PS News

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PLANT SURVIVAL
National Centre of Competence in Research

Newsletter of the National Centre of Competence in Research (NCCR)
Plant Survival in Natural and Agricultural Ecosystems

Editorial

Words from a newcomer

The NCCR *Plant Survival* has been underway for more than three years and is now awaiting its second phase. During these three years, one of the NCCR's founding members, Enrico Martinoia, left Neuchâtel for the University of Zurich, giving me the opportunity to become his successor in autumn 2002 and take on part of his project in the NCCR. Being new in Neuchâtel, and confronted with the difficulties of a non-francophone teaching in French while concurrently setting up a new lab, I also had my first exposure to the NCCR *Plant Survival*.

I was amazed at the variety of research projects as well as the number of people involved and was, quite frankly, wondering how I would possibly fit in with my entirely molecular programme lacking ecological emphasis. However, my research programme, which focuses on the development of chloroplasts, did have conceptual potential for integration into the NCCR: the magic words being plants and light. Of course, it's obvious that plants interact with their light environment to perform photosynthesis in chloroplasts, but there is far more to it than that.

Light is a major environmental cue affecting all phases of the plant life cycle. A host of processes such as flowering time, shade avoidance, phototropism (the leaf positioning itself towards the source of light) are all under the control of light. Sam Zeeman, an assistant professor in Berne, was looking at chloroplasts from an entirely different, metabolic point of view, his interest being starch metabolism, which by and large is also under the control of light. Thus, the nucleus of the new Project 3b was born. Other labs, with chloroplast and light interests quickly joined the project: Stefan Hörtensteiner (Berne, chlorophyll catabolism), Doris Rentsch (Berne, plastid nutrient transporters), Christian Fankhauser (Geneva, photoreceptors), and Jean-David Rochaix (Geneva, state transition in photosynthesis).

We had moved from concept to project and started to discover what it means to be part of the NCCR. Initially, I had feared that we would be a somewhat artificial assembly of researchers: strangers put into a room not knowing what to talk about. But quite on the contrary, synergies rapidly emerged facilitated by the extensive use of the *Arabidopsis* model system and the acquisition of common research equipment strategically distributed over the three universities involved. Moreover, as a group, we easily gelled at our project meetings (rotating between Neuchâtel, Geneva and Berne), and also at national and international conferences. We recognized more than ever that our individual research interests are facets of the same much larger topic.

I have also noticed a ripple effect throughout the plant science landscape in Switzerland with all the major laboratories joining a national effort to start a *Swiss Plant Genomics Network*, hosted by the NCCR. Let's hope the NCCR *Plant Survival* will enter its second phase thus allowing this great scientific endeavour and adventure to continue.

Felix Kessler
Professor of Plant Physiology
University of Neuchâtel

Contents

NCCR *Plant Survival* goes on!

The NCCR Section of the Swiss National Science Foundation decided to continue its funding for the second phase (2005 - 2008) of the NCCR Plant Survival. This fundamental decision is based on the NCCR Section's mid-term evaluation and the positive scientific assessment of the Review Panel. When elaborating the full proposal, the NCCR management is requested to observe the recommendations made by the Review Panel's experts.

Plants in the spotlight

The mechanisms that enable plants to use light for their metabolism and development are hidden deep within their cells. The identification of the molecules in question is part of intense research that the NCCR *Plant Survival* has integrated for little over a year.

How do plants adapt to variations of light? That, roughly stated, is the fundamental question that has occupied the mind of Jean-David Rochaix, Professor of Molecular Biology at the University of Geneva. The biologist and his team joined the NCCR *Plant Survival* after Felix Kessler's nomination as professor of botany at the University of Neuchâtel in October 2002. They have reinforced a part of research at the NCCR that deals with the effect of light in plants.

In order to be usable by the plant, light is converted into chemical energy. This complex procedure is carried out in the chloroplasts, organelles the size of bacteria (a few microns) that are located in plant cells and contain the well-known chlorophyll. We can compare this system to two motors, respectively called photosystem II (PS II) and photosystem I (PS I), that are linked by a driving belt, in this case an electron transport chain. Each motor is equipped with its own chlorophyll antenna that captures light. The PS II uses this energy to extract the electrons from water molecules which then starts a flow of electrons along the chain as far as the PS I.

This transfer of electrons enables the storage of energy in the form of ATP, a fuel for cells. It also contributes to the chemical process that fixes carbon dioxide in the air within the plant and transforms it into sugars. Thus, when the quantity of electrons coming from the PS II is entirely absorbed by the PS I, the system is in equilibrium. However, as soon as the light varies in colour or in intensity, the two photosynthesis motors no longer function at the same speed. This creates an imbalance that the plant must compensate to avoid a setback to its metabolism. When the PS II is more active than the PS I, an enzyme from the kinase family intervenes causing the chlorophyll antenna of the PS II to be attenuated while at the same time that of the PS I is reinforced. The equilibrium of the two photosystems is then re-established and an optimal photosynthetic output is ensured.

The feat accomplished last year by Jean-David Rochaix's group was to identify one of the kinases in the green alga *Chlamydomonas reinhardtii*, sought out for 30 years without success. The Geneva researchers utilised a genetic approach by searching for algae that, following changes in the colour of light, were no longer capable of re-establishing the equilibrium between the two photosynthesis motors. These algae possessed a very precise genetic mutation that needed to be located in the genome. Once the genetic sequence was known, the biologists not only identified the kinase coded by that gene and studied its mode of action, but they also discovered that enzyme's counterpart in a higher plant, *Arabidopsis thaliana*.

In fact, it's with this same model plant that Christian Fankhauser, holder of a professorship of the Swiss National Science Foundation, focuses his research on, at the University of Geneva. His work deals with the role that photoreceptors play in the way plants adapt to light. Since even without any eyes, plants can perceive light: who has never observed a green plant opening its leaves towards a window where it regularly receives its dose of photons that it needs to thrive?

A key element to this phenomenon are phototropines, proteins that are found at the surface of plant cells. They transform light into a biochemical signal that makes the plant stem grow in the direction of the light source, a property called phototropism. However, another family of photoreceptors, phytochromes, also play a role that optimises phototropism. In fact, during its development, the stem could be exposed to two distinct stimuli: gravity and light. Under gravitropism, the stem has a tendency to grow vertically, but if a lateral light source is present, the plant will try to orient itself towards it in order to better capture the light that it needs for photosynthesis. With the use of a mechanism that Christian Fankhauser and his team have succeeded in highlighting, it's been shown that photochromes favour this action by inhibiting gravitropism. Therefore, studying how light is captured permits a better understanding of plant architecture and the capacity of plants to adapt to exterior conditions that are constantly changing.

A dive into the earth

Employed by the NCCR *Plant Survival* since September 2001, Claire Le Bayon is a soil specialist. Having obtained a Ph.D. in Biology from the University of Rennes (France) in 1999, she now devotes her time to study the chemical exchanges between roots and soil.

A brownish, shapeless mass that sticks to the soles of shoes and dirties the hands, especially under the fingernails, is how a city dweller would describe a handful of soil randomly picked up while taking a stroll in the country. This is certainly not the description one should use in front of Claire Le Bayon. For this energetic Breton, earth, or more precisely soil, represents a perfectly structured universe. From the compact layer of clay to the fine dust particles, along with the micro and macro aggregates in-between, the variations are numerous. Plants, earthworms, bacteria and fungi are all life forms that participate in the evolution of this complex environment.

The arrival of Claire Le Bayon at the University of Neuchâtel seemed predetermined. Already, at the University of Rennes, the theme of her Ph.D. thesis had a direct impact on plant survival. It dealt with the role that earthworms play in the availability of phosphorus to plants. This essential ingredient for plant development is also present in the ATP molecule, a source of fuel for plant cells. Furthermore, it is part of the phospholipids (fat reserves) and sugars that play a role in photosynthesis. When this element is lacking, the plant does not grow properly and its leaves change colour.

So why is the young soil scientist interested in earthworms? It's because these annelids aid in mixing organic matter with mineral particles. After having passed through the earthworm's digestive tract, the ingested soil ends up as part of the excrements where the nutritional elements are concentrated, including phosphorus in a readily available form to the plants.

Whether in the tunnels the earthworms burrow or at the soil surface, their excrement is omnipresent. In fact, we have all unknowingly touched some. The little blackish aggregates measuring two to three centimetres in diameter that are spread about in pastures: that's them. Specialists call them surface-casts. The quantity of soil brought up to the surface by earthworms is anywhere from 2 to 250 tons per hectare per year, which corresponds to a layer measuring from 1 millimetre to 5 centimetres!

Three years of field studies using corn have shown that the surface-casts cause the soil surface to be rough which will initially, in the case of rain, prevent runoff. The water accumulated in the little dams will eventually weaken the aggregates causing them to break up into tiny particles containing phosphorus that is readily available to the roots by infiltration. So what is the next phase? That's exactly what Claire Le Bayon is researching within the framework of the NCCR *Plant Survival*. "At the end of my research assistant contract in Rennes, I contacted professor Jean-Michel Gobat in Neuchâtel, whose soil science lab is very well known, and by chance, the NCCR was also starting up. With Karl Föllmi, Urs Feller and Enrico Martinoia, they wanted to know how plants, at the root level, deal with a lack of phosphorus", remembers the post-doctoral researcher.

The right person was found. Now only the plants were missing. These ended up being lupine and wheat. The seeds were sown in plastic cylinders containing six layers of moist, sieved soil with a relatively low level of phosphorus. Over the course of one year, samples were regularly taken in order to observe how the roots influence the evolution of the soil structure. Both the chemical elements and organic matter were also analysed. It turned out that lupine forms particular roots that excrete organic acids capable of liberating phosphorus trapped in the soil matrix. Wheat on the other hand, develops an association with mycorrhizae that increase the plant's accessibility to the nutrient. Let's not overlook the activity of phosphatases, enzymes excreted, among others, from roots and soil microorganisms.

The research carried out by Claire Le Bayon is, in essence, interdisciplinary. Geologists, physiologists, microbiologists and soil scientists are all involved in the project PS4, where she is part of the scientific coordination and conducts many experiments.

News from the labs

Congratulations

Laure Weisskopf, a Ph.D. student in Enrico Martinoia's group (University of Zurich), was awarded a prize from the Phytochemical Society of Europe for her poster entitled «Isoflavonoids of white lupines' cluster roots: tissue contents and excretion of root age». She received the award during the symposium "Future Trends in Phytochemistry" which was held from May 5th to the 8th in Gargnano (Italy) along the shores of Garda Lake. This young biologist from the NCCR *Plant Survival*, who is collaborating with Raffaele Tabacchi's group in Neuchâtel, has distinguished herself among the 62 Ph.D.s and post-docs. Bravo Laure!

Christoph Scheidegger, researcher at the Swiss Federal Research Institute for Forest, Snow and Landscape Research WSL of Birmensdorf and project leader at the NCCR *Plant Survival* (PS6: study of pasture woodlands), was named General Secretary of the International Union of Biological Sciences (IUBS). Founded in 1919, this society with its head office in Paris is regrouping 80 international scientific associations. It covers a vast field of disciplines ranging from genetics to ecology while also including human biology. This approach puts forth the notion of integrated biology, which consists of e.g. establishing links between genetic factors and their repercussion on ecosystems. The IUBS offers a platform for discussions that the current General Secretary wants to encourage by using new communication technologies (internet and e-conferencing). This will give the researchers in underprivileged countries that do not have the financial means to attend international congresses equal access to knowledge.

The Living Soil

Two professors from Neuchâtel and members of the NCCR *Plant Survival*: Jean-Michel Gobat and Michel Aragno, along with Willy Matthey, honorary professor from the same university have just finished editing the English version of *Le Sol Vivant*, an instructive book that was first published in French in 1998 at the *Presses polytechniques et universitaires romandes*. An additional success for this real 'bible' that gathers the knowledge at all levels of ecosystems: organic molecules, microorganisms, rhizosphere, and relationships between soil and plants. Forthcoming in autumn 2004.

The Living Soil. Fundamentals of Soil Science, Soil Biology.
Gobat JM, Aragno M, Matthey W.
Science Publishers Inc. Enfield NH, USA, 550 p

A Science Night's Dream

The NCCR *Plant Survival* will be joining the two-day festivities in the lavish park of the Perle du Lac in Geneva. The fifth season of the *Nuit de la science* will be held on Saturday the 3rd and Sunday the 4th of July 2004. The NCCR's booth will offer the opportunity to taste the research currently underway using a few popular themes: grapevine, ecology, and insects. Yours to discover from 14hr to midnight on Saturday and from 14hr to 22hr on Sunday.

For more information: www.lanuitdelascience.ch

Legal affaires

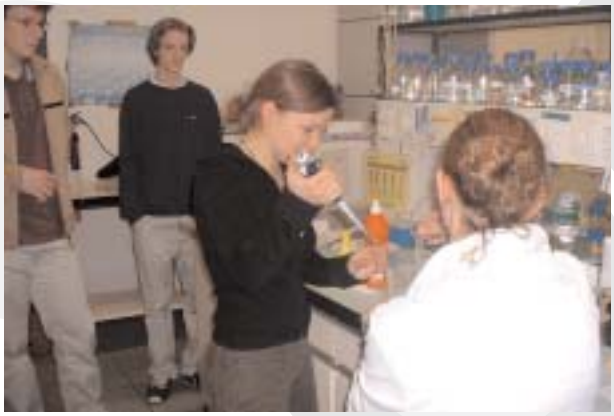
Filing for patents, an eventual partnership with the industry, a collaboration between universities: all these questions can now be directed to Carine Cangemi-Montandon, who is responsible for the Legal Services at the University and replaces Nathalie Tissot in the function of legal counsellor for the NCCR *Plant Survival*.

Contact: carine.cangemi@unine.ch

Visit of High School students

"So tell me, what are you expecting to learn here today?" It was hard not to notice the looks of surprise on the faces of the high school students, 3 girls and 3 boys, who chose to visit the NCCR *Plant Survival* on March 30th. Evidently, the question put forth by Patrick Guerin, Research Director at the University of Neuchâtel, had the intended effect: a heavy silence. Then, little by little, the shyness was replaced by a fun game of questions and answers trying to define the daily work of a scientist, or more specifically of the biologist.

Patrick Guerin eloquently talked about some research themes that he feels very passionate about. Starting with the research on the flight of insects, which could lead to subtle parades that come to the rescue of winegrowing. As described by the physiologist, this implies disrupting the flight pattern of two moths, which attack grapevine, by a rather original procedure. The odours that females emit to attract males are used to intervene and create some sort of 'sexual



High school student extracting tomato DNA

confusion' among the protagonists. In this case, the method consists of attracting males to a paste containing insecticides (see PS News 2), by using synthetic chemicals that imitate the olfactory signal of females. The result: the reproduction of the moths is stopped, to the great satisfaction of the grapevine.

The Denis-de-Rougemont High School students were then introduced to a strange measurement tool: a six-arm olfactometer. Developed by Ted Turlings, also a Research Director, and his team, this instrument is used to test the attraction of insects to the odours given off by corn plants when attacked by leaf-eating caterpillars. In fact, the odour emitted by the plant is an alarm signal that attracts small wasps, which lay their eggs inside caterpillars and in the end protect the plant.

Finally, the afternoon of initiation to biology ended with some hands-on experience. The students, with the help of Olivier Zava, Ph.D. student in plant biochemistry, extracted DNA from a tomato with the use of common household products. By using such ingredients as salt, lemon juice, a detergent, and alcohol, the experiment consists of breaking down the plant's cell walls and the nucleus to transform the long molecule into a whitish filament perfectly visible to the naked eye.

To know more about DNA extraction:
www.unine.ch/bota/bioch/ADNisolation.html

First scientific café in Neuchâtel

Genetically modified organisms (GMO's) in our fields and our plates: a danger or real progress? It was with this slightly provocative title that the first scientific café of Neuchâtel attracted some sixty people last March 24th. Responding to the initiative of the Natural Science Society of Neuchâtel (SNSN), the attendance was composed mostly of researchers and students, but also included farmers and wine-growers. It was a great occasion to converse with invited specialists around a discussion animated by Jacques Ayer, President of the SNSN. The spirit of NCCR *Plant Survival* was not far away as Karl Föllmi, Professor of Geochemistry, is part of the organising committee. Two other NCCR members, François Felber, Director of the Neuchâtel Botanical Gardens and Jean-Marc Neuhaus, Biochemistry Professor in Neuchâtel, were also among the speakers. Alongside them was Laurent Debrot, President of Bio-Neuchâtel and Member of Canton's Parliament for the Green Party, and Albert Spielmann, representative for the OFEFP (Federal Office of the Environment, Forests and Landscape).

Up until now, three varieties of transgenic maize and one variety of transgenic soy are permitted in Switzerland. As for the question of health risks, Jean-Marc Neuhaus indicated that nothing has ever been detected. As far as the environment goes, François Felber reiterated that it is essential to avoid seed dispersal in the fields prior to risk analysis. Moreover, it is important to prevent infestation by herbicide resistant weeds, which is only part of the problem. Jean-Marc Neuhaus, however, pointed out that producing new plant varieties by traditional crosses also involves the introduction of proteins that were not previously present in food.

As far as Laurent Debrot is concerned, he highlighted that the initial goal of GMO, which was to reduce the quantity of pesticides sprayed on the fields, has failed: in the USA the use of herbicides has increased by 33,000 tons since the introduction of GMO's. Whereas with natural selection, we can produce corn varieties that are resistant to many diseases. The organic grower has been disappointed that technology is favoured at the expense of research in ecology, which aims to understand and control the mechanisms of biological diversity. The adaptation is not limited to the study one plant, he added, but also to that of its environment.

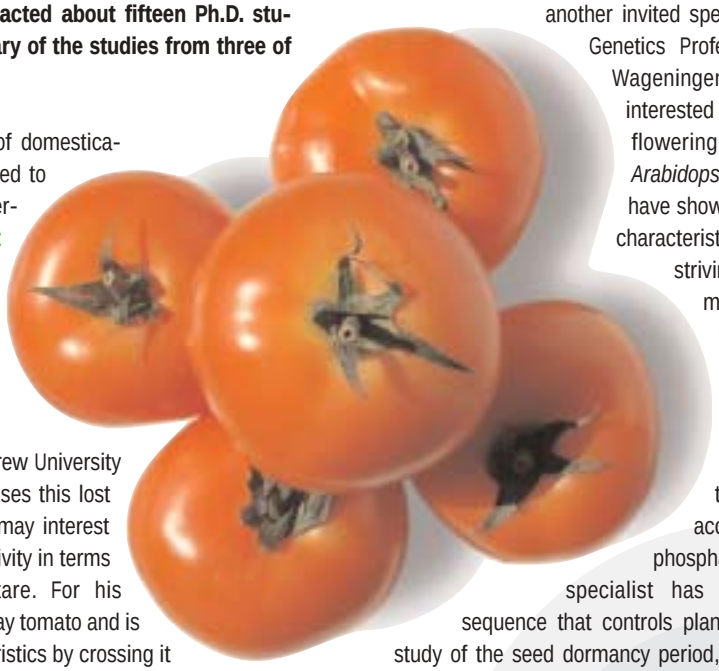
Collaboration: Colette Gremaud, Press and Communication Office, University of Neuchâtel

Graduate School

In search of lost genes

From March 15th to the 17th, a course on the genetics of biodiversity and its applications attracted about fifteen Ph.D. students. The following is a summary of the studies from three of the invited speakers.

As an unavoidable consequence of domestication, the cultivation of plants has led to the impoverishment of genetic diversity. The melons or **tomatoes that we find on the shelves** today have lost over time and breeding the genetic characteristics of their wild ancestors in order to satisfy consumer tastes.



Daniel Zamir, professor at the Hebrew University of Jerusalem in Rehovot (Israel), uses this lost wealth to recover properties that may interest farmers such as increased productivity in terms of quantity harvested per hectare. For his research, he is using the modern day tomato and is attempting to improve its characteristics by crossing it with wild ancestors without using genetic engineering. "Up until now, notes the biologist, selection was based on characteristics that were controlled by a single gene, such as resistance to plant pathogens. However, when we deal with more complex properties, such as yield, there is a large number of genes involved and therefore the breeding task is more difficult".

Drought tolerance

These studies require new methods of analysis (called *Quantitative Trait Loci* or QTL), which enable a group of genes to be associated with the morphological or physiological trait of a plant. Daniel Zamir has thus identified regions of the genome of a wild green tomato (*Lycopersicon pennellii*) responsible for drought tolerance. By crossing this species with the cultivated tomato *Lycopersicon esculentum*, it would be possible to obtain red tomatoes that can better tolerate drought conditions.

Daniel Zamir's research also aims to produce, from crosses with wild ancestors, a tomato that contains up to thirty times more vitamin A than the current commercially available variety. This new product would be well received in many African and south-east Asian countries where the population suffers from a lack of vitamin A. According to the World Health Organisation (WHO), between 250,000 and 500,000 children throughout the world become blind due to this deficiency, that eventually leads to fatal consequences for half of them.

The genetic heritage of wild varieties is also the main focus of another invited speaker, Maarten Koornneef, a Genetics Professor at the University of Wageningen (Netherlands). He is interested in the genes that control the flowering times of different *Arabidopsis* populations. His results have shown that the desirable genetic characteristics, which researchers are striving to inoculate by artificial means, actually exist among the wild varieties (or in nature). These are controlled by different groups of genes on which several vital functions of the plant rely, such as the accumulation of sugar, starch, phosphates or minerals. This Dutch specialist has also identified the DNA sequence that controls plant growth. However, it's the study of the seed dormancy period, in other words the time of inactivity before seed germination, that he's mainly interested in. Research on the genes responsible for those properties in *Arabidopsis* can also be applied in agriculture since we often find the equivalence of those genes in cultivated crops such as rice or wheat.

The third invited speaker was Quentin Cronk, Director of the University British Columbia Botanical Gardens (Canada). He is interested in the links existing between the evolution of genes and its repercussion at the level of species evolution, or even on the population of organisms within the same community. Thus, he is looking at how the shape of lupine flowers attracts specific insect pollinators. The objective of this study is to compare the genetic sequences of the flowers depending on their shapes in order to show that a modification of the sequence results in the attraction of other pollinators. This procedure is necessary to prove that the trait of a plant, such as in this case the capacity to attract a certain pollinator, is in fact the result of evolution and not simply a fluke.

Partners

Grapevine on European Time

The COST 858 programme dealing with grapevine held its first workshop at Monte Verità (Ticino) from April 29th to May 1st 2004. The NCCR *Plant Survival* secretariat in collaboration with that of Raffaele Tabacchi from the University of Neuchâtel organised the event. COST actions aim at encouraging European cooperation in the field of scientific and technical research.

Launched in November 2003, the mission of COST 858 is to treat, under the same banner, the principle biological factors that would lead towards the development of a better quality grapevine. This grapevine research network fulfils the need to establish links between acquired knowledge in genetics, biochemistry and in practice.

The gathering, held under the beautiful skies of Ticino, assembled around 70 handpicked researchers representing 12 countries: France, Germany, Greece, Hungary, Israel, Italy, Poland, Portugal, Slovenia, Switzerland, Spain and Cyprus. Concurrently, the European Union had just acquired new members and it's in this cosmopolitan and festive ambiance that Mark Thomas, a world-renowned expert in grapevine genomic, spoke. The Australian researcher talked about deciphering the grapevine genome and pointed out that the National Center for Biotechnology Information (USA) has already identified more than 12,000 genes out of an estimated total of 25,000. The grapevine is suitable for genome research since it is easily crossed and selfed. The specialist from the Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia) also mentioned two tools, based on microarray techniques, available on the market that are used to determine which plant function corresponds to a given set of genes.

However, Jean-Marc Neuhaus, member of the NCCR and biochemistry professor in Neuchâtel, pointed out that relying on these technologies is quite expensive and that's why it is important to share the costs. It goes without saying that by gathering all the genes identified in several laboratories and by adopting a global measure, we obtain much more meaningful results than if everyone proceeded alone using only their own data. In such a network, we are offered a definite chance. Mark Thomas is convinced that the microarrays used on the grapevine will lead to advancements that, over and above the scientific discovery, will improve the quality of the grape, with a better disease resistance and will contribute to a more sustainable wine-growing.

The organiser of the Monte Verità workshop, Raffaele Tabacchi, stressed that the main goal is to assemble under the same roof genomic and ecophysiology specialists. The latter being an area of

Scientists from twelve countries united by grapvine

research that looks at the impact that environmental factors (climate, soil, etc.) have on grapevine development. The aim of the scientific gathering was to find a common ground concerning five working groups (see box). Their success will not only have an impact on progress made in the areas of improved production and grape quality, but also on the defence against fungal diseases or on drought resistance.

A five-piece puzzle

The first objective of COST 858 is to standardise analysis methods for grape ripening, which implies just as much physiological issues as it does genetic. The second working group is concentrating on the systemic sequencing of genes that are expressed to ensure a certain function (the EST's or Expressed Sequence Tags). An example of this would be genes that express themselves during the flowering period. Hence, under consideration is the set up of a EST's library for the grapevine that would be as complete as possible.

The fine balance between sugars and acids as well as the role of water in grape ripening are the principle themes that the third group in the project is concerned with. With respect to this, the subject of aquaporines was brought up at Monte Verità. These are proteins that regulate the flow of water, which is an important factor in grapevine development and in the ripening of the berries.

The fourth working group is preoccupied with grapevine diseases, primarily downy mildew, and ways to resist them. Their objective: to identify the biochemical chain reactions, which include genes and their corresponding enzymes, that are capable of neutralising pathogenic fungi by using the appropriate proteins produced. Their studies also include the identification of molecules involved in the process that gives the colour, taste and aroma to grapes. As for the fifth group, it is preparing an overview of the knowledge on grapevine DNA with the goal of characterising the different wine varieties, their relationships and their origins. The development of new standardised molecular tools will be useful for both wine breeders and winegrowers.

Upcoming events

Special NCCR Event

International Conference of NCCR *Plant Survival*
March 31- April 3, 2005 in Leysin.

Arrival on March 31, 2005
Lectures from April 1-2, 2005
Facultative excursion on April 3, 2005

For more information: www.unine.ch/nccr
then click on
Events>Meetings>Past and future Meetings>
International conferences

Graduate School courses

Host Recognition by Parasites and Parasitoids
September 8-10, 2004
Joint course with 3ème Cycle romand en sciences biologiques

Parasitic wasps:
Prof. Jim Tumlinson, The Pennsylvania State University, USA

Host plant recognition by herbivores:
Prof. Randy Gaugler, Rudgers University, USA
Prof. Hanna Mustaparta, Norwegian University of Science and Technology, Norway

Other participants to be announced

Environmental Control of Chloroplast Biogenesis and Function
October 7-9, 2004
Joint course with 3eme Cycle romand en sciences biologiques

Klaus Apel, ETH Zurich, Switzerland
Chris Bowler, Ecole normale supérieure, Paris, France
Alfred Batschauer, University of Philipps, Marburg, Germany
Miguel Blazquez, University Politecnica de Valencia, Spain
John Christie, University of Glasgow, U.K.
Wilhelm Gruissem, ETH Zurich, Switzerland
Stefan Hörtensteiner, University of Bern, Switzerland
Jacques Joyard, CEA-Grenoble, France
Jean-David Rochaix, University of Geneva, Switzerland
Eberhard Schaefer, University of Freiburg, Germany
Danny J. Schnell, University of Massachusetts, Amherst, U.S.A
Jürgen Soll, University of Ludwig-Maximilians, München, Germany
Peter Westhoff, University of Heinrich-Heine, Düsseldorf, Germany
Garry Whitelam, University of Leicester, U.K.
Masamitsu Wada, Tokyo metropolitan University, Japan
Sam C. Zeeman, University of Bern, Switzerland

Information and registration: www.unine.ch/nccr
then click on Education>Graduate School>Courses

NCCR events

Annual NCCR conference
September 13-14, 2004
University of Neuchâtel

Public events

***Nuit de la Science* in Geneva**
Theme of the fifth season: counting and measuring
The NCCR will be present and will take up a stand.

Saturday and Sunday, July 3-4, from 14hr till evening
Parc de la Perle du Lac, Musée de l'histoire des sciences

Papiliorama/Nocturama, Chiètres/Kerzers (FR)
An exhibit of the Jardin botanique de Neuchâtel and
NCCR *Plant Survival*
«Quand les cellules s'en vont aux champs,
variations autour d'une plante»
«Von der Pflanzenzelle auf die Felder: Variationen einer Pflanze»

Open daily from 10 a.m. to 5 p.m.

Other events

3rd International Conference on Biological Invasions
NEOBIOTA - From Ecology to Control
September 30 – October 1, 2004
Zoological Institute, University of Berne

Information and registration: www.neobiota.unibe.ch

New press releases

Armoured plant cells to fend off pathogens (21.04.2004)
To eat or be eaten: how do food webs come about? (26.02.2004)

For further information:
www.unine.ch/nccr then click on Press> Press releases

PS News

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Université de Neuchâtel

The leading house of the NCCR *Plant Survival* is the University of Neuchâtel
Head of NCCR *Plant Survival*: Martine Rahier

Die Nationalen Forschungsschwerpunkte (NFS) werden vom Schweizerischen Nationalfonds im Auftrag des Bundes durchgeführt.
L'exécution des Pôles de recherche nationaux (PRN) incombe au Fonds national sur mandat de la Confédération.
The National Centres of Competence in Research (NCCR) are managed by the Swiss National Science Foundation on behalf of the Federal Authorities.

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