch).

Editors
Manuela Dahinden, Sylvia Martínez, Zurich–Basel Plant
Science Center

Text Contributions
The editors would like to thank: T. Boller, A. Endler,
F. Liebisch, M. Paschke

Contact Newsletter
sylvia.martinez@unibas.ch
Phone: +41 (0)61 267 35 03
Institute of Botany, University of Basel,
Schönbeinstrasse 6, 4056 Basel, Switzerland

Contact Plant Science Center
info-plantscience@ethz.ch
Phone: +41 (0)44 632 23 33
Coordination Office PSC, Universitätsstrasse 2,
ETH Zurich, LFW, 8092 Zurich, Switzerland

Production
English language consultant: Penelope Barnett,
8195 Wasterkingen
Graphic Design: Arturo La Vecchia, Zurich
Layout: Esther Schreier, Basel
Printing: Print Media Works GmbH, Schopfheim
Print run: 600 copies
Paper RecyMago 135 g/m²
Pictures: Urs M. Weber, 4494 Oltingen
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