Universität Zürich

Akademischer Bericht 2005
Institut für Pflanzenbiologie

Leitung in der Berichtsperiode:
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Zusammenfassung (Management Summary)

The Institute of Plant Biology as part of the Faculty of Science is responsible for teaching of, and research on genetic, molecular, biochemical, developmental and cellular aspects of plant biology as well as on limnology, aquatic ecology, microbial ecology and microbiology. Microbiology is taught in collaboration with institutes of the Medical Faculties and the ETH Zürich. There are a large number of national and international collaborations at the institute. In particular, the institute is member of the Plant Science Center (PSC http://www.plantscience.unizh.ch/index_EN), a joint Center of seven institutes involved in plant biology from the Universities of Basel and Zürich and ETH Zürich. The PSC strengthens collaborations in research and teaching between the institutes involved and stimulates the discussion and the scientific exchange through joint PhD fellowships, joint lecture series and symposia. The Institute of Plant Biology is also part of Life Sciences Zürich, a network of the biological and biomedical research community in Zürich. In research, we want to be a major contributor to plant and microbial biology at the international level. Finally, we want to communicate the basis and the applications of our research to society and politics. We are actively participating in this dialog at various levels.

The Institute of Plant Biology concentrates on five main topics which are each covered by a professorship. Currently, there are three full professors and two tenure-track assistant professors: Prof. Leo Eberl (Microbiology, since 2003), Prof. Ueli Grossniklaus (Plant Developmental Biology, since 2000), Prof. Beat Keller (Plant Molecular Biology, since 1997), Prof. Enrico Martinoia (Molecular Plant Physiology, since 1.9.2002), Prof. Jakob Pernthaler (Limnology, since 2005). The main focus is on the molecular characterization of plant and microbial systems, the latter with a strong ecological perspective. Plant Biology belongs to the “Schwerpunkte” of the Faculty of Sciences and the Life Sciences in general are forming a major focus at the University of Zürich. In the year 2005, a candidate was selected for the non-tenure track assistant professorship in Plant Evolutionary Genomics. He will start his work at the institute in April 2006.

Due to the retirement of Prof. Friedrich Jüttner and the appointment of Prof. Jakob Pernthaler as new head, the ***Limnological Department*** has undergone a major re-orientation with respect to its infrastructure and future research topics. In this context, the limnological station has undergone substantial renovation, including a complete overhaul of the building fabric and technical installations, and it has been equipped with new furniture for the laboratories and offices. These replacement activities have been largely finished at the end of the year. Prof. Pernthaler started his activities September 1, 2005 and, from the beginning, was strongly involved in the renovation of the Limnological Station and teaching a common block course with ETH.

Research activities in the ***Department of Plant Developmental Genetics*** are focused on the elucidation of the genetic basis and molecular mechanisms that control plant reproduction. The projects center on three major areas: 1) the development of the female gametophyte and double fertilization, 2) early seed development with an emphasis on epigenetic gene regulation and maternal effects, and 3) genetic and biotechnological approaches towards the engineering of apomixis. The group of Rosmarie Honegger investigates the genetic diversity and phylogenies of selected genera of lichen-forming ascomycetes and their green algal photobionts.

During the third year at the University, the ***Department of Molecular Plant Physiology*** (LMPP) entered in the phase where the first PhD students finished their thesis and new PhD students were hired. The NCCR ”Plant Survival” started the second phase and LMPP was granted with a PhD position to continue its participation within this network. The new curriculum required to reorganize and extend the teaching in the second and third year. The admistrative duties of the professors are still increasing and it will be necessary to think about new models which allow the professors to spend enough time with scientific problems.

Research in the ***Department of Plant Molecular Biology*** concentrates on the molecular isolation of fungal disease resistance genes in the cereal crops, and the study of their diversity and evolution in the gene pool. In addition, the structure and evolution of the grass genomes is studied using comparative genomic approaches. In the last year we have made significant progress in the characterization of powdery mildew resistance gene diversity in the wheat gene pools and the molecular characterization of resistance activity. The research projects of the Dudler group focus on the mechanism by which syringolin, produced by a phytopathogenic bacterium, is able to reprogram wheat cells colonized by the powdery mildew fungus to undergo hypersensitive cell death.

Research of the ***Department of Microbiology*** focuses on the analyses of the molecular mechanisms underlying bacterial cell-to-cell communication systems (referred to as quorum-sensing) in various Gram-negative bacteria as well as on medical and ecological aspects of bacterial signalling. This line of research involves investigations on the importance of quorum sensing for the formation of biofilms, expression of pathogenic traits and the production of antibiotics, using classic genetic and biochemical methods as well as functional genomics approaches. The Hanselmann group concentrates on the diversity and the abilities of microorganisms in extreme environments.

To stimulate interactions within the institute, on October 3rd/4th we had our “1st Retreat of the Institute of Plant Biology” on Alp Selamatt, Toggenburg organised by Dr. Hanspeter Schöb.

In 2005, for the first time all teaching activities were based on the reformed curriculum in biology, with the bachelor/master structure according to the Bologna model and the ECTS system. The development of the new courses was very time-intensive. In 2005, there was a massive increase of students in biology in the first semester (from 152 in 2004 to 198). Obviously, the reform and modernization of the curriculum is attracting many new students. At our institute specifically, we had an increase in students taking plant and microbiology courses and specializing in the corresponding Master studies. While the later is no problem, the steep increase in the Grundstudium is causing significant problems for the practical courses. Within the frame of the Plant Science Center, we are offering a graduate programme with courses specifically designed for graduate students. The graduate studies in Plant Sciences are now offered under the umbrella of The Zurich Graduate School in Biology (since autumn 2005). The scientific training of graduate students has a high priority at our institute. In 2005, the institute had a total of over 50 graduate students. Finally, we are also coordinating the education in biology as part of the “Sekundarlehrerausbildung” (formation of teachers), to which the institute contributes significantly. This is mainly done by Prof. F. Schanz, a permanent scientific collaborator at the Department of Limnology.

The institute has a total number of about 80 full-time equivalent positions (FTE), of which about 55 are financed by the University of Zürich and 25 FTE by grants.

In the last year, there were several projects maintaining or improving infrastructure at the institute. In addition to the already mentioned renovation of the Limnological Station, construction of the final phase of new greenhouses has started in the area of the Botanical Garden. Some improvements for infrastructure were made in the institute itself: this includes new lab space for the new assistant professor K. Shimizu and the conversion of a large storage room in the basement into a room for seed storage rooms and large equipment. Finally, we have been strongly involved in the planning of the renovation and use of the Villa Rainhof in the Botanical Garden.

Last but not least, the institute is making strong efforts in information and education of the general public about the benefits and problems related to research in plant biology and microbiology. A large part of these activities is related to the discussion on GMO plants, their role in food production and their potential effects on the environment. In the last year, we have beem strongly involved in the public debate on the “Moratoriumsinitiative für eine gentechnikfreie Landwirtschaft”. This work is important, but it

also consumes many resources, in particular time.

Finally, we have to emphasize again that the continuing increase of administrative duties and additional teaching due to the Bologna reform poses a threat to the quality of research, especially with constant or decreasing budgets.

1 Allgemeine Einschätzung

1.1 Wo stehen wir heute: Standortbestimmung

The focus areas of research at the institute were introduced in the Zusammenfassung above and synopses of the various research programs are given in the Forschungsdatenbank. Thus, these will not be reiterated here. Clearly, our aim is to be competitive at the international level both in scientific contributions and the recruitment of co-workers. All groups have published in 2005 in internationally recognized journals and four of the institute's professors are within the top percentile of cited authors in their respective fields. Moreover, the fact that we currently have graduate students from 12 nations and postdoctoral fellows from 10 countries illustrates that the institute is internationally competitive with regard to the recruitment of co-workers.

Over the last years, the Institute of Plant Biology has been re-established by hiring six professors since 1997. This process was completed in 2005 by hiring Dr. Kentaru Shimizu as Assistant Professor. While the institute has currently an internationally renowned profile, the quality and impact of its research is under threat by a steady increase in administration and a considerably higher amount of teaching as a result of the Bologna Process. If the institute is to maintain its high quality in teaching and research, this development has to be stopped. A strong "Mittelbau' and sufficient financial resources are required to maintain teaching and research at an internationally competitive level. The goal for the next years is to maintain the attractiveness of the different research groups, to attract excellent young scientists and to support them in order to make them attractive for the job market in academia and industry. As in the year before, a number of post-docs and guest scientists coming with their own salaries could be attracted to the institute.

The laboratory for molecular plant physiology is now well established (it was started September 1^{st}, 2002 and the number of coworkers fluctuates around thirty. The Dept. of Microbiology has grown considerably and is now also very well established (also it is still very young, it started September 1^{st}, 2003).

Teaching at the basic and advanced levels is a major activity of the institute. A survey for the administration performed in 2003 showed that the professors invest about 40% of their time towards teaching and training. The majority of the lectures are held by the five Professors and four 'Titularprofessoren', with the non-permanent 'OberassistentenInnen' playing a crucial role in the teaching of practicals and the training of graduate students.

Over the last four years, the Faculty of Science (MNF) worked towards the implementation of the Bologna Declaration with the aim to introduce three step study programs with Bachelor, Master and PhD degrees. This opportunity was taken to completely restructure the biology curriculum. The new curriculum, which leads to the degree 'Bachelor of Science in Biology' over a minimum of six semesters, started in October 2004 and for the first time, a complete teaching year was made based on the new curriculum in 2005. At the Master level, a 'Master of Science in Biology' with 12 possible specifications (Molecular and Cell Biology, Developmental Biology, Genetics, Microbiology, Plant Science, Neurobiology, Medical Biology, Anthropology, Behavioral Biology, Ecology, Systematics and Evolution, Paleontology) can be obtained in an additional three semesters. In the last year, many students started their masters studies at our institute and all of us are getting acquinted with the advantages and problems of the new degree.

The new biology curriculum was structured in a modular fashion to comply with the Bologna Declaration where a specific number of credit points is assigned to each module to facilitate student mobility. The

Bachelor degree comprises two years of basic studies followed by one year of blockcourses that can be freely chosen from over 70 blockcourses offered by the institutes of the 'Fachbereich Biologie'. The 'Grundstudium' has been restructured considerably.

The contribution of our institute to the new 'Grundstudium' is still very high with 25.5% of the lectures held by our staff. While the major part of this is taught within module 'Form und Funktion der Pflanzen' we also contribute to the modules 'Zellbiologie', 'Biodiversität: Pflanzen, Wirbeltiere, Pilze', 'Molekular- und Mikrobiologie', 'Entwicklungsbiologie' and 'Oekologie und Biodiversität'. The institute also offers excursions in marine biology (at stations in Roscoff and Banyuls) and microbiology.

The third year of the Bachelor studies is dedicated to blockcourses of 3.5 weeks (or sometimes 7 weeks) where research-oriented teaching with practicals, lectures, self-study and soft skill development are combined in one module. All institutes adopted this system such that now all biology students can freely choose among over 70 courses, of which our institute offers 12. Mondays are kept free for either specialized lecture courses (over 70 are offered) or a few specific blockcourses that run over the entire semester. The degree 'Bachelor of Science in Biology' is awarded if eight of the blockcourses have been successfully completed and 12 additionally required credit points have been accumulated.

The Masters program allows specializations in 12 different areas. Our institute is leading the 'Plant Science' and 'Microbiology' programs but also participates in the 'Cell- and Molecular Biology', 'Developmental Biology', and 'Genetics' programs. At the centre of the Masters studies is an independent research project, the Masters thesis that has to be completed within 12 months. In addition, 2 to 3 blockcourses in the respective field are taken. Written and oral exams conclude the Masters program after a minimum of three semesters. More detailed information about the new curriculum is available at http://www.biologie.unizh.ch.

1.2 Wo wollen wir hin: Ziele in den nächsten Jahren

The goal for the next years is to maintain or even increase the quality of research, the international reputation of the institute and to attract excellent young scientists. In addition, we continue to use the opportunity of the Bologna reform to revise, reorganize and update our teaching activities, in the future particularly at the master level. Closer collaboration with the ETH Zürich in teaching of Biology will be given a high priority. In a very ambitious plan and time table, the biology departments of the ETH Zürich and the University have decided to offer a joint teaching programme (compatible scheme and organization of courses and lectures) starting in autumn 2006. The work on this programme was very intense during 2005 and the decision to start in 2006 is fixed. Thus, the plan is to expand currently available joint teaching programmes (Studies in Microbiology, Graduate Programme in Plant Sciences) in a future teaching programme in “Biologie Zürich”.

The institute was evaluated in 2004. We have obtained the evaluation report of the expert committee and the final report of the Evaluationstelle of the University in 2005. We have carefully analyzed and discussed the suggestions of the committee and prepared actions to the different suggestions. In 2006, the final ”Zielvereinbarung” will be made.

We want to strengthen the groups in microbiology, and to a lesser degree in aquatic ecology. As was clearly stated by the evaluation committee in 2005, this strengthening can and will not be based on reducing the groups in plant biology.

The construction work on additional greenhouses at the Zollikerstrasse has started in 2005 and it is foreseen to be able to start to use them during 2006. This will provide highly needed additional space for plant growth a the institute. Although most of the space will be reserved for the Institute of Systematic Botany, one chamber of 70 m^2 will be available for our institute, thus complementing the greenhouse infrastructure. We have also started to plan the renovation and new use of the Villa adjacent to the Botanical Garden which was vacated by the ETH in 2005. This will provide our institute with the critically needed office space, although the problem of lacking lab space can not be solved with this building.

We would also like to support the Universitätsleitung in efforts to reverse the trend of the last years for an increasing regulatory density in all aspects of our work. The endless stream of inquiries and forms

from the Stabstellen of the University has to be reduced. The Stabstellen have to be restructured in a way that they support the core activities of our University, i.e. teaching and research, instead of inhibiting them.

The institute plans to give itself an ”Institutsordnung” during 2006. In addition, we plan to critically analyze the management processes at the institute. The time we devote to administration (including administration for teaching and examinations which have increased dramatically by the Bologna reform) has increased to a level that requires action. We will carefully analyze the situation and take the necessary measures to allow the professors again to focus on their core duties.

1.3 Wie kommen wir dahin: Strategien, Massnahmen

In autumn 2006, joint and compatible teaching programmes will start together with ETHZ. This will result in great changes in the way we teach and attract students. The creation of a common set of courses, being offered as “Biologie Zürich” will make Zürich an even more attractive place to study Biology than it is already now. Therefore, we strongly support the development of joint teaching. This new development will be possibly as demanding as the Bologna reform to develop adapted courses, processes, administration, exams and last but not least, contents. It is not yet clear how with reduced budgets all the goals can be reached.

The hiring of the new, non-tenure track assistant professor in evolutionary genomics will greatly strengthen the education in bioinformatics and biostatistics as well as the integration of bioinformatic research directions in several groups. Dr. Kentaro Shimizu will start in April 2006 and we plan to integrate him into our teaching curricula as much as this is possible for a non-tenure track assistant professor.

To house this new research group, we need additional space for our institute. We plan to move some office and other non-laboratory infrastructure to an existing building adjacent to the Botanical Garden, which is currently vacant and will be renovated in the next two years. Hopefully, the Regierungsrat of the Kanton Zürich will rapidly approve the renovation of this building.

Molecular and environmental microbiology will continue to be a major focus in research and teaching. The new group of Prof. J. Pernthaler will be instrumental to further develop this discipline at the institute. In addition, we envisage a further strengthening of this research direction by the promotion of Prof. L. Eberl to a full professor and enlarging his group. Together with the now well established topic of molecular aspects of plant biology, the Institute of Plant Biology will be clearly positioned in the research landscape of the Life Sciences in Zürich. The further strengthening of microbiology will be a major activity of the institute in coming years, including the establishment of new courses. Plant biological research will be consolidated and no major changes are foreseen. Some of the permanent senior scientist positions in plant biology, and one in microbiology/aquatic ecology, will have to be replaced at the permanent level with carefully selected candidates.

The major challenge of the last two years, the introduction of the new Bachelor/Masters curricula in Plant Biology and Microbiology, will continue to need our attention. Although most courses and lectures have now been taught at least once, there is still a great need for fine-tuning to improve contents and administration. The continued absence of qualitatively good software (UniVers) represents a big problem and we would like to contribute to better solutions.

2 Forschung

2.1 Überblickstext

Research of the ***Department of Microbiology*** focuses on the analyses of the molecular mechanisms underlying bacterial cell-to-cell communication systems (referred to as quorum-sensing) in various Gram-negative bacteria as well as on medical and ecological aspects of bacterial signalling. This line of research involves investigations on the importance of quorum sensing for the formation of biofilms, expression of pathogenic traits and the production of antibiotics, using classic genetic and biochemical

methods as well as functional genomics approaches. Compounds capable of specifically interfering with quorum-sensing circuitries for use as novel therapeutical options for the treatment of bacterial infections are being developed. The work of the *Microbial Ecology Group (K. Hanselmann)* concentrates on the diversity and the abilities of microorganisms in extreme environments. Emphasis is put on low nutrient concentrations and cold temperatures as habitat conditions.

Research in the ***Department of Plant Molecular Biology*** concentrates on the molecular isolation of fungal (leaf rust and powdery mildew) disease resistance genes in the cereal crops wheat and barley, and the study of their diversity and evolution in the gene pool. In addition, the structure and evolution of the Triticeae genomes is studied using comparative and evolutionary genomic approaches. In the last year we have made significant progress in the characterization of powdery mildew resistance gene diversity in the gene pools of wild and domesticated wheat and the molecular characterization of resistance activity. In addition, the study of long-term evolution of resistance like genes in wheat and rice has revealed suprising new mechanisms of resistance gene evolution. The research projects of the *Dudler group* focus on the mechanism by which syringolin, produced by the phytopathogenic bacterium *Pseudomonas syringae,* is able to reprogram wheat cells colonized by the powdery mildew fungus to undergo hypersensitive cell death.

The main research focus in the ***Department of Molecular Plant Physiology*** is to elucidate transport processes across plant membranes. This includes regulation of phytohormone transport, regulation of stomata movement, transport of plant secondray metabolites and proteomic and functional approaches to learn more about vacuolar transport processes. In addition, Prof. F. Keller is elucidating the synthesis and the function of raffinose family sugars, which play an important role in many stress reactions.

Studies in the ***Department of Plant Developmental Genetics*** have shown that both genetic and epigenetic mechanisms play a key role in plant reproduction. Areas of research concern embryo sac development and function (Grossniklaus), maternal effects and underlying epigenetic mechanisms (Grossniklaus), the function of ORC in replication and chromatin organization during seed development (Collinge), the development of apomixis technology (Curtis), comparisons of apomixis and sexuality (Grossniklaus), and the study of genetic diversity in lichens (Honegger). The group of Rosmarie Honegger also investigated the mating systems and phylogenies of lichen-forming ascomycetes.The development of new approaches to study the transcriptomes and proteomes of individual cell types constitutes a highlight of our work in 2005.

During the coming years the research focus of the ***Department of Limnology*** will shift from chemical analysis of allelopathic interactions between phyto- and zooplankton to investigating the diversity and structure of freshwater microbial communities. Another line of research will deal with the ecology of particular groups of yet uncultured bacteria in the water column of lakes in the context of food webs and substrate supply. In particular, the dynamics and mechanisms of microbial predator-prey interactions will be investigated both in the field and in laboratory microcosms. For this purpose, new equipment for cell imaging, flow cytometry and cell sorting and for molecular analysis by whole cell fluorescence in situ hybridization will be purchased and installed during the coming year. In addition, the available high-end infrastructure for chemical analysis will be maintained and included in future projects (e.g., about chemical interactions within defined microbial predator-prey systems).

2.2 Vorträge an Kongressen

Baroux Célia Dr.
Fitting two females and one male in a single room: structure and organisation of endosperm nuclei in Arabidopsis seeds
Epigenome NoE (Network of Excellence) workshop within the EMBO / FEBS Conference on Nuclear Structure and Dynamics, La Grande Motte, Frankreich, September 2005

Baumann Heike PhD student
Chemical Defence by Digestive Protease Inhibitors of Plankothrix rubesecens and Adaption by Grazers
SEFS4 – Symposium of European Freshwater Sciene in Krakau, Polen, 22.-26.08.2005

Baumann Thomas W. Prof.
Scientifically assistance regarding the exposition 'Koffein– Der Kick aus der Bohne'
Johann Jacobs Museum in Zurich, Switzerland, 22. 5. 2005 – 30. 4. 06

Becher Paul PhD student
Characterisation of indole alkaloids in the benthic cyanobacterium Fischerella and their potential role as grazer toxins.
SEFS4 – Symposium of European Freshwater Sciene in Krakau, Polen; 22.-26.08.2005

Collinge Margaret Dr.
The quest for orcs
14th Swiss plant molecular and cellular biology conference, Les Diablerets, März 2005

Eberl Leo Prof.
Bakterielle Kommunikation: Auswirkung auf und Wechselwirkung mit Pflanzen
EAWAG, Dübendorf Switzerland, 22.03.2005

Escobar Juan Miguel
The Feronia Mutant in Arabidopsis thaliana
International Workshop. Sperm and seminal fluid: what males produce and how females respond. Monte Verita, Ascona, Februar 2005

Geisler Markus Dr.
Active export of auxin by MDR-type ATP-binding cassette transporters
1st Symposium on Plant Neurophysiology in Firenze / Italy, 18.05.2005

Geisler Markus Dr.
TWISTED DWARF1 modulates auxin transport activities of ABC transporter, AtPGP1, by protein-protein interaction.
2nd International Symposium Auxins and Cytokinins in Plant Development in Prague / Czech Republic, 09.07.2005

Grossniklaus Ueli Prof.
Genomic Imprinting and PcG-mediated Regulation during Arabidopsis seed development
2nd Alan Wolffe EMBO Conference on Chromatin and Epigenetics, Heidelberg, Deutschland, 20.05.2005

Grossniklaus Ueli Prof.
Apomixis: an epigenetic variation of sexuality? PARthenogenesis NEtwoRk (PARTNER)
4th Workshop 'The Paradox of Asexuality: An Evaluation', Linnean Society, London, UK, 22.09.2005

Grossniklaus Ueli Prof.
Genomic impriting and PcG-mediated regulation during seed development
Annual Meeting of The American Society of Plant Biologists, Plant Biology 2005, Seattle, WA, USA, 18.07.2005

Grossniklaus Ueli Prof.
Genomic Imprinting and PcG-mediated Regulation during Arabidopsis seed development. "Epigenetics and the dynamic genome conference"
Babraham Cancer Institute, Cambridge, UK, 01.07.2005

Grossniklaus Ueli Prof.
Potential applications of apomixis in plant breeding and transgene containment
Conference on the Coexistence of GM and non-GM crops, FAL Reckenholz, 10.06.2005

Grossniklaus Ueli Prof.
Chancen and Risiken der Grünen Gentechnologie
Gesprächskreis Erasmus zu Predigern, Zürich, 29.04.2005

Grossniklaus Ueli Prof.
Evolutionary implications of epigenetic phenomena in plants
Gordon Research Conference “Epigenetics”, Holderness, NH, USA, 09.08.2005

Grossniklaus Ueli Prof.
Epigenetic gene regulation during plant reproduction in Arabidopsis
Juan March Workshop on Plant stem cells: Independent inventions and conserved mechanisms, Madrid, Spanien, 25.05.2005

Grossniklaus Ueli Prof.
Naturwissenschaftliche Grundlagen zur Grünen Gentechnologie. ”Dialog zwischen Medien und Forschung”
Life Science Zürich-Tagung für Medienschaffende zur Pflanzen-Gentechnologie, Zürich, 05.10.2005

Grossniklaus Ueli Prof.
Sex, parental conflict, and Infanticide
Symposium Inaugural du CIG-Centre Intégratif de Génomique de l’Université de Lausanne, Lausanne, 28.10.2005

Grossniklaus Ueli Prof.
Epigenetic Gene Regulation in Development and Evolution
Symposium of the Zürich-Basel Plant Science Center: Plant Genome Evolution and Regulation, ETH Zürich, Zürich, 16.12.2005

Grossniklaus Ueli Prof.
Cell-cell interactions during plant reproduction
Tagung der Deutschen Gesellschaft für Entwicklungsbiologie GfE, Münster, Deutschland

Grossniklaus Ueli Prof.
Interrelationship of amphimixis and apomixis
XVII International Botanical Conference (IBC), Wien, Oesterreich, 21.07.2005

Grossnilaus Ueli Prof.
Beyond the genome: epigenetic regulation of identity
Epigenetics in differentiation and reprogramming. The 6th Horizon Symposium; Nature Publishing Group, Maine, USA, 06.05.2005

Honegger Rosmarie Prof.
Mating systems and speciation in lichen-forming ascomycetes (Invited lecture),
17th International Botanical Congress (IBC 17), Vienna; 17 - 23 July 2005

Höckelmann Claudia Dr.
Cyanobacterial Odor Compounds as Infochemicals for Aquatic Nematodes
ASLO Summer Meeting, Santiago de Compostela, 19.-24.6.2005

Jüttner Friedrich Prof.
Plenary Lecture: Biochemical and ecological control of off-flavours of aquatic cyanobacteria and algae.
VII. Sympos. on Off-Flavours in the Aquatic Environment. Cornwall, Ontario, Canada, 12.09.-16.09.2005

Jüttner Friedrich Prof.
Cyanobacterial defence against grazers: inhibitors of digestive hydrolytic enzymes.
XVII International Botanical Congress, Vienna Austria, 18.07.2005

Keller Beat Prof.
Ancient haplotypes resulting from extensive molecular rearrangements in the wheat A genome have been maintained in species of three different ploidy levels
8th Gatersleben Research Conference „Genetic diversity and genome dynamics in plants, Schloss Meisdorf, Germany, 04.06.2005

Keller Beat Prof.
Diversity and evolution of resistance genes in cultivated and wild wheat: exploring the resources of a crop plant.
Annual Congress of the Society of Experimental Biology, Barcelona, Spain; 14.07.2005

Keller Beat Prof.
Molecular approaches to isolate and characterize agronomically important genes in wheat.
KWS Saatzucht AG, Einbeck, Germany; 15.06.2006

Keller Beat Prof.
Gentechnik und nachhaltige Landwirtschaft: Missverständnisse zu einem neuen Werkzeug der Pflanzenzüchtung.
Tagung Zurich-Basel Plant Science Center and der ETH Zürich zum Thema: Welche Zukunft hat Pflanzenforschung mit gentechnischen Methoden in der Schweiz? 11.03.2005

Klein Markus Dr.
Membrane transport processes and Arabidopsis proteins of the ABC and MATE transporter families involved in secondary metabolite transport and guard cell regulation.
Phytosphere Institute, German Research Center Jülich, Germany; Feb. 05

Martinoia Enrico Prof.
Plant ABC transporter.
11th DRDC Workshop; Autrans, France; 26. - 29.01.2005

Martinoia Enrico Prof.
The role of the vacuole in detoxification and homeostasis.
Bioscience Research Report BASF; Ludwigshafen Germany, 12. - 14.09.2005

Martinoia Enrico Prof.
The multifunctionality of plant ABC transpoters.
Franco-Belge Worshop on ABC transporters; Paris, France; 18.07.2005

Martinoia Enrico Prof.
The role of the vacuole in cellular compartmentation and storage.
Gordon Conference, Tilton, USA, 10. - 15.07.2005

Martinoia Enrico Prof.
Organic acid and sugar transport in plant vacuoles.
Symposium Molecular and Cellular Biology of plant storage function- from gene to food; Nagoya, Japan; 27. - 29.11.2005

Martinoia Enrico Prof.
About real auxin transporters?
Workshop on Phytohormone action; Wuerzburg, Germany; 20. - 22.04.2005

Mozerov Peter PhD Student
The origin recognition complex - How has it evolved to meet the needs of plant development?
2nd Swiss Meeting on Genome Stability, ”DNA Dynamics and Epigenetics”, Zehntenhaus, Uetendorf, Oktober 2005

Riedel Kathrin Dr.
Mining quorum sensing regulated proteins - Role of bacterial cell-to-cell communication in global gene regulation as assessed by proteomics (invited talk).
12th European Congress on Biotechnology, Copenhagen, Denmark; 23.08.2005

Riedel Kathrin Dr.
Quorum sensing or how bacteria talk to each other.
First international conference on Plant-Microbe Interactions, Sarisälka, Finnland; 21.04.2005

Riedel Kathrin Dr.
Mining quorum sensing regulated proteins by comparative two-dimensional gelelectrophoresis.
HUPO World Congress, Munich, Germany; 31.08.2005

Ringli Christoph Dr.
Mutations affecting pectin formation suppress the Arabidopsis cell wall formation mutant lrx1.
Swiss Plant Molecular and Cellular Biology Conference, les Diablerets, Switzerland.

Ringli Christoph Dr.
Mutations affecting pectin formation suppress the Arabidopsis cell wall formation mutant lrx1.
XVII International Botanical Congress, Vienna Austria; 23.07.2005

Tomasi Nicola, PhD student
Citrate exudation in white lupin cluster roots is coupled with the activity of the proton pump.
FISV 2005 at Riva del Garda, Italy, 24.09.2005

Tomasi Nicola, PhD student
Cluster root formation in white lupin: is a transcription factor involved?
NCCR annual meeting at Leysin, Switzerland, 01.04.2005

Vijverberg Kitty Dr.
Genetic linkage mapping of an apomixis locus in Taraxacum (common dandelion; Asteraceae)
International Botanical Conference (IBC), Wien, Oesterreich, Juli 2005

Watson S. Dr.
Algal taste and odour Daphnia-style
ASLO Summer Meeting, Santiago de Compostela, 19.-24.6.2005

2.3 Forschungsdatenbank

Professur/Forschungsbereich: Eberl, Leo
Investigations on the role of quorum sensing for biofilm formation, plant colonization, and biocontrol activity in Burkholderia cepacia complex strains
Taxonomic studies of the past few years have shown that Burkholderia cepacia-like organisms comprise a very heterogenous group of strains, collectively referred to as the B. cepacia complex. Strains of the B. cepacia complex are ubiquitously distributed in nature and have been isolated from soil, water, the rhizospheres of various plants, industrial settings, the hospital environment and from infected humans. B. cepacia complex strains have an enormous biotechnological potential and have been used for bioremediation of recalcitrant xenobiotics, plant growth promotion, and biocontrol purposes. At the same time, however, B. cepacia strains have emerged as opportunistic pathogens of humans, particularly those with cystic fibrosis. The project aims at identifying factors important for pathogenicity, biocontrol, and colonization of plants and to elucidate the role of quorum sensing for the expression of these functions. The specific aims are:

•To identify functions required for the coloniziation of biotic and abiotic surfaces and to analyze the role of quorum-sensing in these processes

•To define the quorum sensing regulon of B. cenocepacia H111 and to analyze how conserved QS-regulated functions within the B. cepacia complex are

•To identify those quorum sensing-regulated genes that direct the synthesis of an antifungal compound in B. cenocepacia H111

•To identify virulence factors of B. cenocepacia H111 and to determine their distribution among strains of the B. cepacia complex

01.04.2004-30.04.2007

Professur/Forschungsbereich: Eberl, Leo
Proteome profiling and comparative analyses of Burkholderia cepacia complex strains

Burkholderia cepacia-like bacteria comprise a very heterogeneous group of strains, collectively referred to as the B. cepacia complex (Bcc) that consists of at least nice species. Bcc strains are naturally present in soil, water and the rhizosphere of plants and have attracted considerable attention not only as plant pathogens but also because of their biocontrol, plant growth promoting and bioremediation potential. However, Bcc strains can also cause life-threatening lung infections in cystic fibrosis patients or individuals with chronic granulomatous disease.

The objective of the current project is to gain new insights into the molecular basis of Bcc beneficial and pathogenic traits. Recently, several Burkholderia genome projects of environmental and clinical isolates have been initiated providing a solid basis for functional analysis on the post-transcriptional level. Our ongoing proteome analyses are based on two-dimensional gelelectrophoresis (2-DE) of pre-fractionated protein mixtures (extra-, surface-, and intracellular proteins), followed by tandem mass spectrometry (MS) analysis to identify the respective genes. Furthermore, we plan to employ and optimize novel technologies such as multidimensional liquid chromatography coupled to MS. The protein profiling of selected Bcc strains will help to identify species- or strain-specific protein markers related to Bcc pathogenicity that could serve as novel diagnostic tools. Moreover, these 2-DE reference maps will greatly facilitate the detection of proteins that are differentially expressed in response to certain stimuli or during colonization of a particular environmental niche.

01.04.2004-30.04.2007

Professur/Forschungsbereich: Grossniklaus, Ueli
Kreditnummer 37150601 / Research Co-operation and License Agreement on the nrm1 and nrm2 Mutants of Maize
01.01.2004-31.12.2006

Professur/Forschungsbereich: Grossniklaus, Ueli
Kreditnummer 37150602 / The Oedipus Screen: The Identification of Novel Sporophytic Maternal Effect Mutations in Arabidopsis
01.07.2003-30.06.2005

Professur/Forschungsbereich: Honegger, Rosmarie
Mating systems and speciation in lichen-forming ascomycetes

Mating systems and speciation processes are poorly understood in lichen-forming fungi. Our team focuses on Teloschistaceae, a family of lichen-forming ascomycetes. Phylogenetic analyses of mycobionts (ITS 1 + 2, 5.8S rDNA, hydrophobin, tubulin and mitochondrial genes; PhD thesis of Christof Eichenberger) and their Trebouxia photobionts (ITS 1 + 2, 5.8S rDNA, rbcL gene; PhD thesis of Shyam Nyati) are combined with studies on mating systems in the fungal partner. Changes in reproductive strategies, from cross- to self-fertilization (hetero- to homothallism) or even loss of sexual reproduction, as seen in many lichen-forming ascomycetes, have a strong impact on speciation processes and on population structure. Most lichen-forming ascomycetes can be axenically cultured in the aposymbiotic state, but they do not differentiate sexual reproductive structures in sterile culture, the reasons being unknown. Thus their mating systems are retrospectively studied by analysing the progeny of meiosis. DNA extracted from single ascospore isolates, 8 per ascus, and from the sterile cultured vegetative mycelium of the mother thallus is subjected to fingerprint analysis by means of RAPD-PCR. This technique is also used for analysing the mating systems of rarely fertile, either common and widespread or rare and endangered Parmeliaceae, Ramalinaceae and Physciaceae. Heterothallism is easily detected with fingerprinting techniques, but homothallism has to be confirmed and analysed at the gene level. As mating type genes evolve very rapidly they are difficult to investigate. Sandra Scherrer characterized the mating type loci plus flanking regions of a range of Xanthoria spp. and the genetics of homothallism in two ubiquitous species. One of these self-fertile species (X. elegans) had both idiomorphs (MAT 1-1 + MAT 1-2) per haploid mycelium, the other (X. parietina) a HMG box (MAT 1-2) only, an exceptional situation among ascomycetes. Genetic diversity within populations of homo- and heterothallic Xanthoria spp. and their photobiont and the distribution of MAT idiomorphs in natural populations of the heterothallic X. polycarpa are currently analysed.

01.04.2004-31.03.2007

Professur/Forschungsbereich: Keller, Beat

A strategy for durable resistance - Pyramiding Pm3 alleles in wheat

The fungal pathogen Blumeria graminis f. sp. tritici is the causal agent of the powdery mildew disease in wheat. Resistance to this pathogen is mediated by the Pm genes. Recently the 10 resistance alleles at the Pm3 locus on chromosome 1AS have been cloned and characterized. These alleles confer race-specific resistance to different isolates of this pathogen. Since race-specific resistance is restricted to pathogens that carry the matching avirulence (avr)-gene, this type of resistance can be overcome in the field. For breeders, it is therefore desirable to create plants with more broad-spectrum and long-lasting resistance features. One strategy to achieve this goal is to combine different resistance genes by classical breeding. However, this is a time-consuming approach. Genetic engineering provides a more rapid tool to introduce new disease resistance specificities into crop plants. The aim of this project is to create expression cassettes that combine at least two different Pm3 alleles (Plant Physiol. 2005, 139: 885-895). We will combine alleles that give resistance to a broad variety of powdery mildew pathotypes. Wheat cultivars like Bobwhite, Cadenza and Fielder will be transformed via agrobacterium-mediated transfer. Resulting transgenic plants will be analyzed regarding their resistance reactions. We will examine if the different alleles give additional effects only or if we created new resistance specificities by combining different Pm3 alleles.

01.10.2005-31.10.2007

Professur/Forschungsbereich: Keller, Beat

Analysis of the syringolin-triggered transformation of compatibility to incompatibility in powdery mildew-infected plants

Plants are exposed to pathogenic microbes and thus have evolved a variety of passive and active defense measures. A prominent defense response is the hypersensitive reaction, which is associated with localized programmed cell death and provides full protection against the pathogen. Genetic analysis has revealed that this form of resistance is often race-specific and depends on the recognition of the pathogen by the host. Recognition occurs according to the gene-for gene concept, i. e. when a host variety carrying a specific dominant resistance (R) gene meets a pathogen race with a cognate avirulence (Avr) gene. Absence of either the specific R gene or the cognate Avr gene leads to a compatible host-pathogen interaction and to disease. In recent years, we have studied the interaction of wheat (Triticum aestivum) with powdery mildew (Blumeria graminis f. sp. tritici), an obligate biotophic fungus and one of its important pathogens. This research resulted in the isolation of syringolin, a small cyclic peptide secreted by strains of the phytopathogenic bacterium Pseudomonas syringae pv. syringae for which wheat is not a host. Syringolin has the remarkable ability to induce hypersensitive cell death at infection sites of powdery mildew-infected wheat in a compatible interaction. That is, syringolin can reprogram a compatible interaction into an incompatible one. This is also true for the interaction of powdery mildew (Erysiphe cichoracearum) with Arabidopsis thaliana. To elucidate the molecular details behind this activity we are attempting to genetically dissect the syringolin response pathway by screening mutagenized Arabidopsis for mutants in which the hypersensitive reaction is not triggered in infected plants by syringolin spraying. We have also constructed transgenic plants harboring a herbicide resistance gene under the control of a syringolin-inducible promoter. Trangenic plants are mutagenized and mutantw with altered transgene expression are selected and analysed with the aim to identify signal transduction components. In addition, transcript profiling expreriments have identified genes whose expression is significantly altered by syringolin treatment. A number of mutants are analysed that contain insertions in regulatory genes exhibiting early and strong expression after syringolin treatment. In order to study the funcition of syringolin for the interaction of Pseudomonas syringae pv. syringae with host plants, we sought to obtain mutants that do not produce syringolin. We were successful to isolate the genes encoding a mixed non-ribosomal peptide/polyketide synthetase responsible for the synthesis of syringolin. Knock-out mutants are being analysed.

01.07.2003-30.06.2007

Professur/Forschungsbereich: Keller, Beat
Association mapping of Stagonospora glume blotch resistance in modern european winter wheat varities
Association mapping in populations relevant for wheat breeding has a large potential for validating and fine-mapping QTLs identified in F2-derived populations. In this study, associations between markers in the region of QSng.sfr-3BS, a major QTL for resistance to Stagonospora nodorum glume blotch (SNG, Paillard et al. 2003; Schnurbusch et al. 2003), and SNG resistance were investigated by linkage and association analyses. After increasing marker density in 240 F5:7 Recombinant Inbred Lines (RILs), QSng.sfr-3BS explained 43% of the genetic variance and peaked 0.6 cM proximal from the marker SUN2-3B. Association between SNG resistance and markers mapped in the region of QSng.sfr-3BS was investigated in a population of 44 modern European winter wheat varieties. Two genetically distinct subpopulations were identified within these lines. Structured association mapping of 32 SSR and STS marker loci revealed the highest association with SNG resistance for SUN2-3B ($p<0.001$), in agreement with linkage analyses. Association mapping provided an effective mean of relating genotypes to complex quantitative phenotypes in hexaploid wheat and new alleles associated with high average resistance levels could be detected. Linkage disequilibrium (r2) in chromosome 3B extended less than 0.5 cM in 44 varieties, while it extended about 30 cM in 240 RILs, based on 91 SSR and STS marker-pair comparisons. This indicated that the association mapping population had a marker resolution potential at least 60-fold higher compared to the RIL population.
01.03.2004-31.03.2007

Professur/Forschungsbereich: Keller, Beat
Development of engineered male sterility in triticale
The aim of the project is to develop a method for the commercial production of hybrid triticale using molecular biological tools and genetic engineering. The strategy to produce male sterile plants consists in pollen and/or anther specific down-regulation of an essential gene by tissue-specific induction of gene silencing. Previous work in our group has identified sucrose synthase (susy) and allene oxide synthase (AOS) as target transcripts. Promoters to drive tissue-specific expression were derived from the 5' non-coding sequence of Osg6 (rice) and Zmc13 (maize) genes, as well as from the -galactosidase gene (-gal; isolated in our lab from Triticum monocuccum). The suitability of the selected components and the effectiveness of the strategy were first tested in bread wheat (Triticum aestivum). Each of the three available promoters was fused to the E.coli beta-glucuronidase (GUS) coding sequence to assess the tissue-specificity of the promoters in transgenic plants. Transgenic wheat lines were also produced to expressing either 'AOS' or 'susy' hairpin constructs from the same promoters. The combination of AOS sequence with either promoter had no detectable effect. 'Susy' hairpin constructs had an effect on seed set, independent of the promoter used. Reduced seed set was a result of reduced pollen fertility, as the effect could be associated with the male parent in reciprocal crossing experiments. This phenotype was stable over several generations within a specific transgenic line. However, the phenotype was highly variable among different independent lines with the same transgene. Seed set was reduced nearly totally in the most effective lines with the Zm13 or -gal promoters. The effect of the transgene is gene dose dependent, as homozygous progeny plants are less fertile than heterozygous progeny. For the Zmc13 promoter, reduced seed set was correlated with reduced grain filling leading to shrunken seeds, probably due to undesired activity of the promoter in the developing seed endosperm.
01.05.2000-31.03.2007

Professur/Forschungsbereich: Keller, Beat
Evolution and organisation of the resistance gene loci Mla, Pm3 and Lr10 in wheat and barley
During their life cycle plants are exposed to a multitude of pathogens. Plant have evolved efficient defense systems against pathogens. So far more than 40 resistance genes against a great variety of pathogens have been cloned. Interestingly, the vast majority of these genes encode similar proteins: the NBS (nucleotide binding site) - LRR (leucine-rich repeat) class of proteins. The finding that plant resistance genes against diverse pathogens like viruses, fungi and bacteria encode similar proteins could be an indication for the theory of a common ancestor gene for recent resistance genes. The aim of this project is to study the evolution and organisation of the powdery mildew resistance gene loci Mla

(barley) and Pm3 (wheat) and the wheat leaf rust resistance gene Lr10. These resistance gene loci will be compared between barley and wheat which diverged ~11 mya. In the first experiment, we used a part of the Mla1 LRR to probe a Triticum monococcum BAC library. BAC clones containing the potential wheat homologs of Mla will be analyzed by low-pass sequencing to find the corresponding genes. For the wheat genes Pm3 and Lr10 we will screen barley BAC libraries to search for homologous genes. Further prospects for this project are the comparison of larger genomic regions and functionality tests of the genes identified.
01.10.2005-31.10.2007

Professur/Forschungsbereich: Keller, Beat
Functional analysis of the LRX gene family in Arabidopsis
We have previously identified a gene family in Arabidopsis encoding extracellular LRX proteins that are likely to be involved in plant cell wall formation (Plant Physiol., 131: 1313-1326, 2003). LRX proteins consist of an N-terminal leucine-rich repeat (LRR) domain with a potential signaling- or regulatory function and a C-terminal structural extensin domain for anchoring of the protein in the cell wall (Genes & Dev. 15: 1128-1139, 2001). In Arabidopsis, the LRX gene family consists of four members that are specifically expressed in pollen whereas seven genes are predominantly expressed in vegetative tissue (Plant Physiol. 131: 1313-1326, 2003). We have identified T-DNA and En-1 transposon insertion mutants of all the vegetatively expressed LRX genes and are characterizing these lines. A detailed work on the lrx1 and lrx2 mutants is described in the project ”suppression of the lrx1 phenotype by rol mutations”. So far, we were not able to detect striking mutant phenotype in other lrx mutants, probably due to functional redundancy. For this reason, a triple mutant of closely related LRX genes with a similar expression pattern was established and seems to develop a mutant phenotype. We are currently analyzing this triple mutant in detail.

A second aim of our work is to functionally characterize the extensin domain of LRX1. Extensin domains are recalcitrant to analysis since modifying extensin expression rarely causes an aberrant phenotype. Using complementation of the lrx1 root hair phenotype as the parameter for protein function, we use variants of LRX1 in which the extensin domain is modified, for assessing the function of individual domains in the extensin domain. The extensin of LRX1 contains a number of distinct but similar motifs, each of which is repeated several times. So far, our analysis revealed that not all repetitive domains of the extensin domain are crucial for LRX1 protein function. We are currently determining an “extensin minimal domain” required for LRX1 function and will then test individual amino acid residues in this domain for their contribution to protein function.

01.10.1997-31.03.2007

Professur/Forschungsbereich: Keller, Beat
Functional analysis, evolution and diversity of powdery mildew resistance genes at the Pm3 locus of hexaploid wheat
In wheat (Triticum aestivum L.), resistance to the fungal pathogen powdery mildew (Blumeria graminis f. sp. tritici) is controlled by Pm genes. The Pm3 locus encodes ten alleles (Pm3a to j) conferring specific resistance to different isolates of powdery mildew. We have cloned the Pm3b gene, a member of the CC-NBS-LRR type of disease resistance genes by a map-based cloning strategy (Plant J 37: 528-538, 2004). Based on haplotype conservation in the Pm3 region for all the lines carrying known Pm3 alleles (Pm3a to j), a PCR-based strategy was used to isolate additional Pm3 resistance alleles from these lines (Plant Physiol 139: 885-895, 2005). The Pm3 candidate alleles were tested in a transient transformation assay and were shown to confer race-specific resistance to powdery mildew. These results indicate that the cloned Pm3 genes form a true allelic series encoded by a single member of a large gene family on wheat chromosome 1A. Sequence comparison of the Pm3 alleles shows a very high level of sequence identity (97-99%) suggesting recent divergence. Domain swapping experiments were performed by combining sequences from different Pm3 alleles and testing them in the transient transformation assay. This allowed the identification of functionally important domains in Pm3 proteins that are determining the resistance specificity conferred by the Pm3 alleles. Alignment of the different Pm3 sequences uncovers the mechanisms that contributed to their evolution. It also allows the design of spe-

cific PCR-based markers that enable their detection in different wheat genotypes. These markers can be implemented into marker-assisted breeding programs for wheat resistance to powdery mildew. We are currently undertaking a molecular screen for new Pm3 alleles using a large collection of cultivated and wild wheat accessions.
01.10.2001-31.12.2007

Professur/Forschungsbereich: Keller, Beat
Functional characterization of Lr10 and RGA2 genes of wheat
In the past, our group has identified the Lr10 leaf rust resistance gene locus of hexaploid (Triticum aestivum L.) wheat (Feuillet et al., 2003). Two RGA genes were identified of which RGA1 corresponds to Lr10 and confers race-specific resistance to leaf rust. The role of RGA2, encoded adjacent to Lr10, so far remains unclear. The aim of this study is to characterize the function of the RGAs by modifying RGA expression in transgenic wheat. Wheat was transformed with the leaf rust gene Lr10 and the RGA2 gene under control of the strong ubiquitin promoter. Phenotypic and genotypic analysis on T1 and T2 plants confirmed the presence of both recombinant Lr10 and rga2 genes. Strong resistance to leaf rust was observed in the double transgenic lines in comparison to the susceptible Bobwhite cultivar used for transformation. The introgression of the transgenes into agronomically relevant cultivars is currently being carried out.

In parallel, the virus induced gene silencing technology (VIGS) is being established and applied to silence genes of interest in wheat, i.e. Lr10 and rga2. This represents a rapid and efficient method to check for the function of genes in wheat. Extending this method to other hexaploid and also tetraploid wheat potentially allows for the identification of new Lr10 alleles. To this end, a collaboration with Dr. Tzion Fahima at the University of Haifa was established to characterize wild wheat accessions collected from the Middle East region.

01.10.2002-31.12.2007

Professur/Forschungsbereich: Keller, Beat
Genetic analysis of root-hair development in Arabidopsis
An EMS-mutagenized Arabidopsis population (ecotype C24) was screen for root hair mutant phenotypes with similarity to the previously isolated lrx1 mutant, which is characterized by short, distorted, and frequently collapsed root hairs (Baumberger et al., 2001; Genes & Dev. 15, 1128-39). Nine der (deformed root hairs) mutants were isolated and der1 revealed to encode ACTIN2, a major actin of Arabidopsis. der1 is affected in the site-selection of root hair emergence and in the tip-growth process, corroborating previously obtained evidence on the function of the actin cytoskeleton during root hair formation (Ringli et al., 2002; Plant Physiol. 129, 1464-1472). Microscopic characterization and double mutant analysis of the der2-9 mutants revealed that they are affected at different stages of root hair development. Furthermore, exogenous application of the phytohormones auxin and ethylene, both known to be involved in root hair formation, revealed that some der mutants do respond to these phytohormones whereas others are irresponsive. Our results demonstrate that the function of auxin and ethylene is not limited to cell differentiation and root hair elongation but that the two hormones are effective throughout the whole root hair developmental process.ant (Baumberger et al., 2001; Genes & Dev. 15, 1128-39), der (deformed root hairs) mutants were isolated from an EMS-mutagenized Arabidopsis population. The der1 mutant was cloned and revealed to encode ACTIN2, a major actin of Arabidopsis. der1 is affected in the site-selection of root hair emergence and in the tip-growth process, corroborating previously obtained evidence on the function of the actin cytoskeleton during root hair formation (Ringli et al., 2002; Plant Physiol. 129, 1464-1472). Microscopic characterization and double mutant analysis of the der2-9 mutants revealed that they are affected at different stages of root hair development. Furthermore, exogenous application of the phytohormones auxin and ethylene, both known to be involved in root hair formation, revealed that some der mutants do respond to these phytohormones whereas others are irresponsive. This effect is now investigated in more detail.
01.02.2000-31.03.2007

Professur/Forschungsbereich: Keller, Beat

Influence of pesticide application on gene expression in wheat Triticum sp.

Wheat is resistant against some herbicides but little is known about the changes in metabolism of resistant plants after treatment with these products. The action of three herbicides with different modes of action (cinidon-ethyl, a heme biosynthesis inhibitor, tribenuron-methyl, an amino acid synthesis inhibitor and 2,4-D, an auxin-like product) on wheat gene expression has been assessed by cDNA microarray analysis. Expression profiles of plants grown either under controlled conditions or in the field were analysed 24hrs, 72hrs, one week and two weeks after treatment in order to determine if plant protection compounds have any role consequences wheat metabolism. Under controlled conditions, 2,4-D clearly induced genes of the phenylpropanoid pathway early after treatment. This possibly reflects 2,4-D detoxification by its incorporation into the cell wall in lignol form. Cinidon-ethyl triggered a strong expression of peroxidase and defence-related genes under controlled conditions, probably because reactive oxygen species are released by photo-oxidation of protoporphyrin-IX. Furthermore, peroxidases could be involved in several steps of the cinidon-ethyl detoxification process. The same genes as under controlled conditions were up-regulated in the field, albeit at a weaker level. For tribenuron-methyl under controlled conditions, no change in the expression profile was found early after treatment, but defence-related genes were up-regulated after one week. Sulfonylureas are known to be rapidly detoxified but the activity of some resulting metabolites could explain these changes in gene expression. Besides, in the field, over-expression of the isopropylmalate synthase gene which is involved in branched-chain amino acid synthesis was observed. This could indicate that the detoxification pathway of tribenuron-methyl is sensitive to environmental conditions.

01.01.2001-31.03.2006

Professur/Forschungsbereich: Keller, Beat

Map-based cloning and comparative analysis at the leaf rust resistance gene locus Rph7 in barley (Hordeum vulgare L.)

In order to isolate the barley leaf rust resistance gene Rph7, we have developed a high-resolution genetic map at the Rph7 locus on chromosome 3HS (Theor. Appl. Genet., 101: 783-788, 2000). A BAC contig of more than 200 kb was established from the susceptible barley cv. Morex. Ten genes were found on the contig whereof five are candidates for Rph7 (Genetics, 164: 673-683, 2003). In order to isolate the candidate genes from a resistant variety and to exclude the possibility that an additional gene is present in such a line, we have constructed a BAC library of the resistant barley variety Cebada Capa (Funct. Integr. Genomics, 5: 97-103, 2005). Sequencing of two BAC clones spanning the Rph7 locus revealed no additional genes in Cebada Capa compared to Morex. Moreover, one of the genes identified in Morex turned out to be part of a helitron transposable element which is not present in Cebada Capa. Thus, there are four genes candidates for Rph7.

The four candidate genes were validated by Agrobacterium tumefaciens-mediated transformation of the susceptible barley cv. Golden Promise. For each construct, about 10 T1 families derived from individual T0 plants with a single insertion of the transgene were pheno- and genotypically analyzed. None of the four candidate genes was able to complement the susceptible phenotype of Golden Promise. RT-PCR experiments demonstrated that all four genes are expressed in the transgenic plants. A virus induced gene silencing (VIGS) experiment was set up for one of the candidate genes and it confirmed the non-complementation results. We are currently investigating different hypotheses to explain the lack of complementation observed with these candidate genes.

To study the haplotype diversity at the Rph7 locus in the wild-barley gene pool and compare it with the diversity previously observed in the cultivated gene pool (Plant Cell, 17: 361-374, 2005), 147 Hordeum spontaneum lines originating from Israel were analyzed. Four out of the six haplotype combinations identified in the cultivated gene pool were also found in the wild-barley pool. Four additional combinations were found to be unique for the wild-barley pool whereas two were only present in the cultivated-barley gene pool. The haplotype which is characteristic for the lines known to carry Rph7 was not found among the 147 H. spontaneum lines suggesting that Rph7 likely originates from another region than Israel.

01.11.2002-31.03.2007

Professur/Forschungsbereich: Keller, Beat
Marker development for Lr34 in wheat using colinearity with rice
Leaf rust is a very important disease for wheat worldwide and it is mainly controlled by means of genetic resistance. In the swiss winter wheat cultivar 'Forno' a major leaf rust resistance QTL has been identified on chromosome 7DS. It was mapped in two populations of single seed descent (SSD) lines derived from the cross 'Arina x Forno' and 'Forno x Oberkulmer' (Phytopathol 94: 1036-1041, 2004). This QTL confers a durable and slow-rusting resistance phenotype, is co-segregating with a QTL for leaf tip necrosis (LTN), and in both populations maps distal to Xgwm295 and proximal to Xgwm1220. Mapping data reveal a very similar location and phenotype to the adult plant leaf rust resistance gene Lr34 described in CIMMYT spring wheat material. More recently, additional markers were mapped to chromosome 7DS: two flanking ESTs delimit the QTL interval to 7.4 cM corresponding to ~300 kb in the orthologous region in rice. Unfortunately, none of the rice genes present in the contig were polymorphic in wheat but they could be used for a PCR-based screen of BAC libraries of wheat, cv. Glenlea and Ae. tauschii, the wild species donor of the wheat D-genome. This lead to the isolation of several SSR markers which were found to be linked to the Lr34 locus in several Lr34 introgression lines and the 'Arina' x 'Forno' segregating population.

The orthologous region from the wild grass Brachypodium sylvaticum was identified by screening of a BAC library (Funct. Integr. Genomics, 4: 26-33, 2004). This allows to compare the Lr34 region in wheat, Brachypodium, and rice, which provides an excellent insight into the evolution of this region and allows for the development of new markers for Lr34.

01.01.2000-31.07.2007

Professur/Forschungsbereich: Keller, Beat
RNAi based gene silencing as an efficient tool for functional genomics in hexaploid bread wheat (Triticum aestivum L.)
At the level of functional gene analysis and the isolation of agronomically important genes, wheat is clearly lagging behind compared to other major food crops such as maize, rice and even species such a tomato. This is mainly due to the lack of effective tools available in other systems. Without efficient methods for studying gene function, wheat breeding in the long term will not be able to profit from the ongoing genomic work. Insertional mutagenesis and gene silencing are efficient tools for the determination of gene function. RNA interference (RNAi)-induced gene silencing potentially allows to simultaneously suppress several homologous genes (Plant J, 36: 114-121, 2003). This is of great importance for functional studies in polyploid species such as hexaploid wheat where most of the genes are present in at least three homoeologous copies and conventional insertional mutagenesis is therefore not effective. We have made significant progress in the establishment of an efficient plant transformation protocol and the development of the RNAi technology in hexaploid wheat We have introduced into bread wheat double-strand (ds)RNA-expressing constructs containing fragments of genes encoding the enzyme phytoene desaturase and the signal transducer of ethylene Ethylene Insensitive 2 (EIN2). Transformed plants showed phenotypic changes that were stably inherited over several generations. These changes were very similar to mutant phenotypes of the two genes in diploid model plants. Quantitative real-time PCR revealed a good correlation between decreasing mRNA levels and increasingly severe phenotypes with homozygous plants showing the strongest mRNA reduction and the most severe phenotype, suggesting that the effect of RNA interference in hexaploid wheat can be gene-dosage dependent. Wheat seedlings with low mRNA levels for EIN2 were ethylene-insensitive and the expression of the ethylene-responsive gene SC255 was drastically reduced in the EIN2-dsRNA transformants. Thus, EIN2 is a positive regulator of the ethylene-signaling pathway in wheat, very similar to its homologs in Arabidopsis and rice. Our data show that RNA interference results in stably inherited phenotypes and therefore represents an efficient tool for functional genomic studies in polyploid wheat.
01.04.2001-31.08.2007

Professur/Forschungsbereich: Keller, Beat
Suppression of the Irx1 root hair phenotype by rol mutations
LRX1 encodes an extracellular LRR-extensin protein that might have a role in cell wall formation (For

details on LRX genes, please refer to “functional analysis of the LRX gene family of Arabidopsis). LRX1 is specifically expressed in root hairs and lrx1 mutants show aberrant root hair development. The paralogous gene LRX2 is also expressed in root hairs and lrx1/lrx2 double mutants develop a strongly enhanced lrx1 phenotype, suggesting a synergistic interaction between LRX1 and LRX2 (Plant J. 35: 71-81, 2003). The cell wall ultrastructure in lrx1 and lrx1/lrx2 mutants is strongly affected, indicating a signaling or regulatory function of LRX1 and LRX2 during root hair cell wall formation.

To characterize the process LRX1 is involved in, we have performed a suppressor/enhancer screen on the lrx1 mutant. After EMS mutagenesis, 23 rol (repressors of lrx1) mutants were isolated that develop wild-type root hairs in the lrx1 mutant background. Two recessive rol mutants (rol1-1 and rol1-2) are affected in RHM1, which is important for rhamnose (Rha) biosynthesis. Rha is an important component of pectin and rol1 mutants are modified in their pectin structure, i.e. rhamnogalacturonan I & II. This suggests that a change in the pectin structure is responsible for the suppression of the lrx1 root hair phenotype through rol1, indicating a possible role of LRX1 during pectin formation.

The rol5 mutant, which also effectively suppresses lrx1, was also cloned by map-based cloning. ROL5 encodes a protein of unknown function. The properties of similar proteins in other organisms are unknown as well. We are currently characterizing the localization of ROL5 on the tissue- and the subcellular level. Since the rol5 mutant contains a miss-sense mutation, a rol5 knock-out mutant is tested whether it is able to suppress lrx1.

01.10.1998-31.03.2007

Professur/Forschungsbereich: Keller, Beat
Wheat genome analysis and evolution
To investigate the evolution of resistance gene analogs (RGAs) of the NBS-LRR type, we have sequenced the orthologs of the Pm3 resistance gene locus (Plant J. 37: 528-538, 2004) from three wheat species at different ploidy levels (hexaploid wheat Triticum aestivum, tetraploid wheat T. durum and diploid wheat T. monococcum). Analysis of that dataset revealed that resistance gene loci undergo rapid and drastic changes both in intergenic and genic sequences within relatively short evolutionary periods. Data on the evolution of wheat resistance genes was then compared to those in rice and other species. Mechanisms such as unequal crossing over and gene conversion were found to be common and frequent contributors to RGA evolution in plants.

For comparative genomics, software was developed to efficiently process large datasets for BLAST searches and other analyses. Especially for comparison of wheat, rice and Arabidopsis sequences, software was developed that visually displays annotations and distributions of sequence elements across entire genomes (e.g. high-copy genes or repeats in the rice or Arabidopsis genomes). Additionally, the TREP database for Triticeae repetitive DNA was expanded to contain more than 1000 repetitive sequences. This database has become an indispensable tool for the annotation of Triticeae sequences for researches worldwide.

An additional research focus was the improvement of sequencing strategies for plants with large and complex genomes such as wheat and barley. This included studies on occurrence and distribution of sequences prone to cause problems in any steps of the sequencing process (cloning, sequencing, assembly). It was shown that retrotransposons and CACTA elements are frequent sources of problems, causing mistakes in sequences assemblies as well as problems in cloning and sequencing. Additionally, software was developed to make identification of problematic regions easier.

01.01.2005-31.12.2007

Professur/Forschungsbereich: Keller, Felix
Molecular physiology of the raffinose family oligosaccharides (RFOs) in plants
The raffinose family oligosaccharide (RFOs) are -galactosyl extensions of sucrose. They are the most abundant oligosaccharides in the plant kingdom and many RFO-producing plants are of economic importance including cucurbits, mints, and pines. The ultimate goal of our research is to understand the plant RFO metabolism in depth, from the whole plant to the genes. In recent years, we have mainly used

Ajuga reptans (common bugle), as our model plant. This frost-hardy and evergreen labiate has proved to be a multifunctional RFO-champion. We have shown that A. reptans produces RFOs in the mesophyll and in specialized phloem cells called intermediary cells. This plant stores RFOs in mesophyllic vacuoles and translocates them through the phloem. Finally, it probably uses RFOs as cryoprotectants. This is in contrast to many other RFO-plants which either only translocate (e.g. cucurbits) or store (e.g. legume seeds) RFOs.

We recently found mesophyllic raffinose, sucrose, and myo-inositol to be partially located in chloroplasts from cold-acclimated A. reptans leaves and are currently studying chloroplastic raffinose uptake, both on the biochemical and the molecular level. The discovery of such a raffinose translocator would help to clarify a long-standing controversy over the putative role of sugars in protecting chloroplasts from frost damage. Additionally, we are applying our molecular RFO tools collected over the last years to selectively silence the RFO biosynthetic pathway in A. reptans to determine if and which RFOs are needed to develop the frost tolerance observed in nature.

01.04.2004-31.03.2006

Professur/Forschungsbereich: Martinoia, Enrico
Cluster roots – an efficient way to survive under phosphate starvation
Cluster roots are a characteristic of members of the Proteaceae and of several other plant species that are adapted to habitats of extremely low soil fertility, usually without formation of mycorrhizal associations. Functionally linked with intense mobilization of nutrients (P, Fe, Zn, Mn) by root-induced chemical changes (pH, root exudates, redox potential) in the rhizosphere, cluster-rooted plant species can serve as model plants to study rhizosphere processes and regulatory aspects of plant adaptations for chemical mobilization of nutrients in the rhizosphere. We use white lupin as a model plant and study the biochemical processes required to excrete the huge amounts of organic acids. We are also interested how these plants interact with soil microorganisms. For instance their growth has to be inhibited in regions of the root specialized in excreting organic acids which solubilize phosphate strongly bound to the soil. If microorganisms would use most citrate, phosphate could not be solublized from the soil and hence organic acid excertion would not help to survive a plant in soils with sparingly available phosphate.Furthermore, we are interested in the formation of this particular root structure and use several molecular tools to identify genes involved in this process.
01.09.1997-30.09.2006

Professur/Forschungsbereich: Martinoia, Enrico
INTERACTION BETWEEN ARABIDOPSIS ABC TRANSPORTERS AND FK506-BINDING IMMUNOPHILINS
FK506 binding proteins (FKBPs) represent a class of immunophilins known to function as cis-trans-peptidylprolyl isomerases (PPIases) and to bind different immunosuppressant drugs, like FK506 and rapamycin. In mammals, these products of soil-borne microorganisms are blocking Ca2+-dependent signaling leading to inhibition of T-cell activation. Therfore, they are widely used to treat and prevent graft rejection in organ transplantation patients.

The Arabidopsis FKBP42 mutant twisted dwarf1 (twd1), results in a drastic reduction of cell elongation combined with a disoriented growth behavior. The pleiotropic mutant phenotype is characterised by reduction of cell elongation and disorientated growth of nearly all plant organs. Leaves and cotyledons of twd1-1 show epinastic growth, hypocotyls are shorter and root growth is reduced in the light, but enhanced in the dark. Cell elongation in twd1-1 plants (right) is severely impaired compared to the wild type (left) which results in a dwarf phenotype.

Heterologously expressed TWD1 does not exhibit a PPIase activity and does not complement yeast FKBP12 shown by its inability to restore the sensitivity towards rapamycin, which is caused by disruption of the FKBP12 gene in yeast. Therefore, we assumed that TWD1 acts indirectly via protein-protein interactions.

Yeast two-hybrid protein interaction screens with TWD1 identified cDNA sequences that encode the C-terminal domain of Arabidopsis multidrug-resistance-like ABC transporter AtPGP1. This interaction was

verified in vitro. Mapping of protein interaction domains shows that AtPGP1 surprisingly binds to the N-terminus of TWD1 harboring the PPIase-like domain and not to the tetratricopeptide repeat domain, which has been shown to mediate protein-protein interaction. Unlike all other FKBPs, TWD1 is shown to be an integral membrane protein that co-localizes with its interacting partner AtPGP1 on the plasma membrane.

TWD1 also interacts with AtPGP19 (AtMDR1), the closest homologue of AtPGP1. The single gene mutation twd1-1 and double atpgp1-1/atpgp19-1 (atmdr1-1) mutants exhibit similar phenotypes including epinastic growth, reduced inflorescence size, and reduced polar auxin transport, suggesting that a functional TWD1-AtPGP1/AtPGP19 complex is required for proper plant development. We could show thattwd1 mutants exhibit a reduced auxin transport activity. Therefore we investigated whether AtPgp1 is an auxin transporter. Careful analysis with yeast, animal cells and plant protoplasts showed that this is the case. In a project funded by the EU (framework V) we are now investigating how the interaction of TWD1 and AtPgp1 modulate auxin transport activity.

01.04.2000-31.03.2006

Professur/Forschungsbereich: Martinoia, Enrico
PLANT MRP-LIKE ABC TRANSPORTERS
Out of the ca. 600 predicted membrane transport systems found in Arabidopsis, a great number are made up by ABC transporters. A total of 51 genes can be found for the full-size transporters of the PDR5 (pleiotropic drug resistance), AtMRP (multidrug resistance associated protein) and AtPGP (P-glycoprotein) subclusters. The AtMRP genes (14 in total) which are the best characterized plant ABC transporters also belong to this cluster. These proteins are known to function as vacuolar sequesters of glutathionylated compounds as well as malonylated chlorophyll catabolites. Clearly related are sulfonylurea-receptor like proteins involved in regulating conductance of K+-channels or possibly the water conducting aquaporines.

Although each AtMRP which has been cloned and heterologously expressed in yeast shows at least a weak glutathione conjugate transport activity and at least two AtMRPs transport glucuronide conjugates, information about their functions in planta are still scarce.

It is one of the major goals to fill this lack of knowledge by the isolation and analysis of T-DNA knock-out mutants for the AtMRP gene family apart from expression and localization studies and heterologous expression systems.

Actually, our main goals is to understand the role and function of AtMRP5. We have isolated a knockout mutant in AtMRP5 which surprisingly displays a strong stomatal phenotype leading ultimately to an increased drought resistance.

Carbon dioxide uptake and water release through stomata controlling the opening and closure of stomatal pore size in the leaf surface is critical for optimal plant performance. Stomatal movements are regulated by multiple signalling pathways involving guard cell ion channels. Guard cells from mrp5-1 mutant plants were found to be insensitive to the sulfonylurea compound glibenclamide, which in the wild-type induces stomatal opening in the dark. The knockout in AtMRP5 affects several signalling pathways controlling stomatal movements. Stomatal apertures of mrp5-1 and wild-type Ws-2 were identical in the dark. In contrast, opening of stomata of mrp5-1 plants was reduced in the light. In the light, stomatal closure of mrp5-1 was insensitive to external calcium and abscisic acid, a phytohormone responsible for stomatal closure during drought stress. In contrast to Ws-2, the phytohormone auxin could not stimulate stomatal opening in the mutant in darkness. All stomatal phenotypes were complemented in transgenic mrp5-1 plants transformed with a CaMV 35S-AtMRP5 construct. Both, whole-plant and single-leaf gas exchange measurements demonstrated a reduced transpiration rate of mrp5-1 in the light. Excised leaves of mutant plants exhibited reduced water loss, and water uptake was strongly decreased at the whole plant level. Finally, if plants were not watered, mrp5-1 plants survived much longer due to reduced water use. Analysis of CO2 uptake and transpiration showed that mrp5-1 plants have increased water use efficiency. In the frame of an SNF funded project we are investigating whether AtMRP5 is modulating

channel activities and if channel activities are altered in atmrp5 mutant plantsto identify channels and other factors interacting with AtMRP5.

01.04.2001-31.03.2007

Professur/Forschungsbereich: Martinoia, Enrico
Vacuolar membrane proteins
This project is part of the EC project ”NICIP” which was granted within the human mobility program. Despite the important role of the vacuole in the storage of metabolites, secondary compounds and ions, only few is known about vacuolar transport proteins at the molecular level. Recently we got a Syngenta grant to carry out vacuolar membrane proteomics. Using proteomic analysis, verification of the vacuolar membrane localisation, study of the corresponding T-DNA insertion lines we try to elucidate the role of new putative vacuolar membrane proteins.

01.09.2002-30.09.2007

3 Lehre

3.1 Innovative Lehrveranstaltungskonzepte

The curriculum in Biology has been completely revised and it started in the new form in October 2004. The structure of the curriculum was changed based on the Bologna reform. More importantly, the content of the basic studies in the first two years was adapted to introduce the students in a logical and coherent way into modern biology. Therefore, between 2004 and 2006, all modules of the basic studies have to be newly made. Starting with the third year of the studies, the students are taking block courses of 31/2 or 7 weeks each, respectively. These courses are devoted to specific topics in biology. Our institute offers a total of eight 3 1/2-week courses, as well as two courses in marine biology during the semester breaks. These courses are characterized by a complete immersion of the students during four days of the week into an important aspect of biology. Theoretical concepts are learnt and practically experienced in a real research environment. This close interaction with the front of research introduces our students into the most up-to-date concepts, methods and research aspects.

The ETH Zürich, University of Basel and University of Zürich, coordinated by the Plant Science Center, have decided to offer a joint Master programme leading to a Master in Plant Sciences, starting in 2006. One module is based on e-learning and E. Martinoia is a co-author of this module (the e-learning programme PRESS: Plant Response to Stress). This course will be mandatory for master students in the Master in Plant Sciences at the ETHZ and UZH.

More conventional e-learning approaches based on OLAT and other systems are integrated in several of the modules offered by the institute. The lack of resources for an effective teaching in Microbiology is in part compensated by e-learning courses.

Discussions on the creation of a Zurich curriculum in “Microbiology and Immunology” that would involve partners from various faculties of the UZH and different departments of ETHZ are ongoing. As a possible start point for such a curriculum autumn 2006 is envisaged. At this time point the Microbiology Institute at ETH will also adapt to the UZH bachelor system, such that the Microbiology block courses offered by the two institutions in the third year are open to all students. Moreover, a Zurich Ph.D Programme in Microbiology and Immunology under the umbrella of the Life Sciences Zurich is planned and should become effective in summer 2006.

A ’Forum’ has been established for all lectures of the ’Grundstudium’ to allow anonymous communication and discussion with the students.

3.2 Qualitätssicherung in der Lehre

Most of the lectures in the Grundstudium and also in the more advanced courses are given by the institute professors and the permanent scientific staff consisting of independent group leaders. In the

advanced courses, where many younger collegues are involved, professors and permanent staff are also strongly contributing and can ensure a high standard in teaching. In addition, many of our lectures and courses are being evaluated by the students using a specifically designed form. A 'Forum' has been established for all lectures of the 'Grundstudium' to allow anonymous communication and discussion with the students.

Probably the most relevant contribution to the 'Qualitätssicherung' comes from our institute culture in which teaching is important. We regularly exchange ideas and practical experiences from teaching at the institute meetings to improve our courses and modules and to ensure similar, high-quality standards across the institute.

Several young scientists attended the courses for better teaching offered at the University.

4 Weiterbildung/Fortbildung

5 Nachwuchsförderung

5.1 Standortbestimmung

Graduate students and postdocs are essential for research and teaching as well as public outreach activities at our institute. They will be future leaders in research, administration and teaching. For all these reasons, much of our efforts are devoted to creating good conditions for their work and to supervise them optimally. The goal is to provide enough guidance for successful research without inhibiting their freedom to follow their own ideas.

In the last year a number of our young collaborators have left the institute for high-level positions, mostly abroad. This follows the trend of the last years when many former institute members have successfully continued their career abroad. Therefore, in general, the scientists educated at our institute have good chances on the job market.

Instruments for the promotion of the next generation of academics/scientists

At the level of graduate student training, we have established in 2002 in the frame of the Plant Science Center (PSC) a programme of graduate studies. To have an impression of the programme, please see http://www.plantscience.unizh.ch/education/courses_ps. At our institute, there are the normal research and literature seminars at the level of the research groups and the Plant Biology Workshop where, specifically, graduate students and postdocs present their work at the institute level. In addition, we have year-round a relatively large number of seminars at the institute with speakers mostly from abroad. Through support of several sources, our graduate students and postdocs regularly travel to international meetings, giving them the opportunity to present and discuss their work and also to establish contacts for later applications for postdoc or group leader positions.

In 2005, specific and individual "Pflichtenhefte" have been discussed and agreed upon with all graduate students and postdocs. This should further clarify the job situation for these collaborators and formally guarantee time for research and teaching. In addition, formal "Laufbahngespräche" will be made annually.

At the senior postdoc/non-permanent Oberassistent level, the collegues have the opportunity to apply for their own funding and in addition they are generously supported by funding from the budget of individual professorships.

Inclusion of Young Academics/Scientists in Teaching and Research

Graduate students and postdocs are involved in the practical courses of the "Grundstudium Biologie" and the education of school teachers. In the block courses of the third year, they are organizing and leading the practical part of the course. Depending on the course, they are also giving some lectures.

Finally, they are strongly involved in the teaching at the graduate student level (block courses) and the supervision of the master or graduate students.

K. Seidl received the Hydrobiologie-Limnologie Preis for her Diploma thesis: Characterisation of phototrophic bacteria in Egelsee (Switzerland) and in Lake Shira (Khakasia, Russia).

5.2 Durch Drittmittel geförderte Nachwuchskräfte am Institut

Abderhalden, Olaf, Doktorand
Syringolin action
SNF, 01.01.2005-31.12.2005

Azevedo, Louis, Doktorand
ABC Transporter and stomata
SNF, 01.01.2005-30.06.2005

Bailly, Aurélien, Doktorand
Plant Transporters
EU, 01.01.2005-31.08.2007

Bossolini, Eligio, Doktorand
Durable resistance in wheat
SNF, 01.01.2005-31.12.2005

Brand, Lukas, Doktorand
Inducible Cell-specific Activation Tagging of Genes Affecting Reproduction in Arabidopsis thaliana
SNF, 01.08.2003-31.07.2006

Bruhkin, Vladimir, Postdoktorand
Functional Analysis of the 26S Proteasome during Embryogenesis and Cell Cycle Progression in a Higher Eukaryote
Nachwuchsförderungskredit / Stiefel-Zangger-Stiftung, 01.01.2005-15.03.2005

Bruhkin, Vladimir, Postdoktorand
Functional Analysis of the 26S Proteasome during Meiosis and Cell Cycle Progression in a Higher Eukaryote
Novartis Foundation, 16.03.2005-30.11.2005

Brunner, Arco, Doktorand
The Genetic and Molecular Basis of Gametogenesis and Maternal Effects in Arabidopsis
SNF, 01.06.2005-31.03.2006

Böhm, Andreas, Postdoktorand
Raffinose Sugars
SNF, 01.01.2005-01.04.2005

Eichenberger, Christof, Doktorand
Phylogenies of Teloschistales (lichen-forming ascomycetes)
SNF, 01.03.2003-30.09.2006

Endler, Anne, Doktorand
Vacuolar proteomics
Syngenta / PCS Zürich-Basel, 01.01.2005-30.09.2007

Grob, Hanne, Doktorandin
ABC Transporters and stomata
SNF, 01.07.2005-31.12.2008

Jordan, Tina, Postdoktorandin
Bioexploit
EU, 01.10.2005-31.12.2005

Kaur, Navreet, Doktorandin
Pm3 diversity in the wheat gene pool
SNF und UZH Fellowship, 01.01.2005-31.12.2005

Kessler, Sharon, Postdoktorandin
Feronia interactors
HFSP, 01.02.2005-31.01.2007

Kirioukhova, Olga, Doktorandin
The Genetic and Molecular Basis of Gametogenesis and Maternal Effects in Arabidopsis
SNF, 01.02.2005-31.03.2006

Kirsch, Monika, Doktorandin
Raffinose Sugars
SNF, 01.01.2005-31.12.2005

Koverman, Peter, Postdoktorand
Vacuolar channels
Humboldt / EU, 01.01.2005-31.12.2005

Kretschmar, Tobias, Doktorand
ABC transporters and mycorrhiza
SNF / NCCR, 01.04.2005-30.11.2008

Köhler, Claudia, SNF-Förderungsprofessorin
Role of type I MADS-box proteins during seed development in plants
SNF, 01.05.2000-30.06.2005

Leiber, Ruth, Doktorandin
Root hair development in Arabidopsis
SNF, 01.01.2005-31.12.2005

Loutre, Caroline, Postdoktorandin
Leaf rust resistance in wheat
SNF, 01.01.2005-31.12.2005

Marinova, Krasimira, Doktorandin
Plant secondary product transport
UZH, 01.01.2005-31.03.2006

Michel, Kathrin, Doktorandin
Syringolin action
SNF, 01.08.2005-31.12.2005

Mors Cabral, Luiz, Doktorand
Analysis of AtORC1 mutants, and of the AtORC complex
Ressort Internationale Beziehungen, Universität Zürich, 01.11.2005-31.10.2006

Mozerov, Peter, Doktorand
Origin replication complex subunit 2
SNF, 01.09.2003-31.08.2006

Peters, Shaun, Doktorand
Raffinose Sugars
SNF, 01.08.2005-31.12.2008

Pien, Stéphane, Postdoktorand
The Genetic and Molecular Basis of Gametogenesis and Maternal Effects in Arabidopsis
SNF, 01.04.2005-30.11.2005

Plassé, Caroline, Doktorandin
Frost tolerance in wheat
PSC Fellowship, 01.01.2005-31.12.2005

Rau, Simone, Doktorandin
Syringolin action
SNF, 01.01.2005-31.05.2005

Santelia, Diana, Doktorandin
Plant toxins
SNF, 01.01.2005-31.08.2006

Schauer, Stephen, Postdoktorand
Maternal effect mutants in Arabidopsis
NSF USA, 01.06.2003-31.05.2005

Scherrer, Sandra, Postdoktorandin
Mating systems of lichen-forming ascomycetes
SNF, 01.01.2004-30.11.2005

Schmidt, Anja, Postdoktorandin
The Genetic and Molecular Basis of Gametogenesis and Maternal Effects in Arabidopsis
SNF, 24.10.2005-31.03.2006

Schmidt, Silvia, Doktorandin
Antifugale Wirkstoffe in Burkholderia
SNF, 01.08.2004-30.09.2007

Schmidt, Ulrike, Postdoktorandin
Novel Ion Channels in Plants (NICIP)
EU, 01.01.2005-31.12.2006

Schöb, Hanspeter, Postdoktorand
“multiple archespore” mutants in Arabidopsis
Freiwillige Akademische Gesellschaft Basel, 01.02.2005-31.03.2005

Schönmann, Susan, Doktorandin
Entwicklung eines Phylochips
BMBF - Deutschland, 01.01.2004-31.12.2006

Singh, Kuldeep, Gastprofessor
Indo-Swiss Biotechnology
DEZA, 01.10.2005-24.12.2005

Suh, Sujeong, Postdoktorandin
ABC transporters and stomata
Körber Nationalfonds, 01.01.2005-31.03.2006

Tapernoux, Esther, Postdoktorandin
Raffinose Sugars
SNF, 09.05.2005-30.11.2005

Tiwari, Ratan, Gastwissenschafter
Indo-Swiss Biotechnology
DEZA, 15.09.2005-15.11.2005

Tommasini, Livia, Doktorandin
Linkage disequilibrium in cereals
SNF, 01.01.2005-31.12.2005

Travella, Silvia, Postdoktorandin
Wheat functional genomics
DEZA, 01.01.2005-31.12.2005

Uehlinger, Susanne, Doktorandin
Pathogenitätsinseln in Burkholderia
SNF, 01.08.2004-30.09.2007

Vijverberg, Kitty, Postdoktorandin
A microgenomics-approach to Apomixis
Netherlands Genomic Initiative, 01.02.2005-31.01.2006

Weisskopf, Laure, Doktorandin
Cluster roots and Microbe interaction
SNF, 01.01.2005-31.03.2005

Wöhrmann, Heike, Doktorandin
Epigenome Network of Excellence
EU Framework VI, 01.05.2005-31.05.2009

5.3 Durch Drittmittel geförderte Nachwuchskräfte im Ausland

Meyer, Stefan, Postdoktorand
Institut für Pflanzenbiologie, Universität Zürich
Vacuolar proteomics and transporters
Deutsche Forschungsgesellschaft (DFG), 01.01.2005-31.08.2006

Fukao, Yoichiro, Postdoktorand
Institut für Pflanzenbiologie, Universität Zürich
ABC transporters and auxin transport
Japanese soc. Science, 01.01.2005-31.12.2005

5.4 Durch Forschungskredit der Universität Zürich geförderte Nachwuchskräfte

Baroux, Célia, Postdoktorandin
Chromatin Dynamics during Plant Reproduction
01.01.2005-15.11.2005

Nüesch, Eveline, Doktorandin
Sex, and how to avoid it. Inducing apomeiosis in Arabidopsis thaliana.
01.02.2004-31.12.2005

Schöb, Hanspeter, Postdoktorand
“Multiple Archespore” mutants in Arabidopsis.
01.02.2004-31.05.2005

6 Gleichstellung der Geschlechter

Part-time arrangements were made for several collaborators so they can take care of their families. In general, at the level of master students, PhD students as well as postdocs, at least 50 % of all collaborators are female. In addition, 3 1/2 of the 11 Oberassistant/Wissenschaftlicher Mitarbeiter positions are currently occupied by women. The microbiology group will attempt to correct its present gender imbalance by specifically attracting male students and scientists.

7 Dienstleistungen

7.1 Dienstleistungen innerhalb der Universität

The most-time consuming activity of the institute to serve the University in 2005 was the continued evaluation of the institute.

Several members of the institute have supervised Diploma and PhD students outside the institute in Microbiology and Plant Biology. This includes students in the Medical Faculty and Swiss Federal Research Stations. Members of the institute have contributed to the Maturitätstage to attract the next generation of students to biology (2x per year).

The following contributions to teaching were made by several members of the faculty:

Doktorandenstudium Center of Plant Sciences:

Kolloquium Spectrum of Plant Sciences: Disease resistance, developmental biology, plant physiology (E. Martinoia, U. Grossniklaus, B. Keller, N. Yahiaoui)

Gemeinsame Veranstaltung mit der ETH Zürich: Kleines Nebenfach Bioinformatik:

Bioinformatik WS 2005/2006: 2hrs lecture, 5 hrs practical course. November 2005 (B. Keller, C. Ringli).

Lecture series “General Ecology” within the „Mantelstudium“ for medical students (L. Eberl, E. Martinoia).

Prof. F. Jüttner was Studienberater for Microbiology and until August, 2005 Coordinator of the joint curriculum in Microbiology with ETHZ.

Ueli Grossniklaus is a member of the following commissions: Kommission Studienreform der MNF, Berufungskommission: “Funktionelle oder vergleichende Genomik”, Berufungskommission: “Systembiologie”, Berufungskommission: “Entwicklungsbiologie (NF Hafen)”.

Beat Keller was in 2005 Head of the Department of Biology, member of the Leitungsausschuss of the Plant Science Center, member of the Planungskommission of the Faculty of Sciences and member of the Findungskommission for the next President of the University.

The Scanning Electron Microscope Facility provided services to several other institutes of the university, both within and outside our faculty.

7.2 Dienstleistungen zugunsten anderer Forschungs- und Bildungsinstitutionen

B. Keller is vice-president of the the Swiss Academy of Sciences. He has evaluated grant applications from several agencies (DFG, SNF, NSF, BARD, USDA) and manuscripts for Plant Physiology, Plant Cell, Nature, Genome Research, Genetics, Genome and others. He is member of the Editoral Board of TAG and member of the scientific advisory boards of the German Plant Genome Programme and the Institute of Genetics, Beijing. B. Keller was also a member of the evaluation committee of the Institut für Pflanzengenetik und Kulturpflanzenforschung in Gatersleben, Deutschland.

L. Eberl was an external referee for, among others, the Deutsche Forschungsgemeinschaft, the National Environmental Research Council (UK), the Health Research Bord (Irland), the Science Foundation Ireland, the Danish Natural Science Research Council, the ACI Microbiologie (France) and The Wellcome Trust. He is a member of the editorial boards of J.of Biotechnology and Applied and Environmental Microbiology and acted as a referee for Cellular Microbiology, FEBS Letters, FEMS Microbiology Letters, FEMS Microbial Ecology, J. of Bacteriology and other journals. He was an invited external censor of PhD theses in Switzerland.

J. Pernthaler has served as member of the Editorial Board for the journals Applied and Environmental Microbiology, Aquatic Microbial Ecology and Systematic and Applied Microbiology. In addition, he has reviewed manuscripts for other scientific journals. He has been invited as external censor for a PhD thesis at the MPI for Marine Microbiology, Bremen. F.Jüttner provided reviews for journals and for

candidates for professor positions. He was evaluator of the Leibnitz-Institut für Gewässerökologie und Binnenfischerei, Berlin and for Schwerpunktprogramme of DFG:Aquashift und Chemical Ecology.

U. Grossniklaus was on the faculty of several postgraduate courses: CSHL Course Advanced Techniques in Plant Sciences (Cold Spring Harbor Lab.), Mechanisms of Development (Uni Basel), Frontiers in Apomixis Research (Wageningen University). He was external referee for Dissertations in Portugal and Holland and served on the Scientific Advisory Boards of the Institute of Plant Genetics and Crop Plant Research in Gatersleben, Germany, and the ARC Center for Excellence in Integrative Legume Research in Brisbane, Australia. He also serves on the „Forum Genforschung“ of the Swiss Academy of Science and the „Kommission Förderungsprofessuren“ of the SNF. He has reviewed grant proposals for the SNF, DFG, BARD, USDA und NSF.

E. Martinoia was a member of five thesis committees in other universities in Switzerland, Germany and France. He was contributing to evaluations for Deutsche Forschungsgemeinschaft, USDA, and the Belge Funding Agency. He is a member of the International Scientific Committee for the 14. International Workshop on Plant Membrane Biology, 2007 in Valencia, and member of the International Committee FEBS Advanced Course on ABC transporters 2006, Innsbruck.

7.3 Dienstleistungen zugunsten der Öffentlichkeit

Members of the institute gave introductions to scientific research in general and the Institute of Plant Biology in particular to school classes and other groups. The institute was also contributing to two „Maturanden-Tage“ to attract the next generation of students.

C. Ringli supervised a high school student from the Kantonsschule Wettingen during three weeks of practical work in plant molecular biology. A laboratory visit of the KME Schwerpunktfachklasse „Biologie“ was hosted by Dr. Hanspeter Schöb.

B. Keller gave a lecture on the topic: „Gentechnik in der Landwirtschaft: Wissenschaft im Spannungsfeld der Interessen“ at the Pflanzenbautagung des Thurgauischen Bauernverbandes, January 2005.

Further intensive outreach activities were related to the public discussions on the „Volksinitiative für eine gentechnikfreie Landwirtschaft“. These included an invitation for statements and participation at discussions of the „Nationalrätlichen Kommission für Wissenschaft, Bildung und Kultur” (WBK) Bern (B. Keller) but mainly resulted in demanding activities in the public discussion before the votation.

U. Grossniklaus gave public lectures on „Chancen und Riskien der Grünen Gentechnologie“ and participated in a ‚Life Science Zürich’ event organized for journalists prior to the federal referendum on a moratorium for GMOs. Ueli Grossniklaus also provided expertise to and answered requests from the press (Weltwoche, Tagesanzeiger, WoZ, unicommunication) and the ‚Kantonspolizei Zürich’.

F. Jüttner war Stiftungsrat der Hydrobiologie-Limnologie Stiftung, Zürich und Mitglied der Experten-Gruppe der Seepolizei Oberrrieden: Einsatz von Detergentien bei Oel-Kontaminationen. F. Schanz war Vorstandsmitglied der Schweiz. Gesellschaft für Hydrologie und Limnologie, SGHL und Vertreter des Sekretärs (Prof. Dr. R.G. Wetzel) der SIL (Internationale Gesellschaft für Limnologie) in der Schweiz.

Zudem war er beteiligt an der Durchsicht von Wasserproben für die Kant. Seepolizei, Oberrieden.

In summary, the institute members are involved in many activities related to explaining and demonstrating our work to the society. This is a time- and resource-demanding task. We have noticed with great surprise that this work was not discussed at all during the whole evaluation process. Obviously, it is of no relevance and importance to the Universitätsleitung and the Evaluationsstelle. In this environment, it is possibly wise to stop these activities and retract to the ivory tower.

7.4 Klinische Dienstleistungen

8 Aussenbeziehungen

8.1 Sokrates/Erasmus

8.2 Regelmässige Zusammenarbeit

Australian Center for Plant Functional Genomics, Glen Osmond, Australien, Ozeanien
QTL mapping in wheat

Bundesamt für Gesundheit, Bern, Schweiz, Europa
effect of pesticides on wheat gene expression

Canberra, CAMBIA, Canberra, Australien, Ozeanien
egg apparatus promoters

Canberra, CAMBIA, Canberra, Australien, Ozeanien
egg apparatus promoters

Cardiff University, Cardiff, Wales, Grossbritannien, Europa
Wissenschaftliche Zusammenarbeit

Chinese Academy of Sciences, Bejing, China, Asien
nutrient uptake in Arabidopsis

CNR, Istituto di Genetica Vegetale, Perugia, Italien, Europa
Analysis of apomixis-specfic genes of Paspalum in Arabidopsis reproductive tissues

Colorado State University, Fort Collins (CO), Amerika, Nordamerika
LRX proteins in Arabidopsis

DSP Delley Samen und Pflanzen AG, Delley, Schweiz, Europa
male sterility in triticale

Eawag Dübendorf, Dübendorf, Schweiz, Europa
Zusammenarbeit im Rahmen der wissenschaftlichen Untersuchung des Schweizerischen Nationalparks, speziell der Fliessgewässer (Fuornbach, Spöl) und der Seen (Macun). Langfristige Beobachtungen von Veränderungen der aquatischen Lebensgemeinschaften, verursacht durch Schadstoffeintrag und/oder globalen Wandel.

Eberhard Karls Universität Tübingen, Tübingen, Deutschland, Europa
Cell specification in the female Gametophyte

Ernst-Moritz-Arndt-Universität Greifswald, Greifswald, Deutschland, Europa
Wissenschaftliche Zusammenarbeit

ETH Zürich, Zürich, Schweiz, Europa
MEA/FIE complex

ETH Zürich, Zürich, Schweiz, Europa
Strukturaufklärung von beta-Carbolinen aus Cyanobakterien

ETH Zürich, Zürich, Schweiz, Europa
experimental activities of a PhD student

ETH Zürich, Zürich, Schweiz, Europa
Molecular Genetics of odor production in Ophrys

ETH Zürich, Zürich, Schweiz, Europa
Durchführung von Ultraspurenalysen von isotopen-markierten VOCs bei Insektenfrass (mit dem Institut für Angewandte Entomologie der ETHZ

ETH Zürich, Zürich, Schweiz, Europa
experimental activities of a PhD student (Caroline Plassé) of the group of Prof. Stamp, ETH Zürich

ETH Zürich, Zürich, Schweiz, Europa
Bioinformatics support

ETH Zürich, Zürich, Schweiz, Europa
Proteomics of Chloroplasts in Arabidopsis

FAL Reckenholz, Zurich, Schweiz, Europa
wheat QTL analysis

Federal Research Station of Agronomy, Nyon, Schweiz, Europa
male sterility in triticale

Federal Research Station of Agronomy, Nyon, Schweiz, Europa
disease resistance in wheat

Federal University of Viçosa, Viçosa, Minas Gerais, Brasilien, Südamerika
Wissenschaftliche Zusammenarbeit

Freie Universität Berlin, Berlin, Deutschland, Europa
Yeast two hybrid assays

Genome Dynamics / Scottish Crop Research Institute, Invergowrie, Scotland, Grossbritannien, Europa
Rph7 BAC analysis

GIS Génopole, Montpellier, Frankreich, Europa
comparative genomics in cereals

GSF - Forschungszentrum für Umwelt und Gesundheit, Neuherberg, Deutschland, Europa
Wissenschaftliche Zusammenarbeit

ICARDA, Damascus, Syrien, Naher Osten
genetic diversity study in wheat species

Illinois Crop Improvement Association Inc., Champaign, Amerika, Nordamerika
Maize genetics

Indian Institute of Technology, Chennai, Indien, Asien
Characterization of egg cell-expressed genes in Arabidopsis thaliana

Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben, Deutschland, Europa
Cytogenetics

Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben, Deutschland, Europa
Molecular control of Apomixis

Institut Nationale pour la Recherche Agronomique (INRA), Paris Cedex 07, Frankreich, Europa
construction of BAC libraries

Institute National de la Recherche Agronomique (INRA), VERSAILLES CEDEX, Frankreich, Europa
Analyse der Transportaktivität des vakuolären MATE proteins TT12

L'Universite Louis Pasteur - Strasbourg I, Strasbourg, Frankreich, Europa
analysis of the proteasome pathway

Max Planck Institut für Züchtungsforschung, Köln, Deutschland, Europa
analysis of Mla function in barley powdery mildew resistance barley transformation

Medizinische Hochschule, Hannover, Deutschland, Europa
Wissenschaftliche Zusammenarbeit

Nagoya University, Nagoya, Japan, Asien
ABC protein and vacuoles transporters

Norwich Research Park, Norwich, Grossbritannien, Europa
immuno cell wall analysis

NSW Department of Primary Industries, CALALA, Australien, Ozeanien
genetic diversity study in wheat species

Pennsylvania State University Main Campus (PennState), Middletown, PA, Amerika, Nordamerika
ems1

Pohang University of Science and Technology (POSTECH), Pohang, Gyungbuk, Korea, Asien
Tranpsort of heavy metals (Prof. E. Martinoia ist adjunct professor since 2002).

Purdue University, West Lafayette, Amerika, Nordamerika
ABC and auxin transport

Pädagogische Hochschule Zürich, Zürich, Schweiz, Europa
Flower coloration in Mumulus

Radboud University Nijmegen, HC Nijmegen, Niederlande, Europa
Sreening of mutant populations

Technical University of Denmark, Lyngby, Dänemark, Europa
Wissenschaftliche Zusammenarbeit

Technical University of Denmark, Lyngby, Dänemark, Europa
Wissenschaftliche Zusammenarbeit

Technische Universität Berlin, Berlin, Deutschland, Europa
Strukturaufklärung neuartiger Indol-Alkaloide aus Cyanobakterien

Technische Universität Graz, Graz, Österreich, Europa
Wissenschaftliche Zusammenarbeit

Technische Universität Graz, Graz, Österreich, Europa
Wissenschaftliche Zusammenarbeit

Technische Universität Kaiserslautern, Kaiserslautern, Deutschland, Europa
Vacuolar transporters

Texas AM University, College Station, Amerika, Nordamerika
comparative genomics on the Rph7 locus of barley

The University of Western Ontario, London, Ontario, Kanada, Nordamerika
Wissenschaftliche Zusammenarbeit

Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasilien, Südamerika
analysis of Arabidopsis origin recognition complex

Universiteit Gent, Gent, Belgien, Europa
Wissenschaftliche Zusammenarbeit

University at Albany, State University of New York, Albany, Amerika, Nordamerika
The role of exosome proteins in embryo- and endosperm identity, and in imprinting

University College Cork, Cork, Irland, Europa
gametophytic mutants

University of Bristol, Bristol, Grossbritannien, Europa
Untersuchungen zur Dynamik von Planktothrix rubescens im Zürichsee und der Modellierung des Verlaufs von Photosynthese und Biomasse. Paul K.Hayes (2005-2007): Untersuchungen zur Entwicklung der Cyanophagen von Planktothrix rubescens im Zürichsee.

University of California, Davis, Davis, CA, Amerika, Nordamerika
BAC library construction

University of California, Davis, Davis, CA, Amerika, Nordamerika
gametophytic mutants

University of California, San Diego, San Diego, Amerika, Nordamerika
SERK mutants

University of California, San Diego, San Diego, Amerika, Nordamerika
AtMRP5 and guard cell regulation

University of Connecticut, Storms, Amerika, Nordamerika
cell wall analysis, biochemical analysis of RHM1

University of Haifa, Haifa, Israel, Naher Osten
genetic diversity study in wheat species

University of Hawaii at Manoa Cancer Research Center of Hawaii, Honolulu, Amerika, Nordamerika
SYRINGOLINS, PHARMACEUTICAL FORMULATIONS THEREOF, AND METHODS FOR USE THEREOF

University of Queensland, Brisbane, Australien, Ozeanien
Gene silencing

University of Tirana, Tirane, Albanien, Europa
Zusammenarbeit im Rahmen von SCOPE des DEZA (Leitung der Projekte: Prof.Dr. R.Bachofen). Projekt 1 (2001-2005): Chemische und biologische Beurteilung der Fliessgewässer von Albanien durch Angehörige von Hochschulen in Tirana (Leitung: Prof.A.Miho). F.Schanz– Beurteilung der Untersuchungsprogramme, Mithilfe beim Abfassen von Publikationen. Projekt 2 (2006-2009): Limnologische Beurteilung des Trinkwasserreservoirs von Tirana. F.Schanz– Mitarbeit beim Projektbeschrieb, geplant: Mithilfe bei der Datenauswertung und dem Abfassen von Berichten. 2005 (März bis September): Aufenthalt von Lirika Kupe, Doktorandin der Universität Tirana; Zweck: Einarbeitung in die Verwendung von Diatomeen als Indikatoren der Trophie und Saprobie.

University of Toronto, Toronto, Ontario, Kanada, Nordamerika
ORC complex

Universität Basel, Basel, Schweiz, Europa
wheat QTL analysis

Universität Hamburg, Hamburg, Deutschland, Europa
Gene expression in the female Gametophyte

Universität Hohenheim, Stuttgart, Deutschland, Europa

Universität Konstanz, Konstanz, Deutschland, Europa
GC-MS Analyse von VOCs aus epilithischen Algen des Bodensees

Universität Potsdam, Golm, Deutschland, Europa
ABC transporter and guard cell regulation

Universität Potsdam, Golm, Deutschland, Europa
analysis of cell wall sugar content

Universität Zürich, Zürich, Schweiz, Europa
Wissenschaftliche Zusammenarbeit

Universität Zürich, Zürich, Schweiz, Europa
array experiments

Universität Zürich, Zürich, Schweiz, Europa
Laser Assisted Microdissection

Universität Zürich, Zürich, Schweiz, Europa
Wissenschaftliche Zusammenarbeit

Universität Zürich, Zürich, Schweiz, Europa
Bioinformatics support

Université Blaise Pascal Clermont-Ferrand II, Clermont-Ferrand, Frankreich, Europa
cloning of Rph7 of barley

Université Pierre-et-Marie-Curie (UPMC), Station Biologique, Roscoff Cedex, Frankreich, Europa
Shaggy mutants

Wageningen University, AA Wagenignen, Niederlande, Europa
SERK mutants

Wageningen University, AA Wagenignen, Niederlande, Europa
Apomixis

Washington University in St. Louis, St. Louis, Montana, Amerika, Nordamerika
function of LEP in Arabidopsis development

Wasserversorgung Zürich, Zürich, Schweiz, Europa
Geruchsschwellenwert-Bestimmungen bei Daphnien mit einem Daphnia-Toximeter

École Polytechnique Fédérale de Lausanne, Lausanne, Schweiz, Europa
wheat QTL analysis

8.3 Fachkooperationen

Partneruniversität	SM IN	SM OUT	DM	Forschung
Leopold-Franzens-Universität Innsbruck, Innsbruck, Österreich, Europa	Ja	Ja	Ja	Ja

SM=Studierendenmoblität, DM=Dozierendenmoblität

8.4 Memorandum of Understanding

8.5 Netzwerke

8.6 Forschungsaufenthalte von Institutsangehörigen an anderen Forschungsinstitutionen

Baroux, Célia, Dr.
bei Prof. Ingo Schubert, Institut für Pflanzengenetik und Kulturpflanzenforschung, Corrensstrasse 3, D-06466 Gatersleben, Deutschland
Forschungsaufenthalt, 01.11.2005-10.11.2005

Tomasi, Nicola, PhD student
In the laboratory of Prof. Michael G Palmgren, Plant Physiology and Anatomy Laboratory, The Royal Veterinary and Agricultural University at Copenhagen, Denmark.
Practical work and Discussions, 24.04.2005-04.05.2005

Tomasi, Nicola, PhD student
In the Laboratory of Prof. Roberto Pinton, Department of Crop Science and Agricultural Engineering, University of Udine at Udine, Italy.
Practical work and Discussions, 26.09.2005-30.09.2005

8.7 Forschungsaufenthalte von Angehörigen anderer Forschungsinstitute am Institut

Albrecht, M., student
University of Göttingen, Germany
student
01.09.2005-30.09.2005

Algaro, C. G., Dr.
University of Barcelona, Spain
post doc
01.08.2005-30.11.2005

Aptroot, André, Dr.
Centraalbureau voor Schimmelcultures (CBS) - an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW) in Utrecht, The Netherlands
Inventory of the lichen flora in the Botanical Garden of the University of Zürich
02.08.2005-06.08.2005

Bjelland, Torbjørg, Dr.
University of Bergen, Norway
Ultrastructural investigations of saxicolous lichens and other microorganisms growing on and potentially damaging prehistoric petroglyphs in coastal Norway
07.02.2005-19.02.2005

Calderini, Ornella, Postdoktorandin
Istituto di Genetica Vegetale, Via Madonna Alta 130, Perugia, I-06128, Italia
Wiss. Zusammenarbeit
01.10.2005-31.10.2005

Gambale, F., Dr.
Instituto de Biofisica, Consiglio Nazionale delle Ricerche; Genova, Italy
Gemeinsames Projekt Vakuolen Transport (Ausführung Experimente und Diskussion)
14.02.2005-18.02.2005

Gebert, Marina, Doktorandin
Universität Hamburg, Fachbereich Biologie, Biozentrum Klein Flottbek, Entwicklungsbiologie und Biotechnologie, Ohnhorststr. 18, D-22609 Hamburg
Wiss. Zusammenarbeit
07.02.2005-01.03.2005

Hartmann, I., master student
Technical University of Munich Germany
master student
01.10.2004-01.10.2005

Heinz, Christian, Dr.
University of Vienna Austria
post doc
01.02.2005-28.02.2005

Kupe, Lirika, Biol., Lecturer of General Botany
Department of Agronomy, Agricultural University of Tirana, Albania
Diatomeen: Präparation und Bestimmungen am Beispiel der Töss bei Saland (Leitung: F.Schanz; im Rahmen des Unterstützungprogramms Schweiz-Albanien, Gesamtleitung: Prof.Dr. R.Bachofen).
01.03.2005-30.09.2005

Laitao, J., Prof.
University of Lissabon, Portugal

guest professor
01.09.2005-31.12.2005

Ma, Hong, Prof.
Penn State University, Biology Department, 208 Mueller Lab, University Park, PA 16802-5301, USA
Wiss. Zusammenarbeit
01.03.2005-30.04.2005

Martins, M. L., PhD student
Federal University of Brazil
PhD student
01.09.2005-01.08.2006

Mors Cabral, Luiz, Doktorand
Instituto de Bioquímica Médica, UFRJ Lab. de Biologia Molecular de Plantas, JBRJ Rua Pacheco Leão, 915 Jardim Botânico 22460-030 Rio de Janeiro RJ, Brazil
Wiss. Zusammenarbeit
01.12.2005-30.11.2006

Schiestl, Florian P., Postdoktorand
Ökologische Pflanzengenetik, Institut für integrative Biologie, ETH Zürich, Universitätsstrasse 16, CH-8092 Zürich
Wiss. Zusammenarbeit
01.01.2005-31.12.2005

Singh, Kuldeep, Dr.
Punjab Agricultural University, Ludiana, Punjab, India
In the frame of the ISCB network: Scientific visitor working on on the development of molecular markers for disease resistance gene loci in wheat.
01.10.2005-24.12.2005

Tiwari, Ratan, Dr.
Directory of wheat research, Karmal, India
In the frame of ISCB network: Scientic visitor working on the development of molecular markers for disease resistance gene loci in wheat.
15.09.2005-15.11.2005

Walsby, T., Prof.
University of Bristol, GB
Gastprofessor / Forschungsaufenthalt: Gemeinsame Erforschung der schwachlich-abhängigen Heterotrophie des obligat photoautotrophen Cyanobakteriums Planktothrix rubescens.
01.06.2005-30.06.2005

Watson, Sue, Postdoktorandin
Dept. Biological Sciences, University of Calgary, Canada
Forschungsschwerpunkt: Untersuchung der Alkylthiol-Bildung bei Microcystis.
15.10.2004-31.07.2005

Westendorf, C., master student
University of Rostock, Germany
master student
01.10.2005-30.11.2005

8.8 Gastvorträge von Institutsangehörigen an anderen Universitäten

Eberl, Leo, Prof.
University of Lausanne, Switzerland
Bacterial cell-to-cell communication: Clinical and ecological aspects.

Eberl, Leo, Prof.
University of Zurich, Switzerland
Bakterielle Kommunikation: Small-talk in der Schleimstadt

Eberl, Leo, Prof.
VetSwiss, Zurich, Switzerland
Burkholderia sp. as model organisms to study the role of quorum sensing in biofilm formation and pathogenicity

Eberl, Leo, Prof.
University of Freiburg, Germany
Cell-to-cell communication between bacteria: Gossip and facts.

Eberl, Leo, Prof.
University of Mainz, Germany
Bacterial cell-to-cell communication: Gossip and facts.

Eberl, Leo, Prof.
Botanical Gardens of the University of Zurich, Switzerland
Bakterielle Kommunikation: Auswirkung auf und Wechselwirkung mit Pflanzen

Eberl, Leo, Prof.
University of Vienna, Austria
Bacterial cell-to-cell communication: Do eukaryotes listen to prokaryotic gossip?

Eberl, Leo, Prof.
MPI Jena, Germany
Bacterial cell-to-cell communication: Do eukaryotes listen to prokaryotic gossip?

Eberl, Leo, Prof.
GSF-Forschungszentrum, Neuherberg, Germany
Ecological and clinical aspects of bacterial communication

Geisler, Markus, Dr.
Botanisches Kolloquium Universität Bonn / Germany.
The ABC of Auxin transport.

Geisler, Markus, Dr.
Botanisches Kolloquium Universität Bonn, Germany
The ABC of Auxin transport.

Grossniklaus, Ueli, Prof.
Max Planck Iinstitut für Entwicklungsbiologie, Tübingen, Deutschland
Sex, parental conflict and infanticide

Grossniklaus, Ueli, Prof.
Biozentrum der Universität Basel, Basel
Developmental genetics of plant reproduction

Grossniklaus, Ueli, Prof.
An epigenetic theory for the evolution of apomixis
Wageningen University, Wageningen, Niederlanden

Grossniklaus, Ueli, Prof.
Sex, parental conflict and infanticide
Gulbenkian Institute of Science, Oeiras, Portugal

Grossniklaus, Ueli, Prof.
Megagametophyte development and maternal effects. CSHL Plant Course
Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, USA

Kaur, Navreet, PhD student
NIDECO Network for International Development and Cooperation, ETH Zürich, Sitzerland
Kolloquium on ”Selected aspects of sustainable development”. Title: Analysis of powdery mildew resistance Pm3 gene diversity in the A genome of wheat landraces.

Keller, Beat, Prof.
Institut für Biowissenschaften, Universität Rostock, Germany
Genomic approaches to agronomically important genes in wheat.

Keller, Beat, Prof.
Molecular Biology Zürich. Seminar series Uni / ETHZ, Zürich, Switzerland
Molecular evolution and function of resistance genes against wheat diseases.

Keller, Felix, Prof.
University of Berne, Switzerland
3ème Cycle ”Biosynthesis and Degradation of Reserve Carbohydrates in Plants”: Raffinose Oligosaccharides (RFOs): Jacks of all Trades.

Klein, Markus, Dr.
Botanical Institute, Technical University Karlsruhe, Germany
Vakuolen kontrollieren Flavonoide und Flavonoide kontrollieren Vakuolen

Klein, Markus, Dr.
Institute for Molecular Biology, University of Potsdam, Germany
Vacuoles Control Flavonoids and Flavonoids Control Vacuoles.

Martinoia, Enrico, Prof.
Max Planck Institut für Molekulare Pflanzenphysiologie; Golm-Berlin, Germany
The multifunctionality of plant ABC transporters.

Martinoia, Enrico, Prof.
Botanisches Institut, Universität Erlangen, Germany
The multifunctionality of plant ABC transporters.

Martinoia, Enrico, Prof.
Institute of Cellbiology, University of Berne, Switzerland.
About Plant ABC transporters.

Mozerov, Peter, PhD student
Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, USA, September 2005
The origin recognition complex - How has it evolved to meet the needs of plant development? ”Eukaryotic DNA replication”

Riedel, Kathrin, Dr.
University of Darmstadt, Germany
Quorum sensing – small talk among bacteria

Riedel, Kathrin, Dr.
Functional Genomics Center Zurich, Switzerland
Functional genomics in Burkholderia sp. – Molecular Basis of Pathogenicity and Rhizocompetence

Scherrer, Bea, PhD student
Dept. of Plant Systems Biology, Ghent University, Belgium.
Genome evolution and haplotype diversity in wheat and barley.

8.9 Gastvorträge von Angehörigen anderer Universitäten am Institut

Boland, Wilhelm, Prof.
Max Planck Institute for Chemical Ecology, Jena Germany
How to Survive with Volatiles: Plants against Herbivores

Carroll, Bernie, Dr.
Biochemistry Department, The University of Queensland, Brisbane St. Lucia Australia
Long-distance RNAi signalling in Arabidopsis

Charmet, Gilles, Dr.
INRA Clermont-Ferrand, France
QTL analysis in bread wheat: from genome scan to fine mapping using various types of populations

Cimino, Guido, Prof.
Institute of Biomolecular Chemistry, Italian National Research Council, Naples Italy
Biosynthesis in Marine Organisms: Recent Studies on Opisthobranchs and Diatoms

Colot, Vincent, Dr.
Unité de Recherche en Génomique Végétale (URGV), Evry France
Epigenetic regulation in plants: a view from the junkyard

Giskov, Michael, Prof.
Technical University of Denmark, Centre for Biomedical Microbiology, Lyngby DK
Battling bacteria by jamming their command language

Grimanelli, Daniel, Prof.
Institut de Recherche pour le Developpement, Unite Mixte de Recherche 5096, 34394 Montpellier, France
The maternal to zygotic transition during maize seed development

Jung, Günther, Prof.
Institut für Organische Chemie, Universität Tübingen Germany
Smart Diversity-Oriented Compound Collections Based on Natural Product Chemistry and Biochemistry

Morgante, Michele, Prof.
Università di Udine, Dipartimento di Scienze Agrarie ed Ambientali, Udine Italy
Sequence diversity in plants: is there functional variation beyond SNPs?

Peck, Scott, Dr.
The Sainsbury Laboratory, John Innes Centre, Colney Lane, Norwich, U.K.
Phosphoproteomics in Arabidopsis:Plant-Microbe Interactions and Beyond

Salvi, Silvio, Dr.
DiSTA-University of Bologna, Bologna Italy
QTL cloning in plants

Shaw, Peter, Prof.
The John Innes Centre, Cell Developmental Biology, Colney, Norwich, U.K.
Nuclear organization and gene expression in plants

Sieber, Patrick, Dr.
California Institute of Technology, Pasadena, USA
Role of miRNAs in developmental homeostasis

Vandamme, Peter A.R., Prof.
University of Gent, Laboratory of Microbiology, Gent, Belgium
Diversity and Ecology of Burkholderia species

Weigel, Detlef, Dr.
Max Planck Institute for Developmental Biology, Tuebingen, Deutschland
Plant MicroRNAs: Specificity and Biological Pathways

Williams, Paul, Prof.
University of Nottingham, Centre for Biomolecular Sciences, Notingham U.K.
Quinolone signalling in Pseudomonas and Burkholderia – who's talking to whom and how?

8.10 Doppeldoktorate

9 Wissens- und Technologietransfer

9.1 Patentanmeldungen

R. Dudler, Inst. of Plant Biology, Univ. of Zurich, and Prof. A. Bachmann, Cancer Research Center of Hawaii, Honolulu, Hawaii.
R. Dudler, Inst. of Plant Biology, Univ. of Zurich, and Prof. A. Bachmann, Cancer Research Center of Hawaii, Honolulu, Hawaii.
Syringolins, pharmaceutical formulations thereof, and methods for use thereof.
27.07.2005

9.2 Neue Lizenzverträge oder Abtretungsvereinbarungen

9.3 Firmengründungen

10 Akademische Selbstverwaltung

E. Martinoia is a member of the Forschungskommission, committee member for the professor position succession of Prof. P. Endress and committee member for the professor position Molecular Microbial Ecology at the ETH Zurich. He is responsible for the Master of Science in Biology, Plant Sciences.

U. Grossniklaus is a member of the following commissions: Kommission Studienreform der MNF, Kommission des Fachbereichs Biologie: Studienreform, Kommission des Fachbereichs Biologie: Wegleitung, Arbeitsgruppe des Fachbereichs Biologie: Koordination Lehre ETHZ/UniZH, Berufungskommission (federführendes Mitglied): “Aquatische Oekologie”, Berufungskommission: “Funktionelle oder vergleichende Genomik”, Berufungskommission: “Systembiologie”, Arbeitsgruppe des Instituts: “Evaluation”, and the Strategiekommission “SystemsX”.

B. Keller was the Acting Director of the Institute of Plant Biology and Member of the Steering Committee of the Zurich-Basel Plant Science Center. B. Keller was also a member of the Berufungskommissionen in Aquatic Ecology (Nachfolge Jüttner) and the new Assistant Professorship in Functional and Comparative Genomics. In addition, he was a member of the Planungskommission of the Faculty of Sciences, the “Kommission für das Höhere Lehramt” and of the Fachbereichsrat Biologie. In 2005, he was the Head of the Fachbereich Biologie and member of the Erweiterten Fakultätsvorstand of the Faculty of Sciences. He is a member of the coordination committee “Lehre Biologie Zürich, ETHZ/UNIZ”.

L. Eberl was a member of the appointment committee for the professorship in Aquatic Ecology at the institute. He is responsible for the Master of Science in Biology, Microbiology.

R. Dudler is the representative of the Privatdozenten in the Fachbereich and in several Berufungskommissionen.

F. Jüttner was a member of the Leitungsausschusses: Center for Xenobiotic and Environmental Risk Research Zurich (XERR).

11 Publikationen

11.1 Selbstständige Literatur

Dissertationen

Abderhalden (2005): Analysis of Epidermis and Mesophyll-specific Transcript Accumulation after Syringolin A Application in Powdery Mildew-inoculated Wheat Leaves. Mikrobiologie
Referent/in: Olaf
Universität Zürich, MNF

Bouchard (2005): Export and Regulation of Auxin Transport by PGP/MDR-Type ABC Transporters. Pflanzenbiologie
Referent/in: Rodolphe
Universität Zürich, MNF

Pasquer (2005): Effects of Plant Protection Compounds on Wheat Gene Expression. Pflanzenbiologie
Referent/in: Frédérique
Universität Zürich, MNF

Senn (2005): Approach on Resistance Strategies in Staphylococcus aureus: I Cell-Membrane Associated Steps of Peptidoglycan Synthesis II Temporal Patterns of Global Regulators in a hemB Mutant. Pflanzenbiologie
Referent/in: Maria Magdalena
Universität Zürich, MNF

Yuhana (2005): Microbial Diversity and Community Changes in High Mountain Habitats. Mikrobiologie
Referent/in: Munti
Universität Zürich, MNF

Lehrbücher, Schulbücher

Anzueto, F., Baumann, T.W., Graziosi, G. Piccin, C.R., Söndahl, M.R. van der Vossen, H.A.M. (2005): Espresso Coffee – The Science of Quality (Illy, A, Viani, R., Eds.).. London, Elsevier Academic Press

Baumann, T.W. Kaffee die Zukunft (Rothfos J.B., Lange,H., Eds.). (2005): Botanik des Kaffees.. Hamburg, Behr's Verlag

Baumann, T.W. Kaffee die Zukunft (Rothfos J.B., Lange,H., Eds.). (2005): Physiologische und pharmakologische Eigenschaften des Röstkaffees.. Hamburg, Behr's

Skripte

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12 Besondere Aufgaben und Probleme

The ever-increasing administrative duties and the shift of duties from the central administration to the institutes in general poses as serious threat to the quality of research and teaching. The Bologna reform has significantly increased the time needed for teaching and examinations. Together with a high demand and necessity for public outreach activities in the field of GMO and plant sciences, the time that can be devoted to research activities is reduced. This trend towards more and more administrative assessment, evaluation and control has to be reversed if research and teaching shall be the priorities at the University of Zurich. To give an impression about the feeling in the institute on this matter, two comments submitted to the annual report are cited below:

“Administrative duties are at the upper limit”.

“An dieser Hochschule wird der administrative Aufwand immer grösser, ohne jeglichen Nutzen für Lehre oder gar Forschung, an der wir international gemessen werden. Im Unterrichtswesen hat im akademischen Jahr 2005/06 die komplette Neugestaltung des gesamten Unterrichtsangebotes im Rahmen der Anpassung an das Bologna-System enorm viel Zeit und Energie gekostet. All diese Zusatzarbeiten sind mit seit Jahrzehnten gleichem, in Zukunft an unserem Institut sogar mit reduziertem Personalbestand zu bewältigen.“