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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

International connections

Modern science is an international endeavour and the NCCR *Plant Survival* research is no exception. We, as members, have some of our closest collaborations (or competitions) with colleagues from other countries, and even from other continents. The concept of the National Centre implies first and foremost the idea of linking national competences into a stronger collective effort, and this is reflected in the involvement of people from several other universities and research stations. Nevertheless, none of our individual projects can be envisaged from a strictly Swiss perspective. Each one is embedded in an international context, even if the object of study may seem very local. For example, the study of a typical Jura wooded pasture is contributing to a better understanding of many other ecosystems abroad, and moreover, this study is part of two European projects that also involves a collaboration with a US university.

A systematic collection for our 2002 annual report has indicated 80 different international contacts and collaborations for our 12 projects. Some are collective contacts such as European projects and COST actions, while others are more interpersonal. A few involve the coordination of research, whereas others are mainly the exchange of material or information. In total, this means that we are in contact with hundreds of scientists worldwide and that we are increasing our visibility by being part of an NCCR.

Research on grapevine - the main fruit crop of the world - is undertaken in many countries. There is now an International Grapevine Genome Program with the aim of coordinating the genomic research in Australia, the USA, France, Germany, Italy and several other countries. We are currently implicated as well in this collective effort to provide better tools for the study of grapevine.

Some connections start inconspicuously. At a grapevine genetics meeting in Hungary, Brigitte Mauch-Mani and I met colleagues from the *Institut national de la recherche agronomique* in Colmar (France) who do some remarkable genetic work on disease resistance in grape. While enjoying the hospitality and Hungarian wines together, we decided to arrange a get-together to discuss possible collaborations. After returning home, both groups started thinking that perhaps other people should also be present during this visit. Word spread quickly and in the end we had a little two day meeting in Neuchâtel, with scientific presentations by colleagues from Germany (Freiburg and Siebeldingen), France (Colmar and Dijon) and Switzerland (Neuchâtel, Changins, Lullier). This encounter was such a success and enjoyed by all that we decided to repeat it. In fact, the Dijon people have already invited us all for next July. The future will show whether this is the start of a new formal network.

Jean-Marc Neuhaus
Professor of biochemistry (University of Neuchâtel)
Vice-Director of the NCCR *Plant Survival*

Contents

Graduate School: soaring towards Azur

Last December, the Graduate School definitely integrated itself within the landscape of the universities of french-speaking Switzerland. It has proven its worth by playing the trump of open-mindedness and from now on the Graduate School will be recognized by the University of Fribourg and the 'Triangle Azur', which regroups the Alma Maters of Lausanne, Geneva and Neuchâtel.

The Graduate School *Plants and their Environment* is the result of two years worth of efforts for the recognition of a curriculum designed for the PhD students of NCCR Plant Survival. In a world where specialization is the norm, it seems primordial to offer the young scientists a broad-mindedness that is as large as possible and to propose courses that permit the acquisition of knowledge that is over and beyond themes directly related to their theses while at the same time having their participation recognized by the university's governing body. With this new status, education stemming from Neuchâtel is also progressing geographically since it is opening itself to the University of Geneva, an academic body that did not figure in the original project of NCCR.

Platform for exchange

Apart from the administrative aspect, this winter's achievement shows that NCCR *Plant Survival*'s training policy meets the selection criteria of the 'Triangle Azur'. In other words, it's a matter of offering the PhD students a platform that favors the acquisition of scientific tools (data analysis, time management), developing communication skills, which are indispensable for the proper functioning of an interdisciplinary organization such as NCCR, and also the possibility to conduct part of their research work in an other institute.

In practice, this means organizing seminars, courses, and workshops that help to establish contacts and the exchange of ideas, which is a privilege enjoyed by small groups (an average of fifteen places per course). There is already some measure of success since, for example, the 2001-2002 academic year had altogether 135 PhD students and young researchers that registered for the six courses offered during that period. Without forgetting their participation in specific events such as the Graduate School's annual assembly.

Of international renown

The invitation of internationally renowned researchers is not uncommon. The auditoriums of Neuchâtel have already welcomed, and will continue to do so, specialists from Switzerland, Germany, Canada, Belgium, France, Great Britain and USA. All of which take the sharing of their passion for science close at heart, not only across geographic borders, but also and especially by rendering their presentations accessible to audiences with diversified backgrounds. With subject matters such as the exploitation of plants' chemical defences by insects, plant diseases or the evaluation of risks in the production of GMOs, one can expect very animated, and perhaps at times heated discussions all revolving around genetics, biochemistry and ecology.

Personal initiatives

The Graduate School tries its best to offer the PhD students tools that will be useful for their daily research work. Among others: statistics, without which it would be impossible to quantify the results in the vast domain of life sciences. That's why, from the onset, statistics figures predominantly since no less than three series of courses are devoted to that subject alone.

Another strong point was the establishment of several sessions on effective public speaking, whether it is at scientific meetings or to express a message destined to one and all. Finally, apart from taking courses, PhD students regularly attend seminars where they find themselves in their own milieu. One that is favourable to the creation of personal initiatives that can, for example, result in the invitation of an outstanding individual to give a conference.

Facing the challenges of our contemporary society

Today's Swiss academics are laying down the groundwork for an education that conforms to European norms in order to facilitate exchanges within the continent. And because of its bonds with 'Triangle Azur', NCCR's Graduate School is well placed in this context.

The emergence of graduate schools is a direct consequence of the changes that higher education is going through. For example, replacing the current diplomas that are awarded with a Bachelor and Master's degree. For **Michel Rousson**, vice-principal of the University of Neuchâtel, and also representing Neuchâtel in the 'Triangle Azur', these new structures must help the young researchers to not only be competitive in their respective fields, but also to assert themselves among their peers and establish a network of contacts. Therefore, graduate schools, in their current format, insist more specifically on methodologies and social skills.

"To successfully advance in a social milieu is a difficult hurdle to overcome during the course of one's PhD, reckons the vice rector of Neuchâtel, who is also a professor of work psychology. In my opinion, we have to help the PhD students to be capable of asserting themselves in society. By that I mean to be able, for example, to lead negotiations in partnerships. That implies stating ones interests and to stand by them. It's equally important to learn how to distinguish between what is negotiable and what is not."

These skills are not so much acquired in the classroom, but rather in practice. Therefore, actively participating at a conference implies an apprenticeship in the art of effective communication, the development of critical thinking and the establishment of a network and/or various partnerships.

In french-speaking Switzerland, and for that matter all of Switzerland, the proposals of the 'Triangle Azur' constitute a decidedly original approach. The idea first came about by an offer put forth by Geneva and Lausanne, and soon thereafter professors from Neuchâtel were contacted, in educational sciences for example, to give a hand in building up this project. It is thus that this city of yellow hude buildings has allied itself with its counterparts along the arc of Lac Léman. An alliance that permits the Graduate School of NCCR *Plant Survival* to join seven other schools already recognized (cognitive psychology, languages, education, molecular and cell biology, neurosciences, pharmaceutical sciences and art history).

What's the word from Geneva and Lausanne?

Even before being part of the *Triangle Azur*, NCCR *Plant Survival* included the Institute of Ecology from the University of Lausanne as one of its members and had already created ties with the University of Geneva, or more specifically its department of Molecular Biology. What are the reactions from the shores of Lac Léman on the possibility of participating in the Graduate School of Neuchâtel?

Prof. Edward Farmer (Lausanne): " I think that the graduate school is a great idea. What I would expect from such a program is simple. A 'package' of seminars, courses and other interactions focused on high quality science. These courses etc. should not be the sort of thing that business people use and could find in evening courses in any city. Instead, they should be aimed at fostering scientific curiosity and rigour. This is what I feel that our doctoral students need most in their often short (3-4 year) passage through our institutions".

Prof. Christian Fankhauser (Geneva): "What I like first and foremost from the Graduate School is that students who are studying concurrently can meet even though they are not necessarily from the same laboratory. I find this notion lacking in Switzerland, whereas it is quite common in the USA. Since they already know each other and are aware of one another's respective research interests, these researchers working in the USA will find it easier to build contacts down the road. Secondly, I find it very important to organize annual meetings where the PhD students have the opportunity to present their work. Part of the meeting should exclude the academic body in order to favour discussion between students."

Prof. Jean-David Rochaix (Geneva): "For the past twenty years or so, there exists in the department of molecular biology a graduate school, where one learns, for example, to develop a critical approach to reading scientific publications. However, plant biology was somewhat of a forgotten relative of the research in Geneva, so I think that courses at the graduate level centred on plants are more than welcome. In fact, it's necessary to unite our strengths in order to offer the best possible education to those pursuing a PhD in that field."

People

Claire Arnold, the new coordinator for NCCR

Since February 2003, Claire Arnold has taken up the position of coordinator of NCCR *Plant Survival.* A versatile scientist, her studies have led her from Switzerland to Australia and then Austria. The journey of a scientist that feels as much at home in the alluvial zones of the Sarine than in the genetic analysis of wild grapevine and of willows.

Similar to the projects of NCCR *Plant Survival*, the new coordinator's career path has been interdisciplinary. "Most of the work that I participated in revolved around two key words: alluvial zones and Vitaceae", quickly adds Claire. She easily moved from genetic analysis in the laboratory to ecological considerations dealing with problems of competition between species in the field. "Biology has become so specialized that it's important for the scientists to find the means to communicate in order to increase the chances of success", says Claire Arnold who intends to play the role of intermediary between the various groups in order to ensure a cohesion that is as profitable as possible. Her view from the sidelines should help to unearth common points that are not necessarily evident at a first glance. "I attach a lot of importance to the people, states Claire Arnold. Of course, one could discover several possible collaborations by closely examining the research topics, but then one has to approach each individual researcher, each having their own different personalities. We cannot force the researchers to work together in perfect harmony."

Vitaceae in Australia

In the meantime, Claire Arnold is back on familiar territory: it's at the University of Neuchâtel that she studied biology, followed by a PhD in 1999. Not afraid of fieldwork, she gladly puts on her fishing boots to study along the banks of the Sarine the mosses communities. At the Laboratory of Plant Ecology, while working on her thesis dealing with wild grapevine, she took interested in the ecological factors (importance of soil, competition with other organisms, influence of light, etc.) that could explain the scarcity of this species. A study that spanned four years and was carried out in the forests of 9 European countries.

This led to a stay down under in 2000, at the Southern Cross University, Australia, where she discovered genetic markers common to both wild grapevine varieties *Cissus* and *Vitis*. She also studied the influence of the fragmentation of a subtropical forest on the genetic diversity of *Cissus*.

During the last two years, the *Universität für Bodenkultur* in Vienna offered her the opportunity to establish a research group, within the framework of a European project, dealing with the genetics of willow, named Dynamo*. A fascinating experience, since it concerns the ecology of a tree that is also economically very important. In fact, the wood from willows is used in the fabrication of various tools, in orthopaedic prosthesis, and in the production of paper. Willows are also used in the prevention of natural catastrophes, or more specifically they are planted along riverbanks to offer stability and to prevent soil erosion. Claire Arnold and her group highlighted genetic characteristics, at the chloroplast level, that help to distinguish between the white willow (*Salix alba)* and its numerous hybrids, which are morphologically similar. In most cases, merely looking at the ligneous structure of the hybrids is not sufficient, and hence, the significance of the genetic markers that have been discovered.

The experience in Vienna that Claire Arnold gained has given her the opportunity to become familiar with scientific research that is part of a network, an asset that will certainly work in favour of NCCR *Plant Survival*.

Taking over for Bernd Hägele

Claire Arnold will, to a large extent, assume the responsibilities previously held by Bernd Hägele up until the end of 2002, and who was also involved with the preparatory phase of NCCR *Plant Survival* since January 2000. Co-writer of the final proposal submitted to the Confederation, Bernd Hägele subsequently undertook the position of coordination for a period of two years. During this time, he successfully unearthed the complementarities between the different individual projects of NCCR *Plant survival* in such a way that encouraged collaborations between participants and partners, while at the same time attaching great importance to interdisciplinary research.

The former coordinator was especially appreciated for his vast general knowledge and scientific competences in ecology, physiology and statistics. Many qualities that he will certainly put to good use, with the enthusiasm that he is known for, in his new activities at the Federal Office of Education and Science in Bern. We wish him well and all the best in his new endeavours!

**The dynamic nature of introgressive hybridisation in natural and introduced polyploid plants from agricultural and riparian landscapes: an evaluation of molecular tools in willows.*

Evaluating the ecological risks in agriculture

Head of a NCCR Plant Survival project dealing with the impact of genetically modified (GM) plants on the ecosystem, Franz Bigler works at the Federal Research Station in Agro-ecology and Agriculture in Zurich-Reckenholz. He integrates ecology, gene technology and eco-toxicology to create a pest management system for the protection of crops.

Franz Bigler, you were one of the first in Switzerland to take interest on the ecological impact of agriculture. Could you explain why?

After obtaining my degree from the Swiss Federal Institute of Technology in Zurich (ETHZ), I worked for one year at the Institut National de la Recherche Agronomique, in Antibes (France), before returning to ETHZ to do my PhD. I studied the relationships between an olive pest and its parasitoids in Crete, a field research co-financed by FAO and carried out between 1976 and 1979. Afterwards, I was offered a position at Reckenholz where I immediately took on pest ecology and biological control. My passion then, and still today, was to study the interactions between plants, pests and natural enemies in cultivated fields and in natural habitats.

The research that I was involved with up until 1996 dealt, among other things, with the ecological impact of pesticides, namely the effects on beneficial arthropods. It was in this area of research in ecology that I became initiated to eco-toxicology and its environmental risk evaluation methods.

Is there a common theme between the different types of environmental risks, such as the impact of pesticides, of certain biological pest control agents, or of GM plants ?

Yes, it's eco-toxicology, which was primarily developed to evaluate the risks associated with pesticides *vis-à-vis* habitats and non-targeted organisms. During the 90's, international discussions inspired studies on the impact that biological control methods have on the environment. The use of natural organisms is not necessarily synonymous with ecologically safe. When we release predatory insects, parasites, viruses, or beneficial fungi in the fields, we have to determine to what extent the ecosystem can be affected.

The protocols of eco-toxicology also serve to develop the biosecurity of GM plants, which is a research priority at Reckenholz. What comes immediately to mind are studies by tiered risk assessments: in the laboratory, in the greenhouse, and in the field, which we adapt according to the needs and following precise directives.

Which GM plants have you studied up to date?

We have mostly concentrated on Bt maize. This transgenic plant produces a toxin that kills the European corn borer, a well-known pest (see p.6). Our research shows that the risks of directly destroying beneficial insects are practically zero. We still have to evaluate the consequences for other members of the food chain that influence the population dynamics of potential pests of maize. Furthermore, we are conducting research with the ETHZ and partners abroad dealing with several varieties of transgenic corn, which are, for instance, resistant to a fungus or to aphids.

Is your research affected by the fact that Switzerland prohibits the production of GM plants in the field?

No, for now the ban on the large-scale production of GM plants, or in other words in agricultural production, does not prevent us from doing research on the ecological risks associated with these plants. A large number of questions can be answered by doing tests in the laboratory and in greenhouses. In these environments we have demonstrated the effects of Bt maize on a number of herbivorous insects and their natural enemies inhabiting the same ecosystem of maize. Our results show that the impact on the different organisms present is minimal to nil. This was achieved without doing any field experiments.

It is obvious that certain possible consequences on plant vigour and on the expression of the transferred gene in an agricultural environment cannot be simulated in a laboratory or greenhouse, so past a certain experimental stage, it becomes necessary to do field trials. Hence, we still need to perform field tests producing plants on an agricultural scale if we want to observe the long-term effects as well as any changes to the landscape.

GMOs and ecological risks: answers riddled with nuances

From January 15th to the 17th, the course on Risk Assessment of Genetically Modified Crops was jam-packed. During those two and a half days, respected scientists and PhD students took turns on the podium to debate this delicate subject.

Special guests and organisers of the course. From left to right: Henri Darmency (France), Angharad Gatehouse (UK), Guy Poppy (UK), Ted Turlings (Neuchâtel), François Felber (Neuchâtel), Christoph Tebbe (Germany). Squatting: Christiane Bobillier (Neuchâtel).

Today, more than 58 million hectares of fields worldwide are covered with genetically modified crops. This represents 58 times the surface of land used for agricultural purposes in Switzerland. The number one spot goes to the soybean of which half of the world production is of transgenic origin, followed by corn, cotton and rapeseed. From a geographic standpoint, three countries on the American continent figure prominently in the production of theses types of crops, namely the USA, Argentina and Canada, says Ana Dutton of the Federal Station of Zurich-Reckenholz, who is involved with a project of the NCCR *Plant Survival.*

In resorting to genetic engineering, the main objective is to protect crops against pathogenic organisms (bacteria, fungi), noxious weeds and herbivorous insects. Angharad Gatehouse, an invited speaker from the University of Newcastle, UK, stated that 40% of harvests are lost to herbivores or diseases. The application of a broad-spectrum pesticide seems to be the simplest solution to this problem, with, however, harmful repercussions on the environment and organisms that pose no threat to crops.

Non-target insects

Fine-tuning a poison to such a point where it only affects the target would enable one to deploy a refined pest control strategy. With this in mind, for example, the Bt maize was created. Its DNA contains a gene taken from the bacteria *Bacillus thuringiensis* that controls the synthesis of a protein that is toxic to the European corn borer, *Ostrinia nubilalis*, however some other insects are also sensitive to it. That's one reason why the Bt maize is still undergoing several ecological tests. In Switzerland, it is prohibited to grow Bt maize and other genetically modified plants it in the field until sufficient safeguards for the environment can be guaranteed.

With this in mind, some scientists fear that Bt maize may cause certain undesirable effects on non-target insects and especially beneficial insects such as the green lacewing, *Chrysoperla carnea*. The lacewing devours corn borer larvae and in turn helps to protect maize and hence must be preserved. According to Ana Dutton, though, there seems to be no direct threat to *C. carnea*.

Chrysoperia carnea is a beneficial insect: it feeds most notably on maize pests.

Studies from the research station in Reckenholz show that the toxin does not directly affect the lacewing; nevertheless, if it feeds on lepidopterous larvae that were infected by the toxin then it may die. Yet, the risk remains low, suggests the researcher from Reckenholz, as long as the lacewing's diet includes other organisms, thus minimising exposure to the toxin.

Natural spread

During the course given in mid-January, several speakers underlined the fact that it is not necessary to wait for the advent of genetically modified organisms (GMOs) to study the ecological risks that stem even from conventional plant selection processes. As Henri Darmency, from the *Institut National de la Recherche Agronomique* in Dijon, France, pointed out, the introduction of the red-colored rice in India is an enlightening example. That variety was recommended by agronomists precisely because of its color, which would distinguish it from the wild rice growing in nearby areas. Unfortunately, after a mere three generations, the genes coding for color in rice were exchanged between varieties. As a result, it was no longer possible to distinguish between the cultivated rice and its wild relative causing dramatic consequences on the harvests.

François Felber and Roberto Guadagnuolo of the University of Neuchâtel, have stressed the importance of studying the risks associated with the gene flow between wheat and its wild relative *Aegilops cylindrica* which is considered as a major weed in the USA. Their work shows that for this species the proportion of hybrids – an indication of gene transfer – could vary by a factor of 7, and that, in a region as restrained as the Valais in Switzerland. Here as well, the results beg for reflection, especially in a situation involving transgenic wheat. That's what Nicola Schoenenberger, from the NCCR Plant Survival and third member of François Felber's group, is trying to evaluate. This young PhD student is studying the hybrids between *Aegilops cylindrica* and two varieties of genetically modified wheat, of which one expresses for an insecticide resistance and the other for a fungal disease resistance. The goal of this research is to determine if the gene is transmitted and expressed in the progeny, and to evaluate the development and the performance of the plant under different environmental conditions (temperature, nutrient availability, light and soil humidity). This study is a first step in measuring the ecological consequences of a gene initially intended for wheat and ending up inadvertently being transferred to a weed.

To quantify the risk

But what would be the ecological consequences of an accidental transfer of a resistance gene from a crop plant to a wild relative? That's precisely what Guy Poppy, senior lecturer at the University of Southampton, is working on. He was also an invited speaker at the Graduate School course. "If hybrids originating from crosses between cultivated plants and wild relatives survive and these backcross with wild relatives, then it is possible to eventually have populations of wild plants that contain the Bt gene", argued the British scientist. "If the gene is present in these wild plants, then we need to see if there really are serious consequences on the environment by examining the insect population dynamics, the effects on the soil microorganisms, etc. The aim of our research is to quantify that risk which involves determining the consequence (hazard) and the likelihood (exposure) of it happening. Most previous studies have determind only one of these components and therefore have not been able to quantify the risk, knowing that risk is equal to 'hazard' times 'exposure'". Having said that, most crop plants in the wild, whether they are transgenic or not, have little chance of any significant development, since they are subject to intense competition and are exposed to a variety of diseases, which is not the case in an agricultural environment that is under human care and interventions.

Beware the Superweeds!

One way to improve the fight against weeds is to develop crop varieties that are resistant to the herbicide used against that weed. A typical example of this is Monsanto's genetically modified soybean, Roundup-ready soybean, which contains a glyphosate resistance gene, glyphosate being a very well-known herbicide.

However, the transgene might migrate to a wild relative, resulting in herbicide-resistant weeds, which scientists have coined as superweeds. This has occurred in rapeseed fields in Canada that are rotated with wheat every third year. Supposing that in the year that wheat is grown a few rapeseed plants appeared, then these plants would be considered as weeds. Now, let's further suppose that these plants or weeds also contained the herbicide resistant gene, what would we do to get rid of it? The only solution would be to alternate the herbicides, and their respective herbicide-resistance genes in the crop, in such a way that the weed could be better controlled.

News from the Labs

A bridge connecting two NCCRs

On the one hand we have the evolution of plant populations and on the other climate changes, with as a link, research in forecasting models that enables one to predict the transformations of ecological systems over time and space. One did not have to look far to imagine possible synergies between the National Centres of Competence in Research Climate and Plant Survival.

That's what occurred, following an initiative by NCCR *Climate*, when representatives from both NCCRs met last autumn in Bern. A subsequent meeting resulted, and was held on February 18th in Neuchâtel, dealing with the topic of climatic changes and their impact on plants.

Within the NCCR, the group, directed by Jürg Fuhrer of the Federal Research Station in Agro-ecology and Agriculture in Zurich-Reckenholz, gave itself as an objective to evaluate the consequences, from now up until 2100, of the climatic changes on agricultural ecosystems and plant production. However, before arriving at that, the climatologists had to learn to do climate forecasts on an agricultural scale, or in other words in plots of about 25 km sq. These scenarios lead to the analysis of, among other things, the direct effects of climate changes on the production of fodder. In this case, on two types of plants: the grasses (ray grass) and the legumes (clover).

This type of research method is quite limited from an ecological point of view. Hence, came about the idea of merging the available information with a research of NCCR *Plant Survival* that takes into consideration biological parameters. More specifically, the research deals with the evolution of pasture woodlands of the Jura (project PS 6), an ecosystem where one can trace the changes throughout the 20th century by using aerial photographs.

This research integrates the interactions between the different components of the system (soil, plants, trees and livestock), in a way that one can deduce the probable changes to the landscape in the future depending on the different management methods used. However, for long-term forecasts of ten or more years, it would be necessary to include the influence of climate, additional information that Jürg Fuhrer and his colleagues could bring.

In fact, the climatic models predict an increase of 2 to 5ºC of the average yearly temperature from now until 2100. Such a warming effect would provoke a growth of the plant canopy of several hundreds of meters, causing a risk of considerable modification of the evolutionary conditions of pastures and wooded areas. Reciprocally, the studies on the dynamics of wooded pastures enable the forecast models on climate changes to take into account the data related to the evolution of the vegetation. It goes without saying that the ongoing discussions between the two National Centres of Competence have many sunny days ahead of them.

Legal services at your disposal

Academic research carried out by isolated groups are more and more an exception. Often, partnerships are created with other institutes and the industry. Hence, it is important to establish a climate of confidence between the parties with concise and equitable contracts. That's, at least, the advice of Nathalie Tissot, specialist of intellectual property, professor of law and delegate for the technology transfer at the University of Neuchâtel.

In the framework of NCCR *Plant Survival*, the lawyer gladly offers her advice in order to assist the researchers in avoiding unpleasant surprises when faced with doubts concerning the contracts they are offered. Her offer is also valid for all questions pertaining to patents. However, whatever the case may be, there is one rule to follow: do not leave it to the last minute.

"The patent application should be filed before communicating your findings to the public, warns Nathalie Tissot. If it is done after presenting your results at a conference (even as a poster) or in a scientific journal, then it is too late." What can be patented? To a large extent, all new technical creations including procedures can be patented. However, is does not apply to a discovery, since this implies emphasizing something that already existing in nature.

A patent is useful as soon as one considers a commercial use for the findings, or if one is thinking of establishing a start-up company. It is in this context that partnerships with the industry take shape. Therefore it is important to be aware of certain clauses included in the contract that precedes an invention. A contract of confidentiality, for example, helps to preserve the novelty of an invention, one of the conditions that is primordial in the filing of a patent. One must also be attentive to the exclusive rights of exploitation that are given to the industrial partner, and which can also be limited to a specific domain corresponding to the heart of the research project. In this way, it leaves breathing room for the signatories to exploit the rest of the results in other areas.

Finally, the patent, which protects the invention for a period of 20 years, allows the University to receive royalties that in turn are

divided, to some degree, among the technology transfer service, the laboratory from which the invention originated and the inventors.

In conclusion: as soon as a partnership with the industry seems to be a future prospect, each senior researcher of the NCCR is encouraged to contact Nathalie Tissot.

For further information: nathalie.tissot@span.ch

Please take notice of the new statutes

The updated statutes of the NCCR Plant Survival are available on the Web.
All researchers are invited to become familiar with them:
www.unine.ch/nccr/
Click on 'organisation' and then 'statute'

Welcome to NCCR *Plant Survival*

PhD students

Thierry Delatte started his PhD at the University of Bern in July 2002, under the supervision of Sam Zeeman, after having obtained his MSc at the University of Wageningen, Netherlands.

Gaëlle Messerli is a graduate of the University of Neuchâtel. She was hired in December 2002 to do her PhD in Bern under the supervision of Sam Zeeman.

Sibylle Infanger started her thesis as of January 1st 2003 under the supervision of Felix Kessler where she will work in collaboration with Andreas Hiltbrunner.

Marco d'Alessandro is a PhD student at Neuchâtel since January 2003 where he is taking part in the same project as Matthias Held.

Postdocs

Jérôme Moreau obtained his PhD from the University of Poitiers where he studied the effects of a feminising bacteria responsible for the abnormal proportion of females in the isopods (crustacean which also includes the sow bug). Working in Neuchâtel since October 2002, he is collaborating with Betty Benrey and Ted Turlings.

Matthias Held is originally from Germany where he finished his PhD last year at the Max Planck Institute in Jena. A specialist in chemical ecology, he is working in Neuchâtel since January 2003 in close collaboration with Ted Turlings. His work focuses on the interactions between maize, a leaf-eating caterpillar and its natural enemy: a parasitic wasp. He is analysing the odours that serve as alarm signals for maize to attract the beneficial wasp.

Andreas Hiltbrunner joined Felix Kessler's group at the University of Neuchâtel in January 2003 after obtaining his PhD from the ETHZ where he studied chloroplasts, plant cell organelles that specialize in photosynthesis.

Professors

Christian Fankhauser, professor on a FSN grant since 2000
Specialty: Plant biology, genetics
University of Geneva

Christian Fankhauser's group is interested in the influence of the environment on the growth and development of living organisms. More specifically, they are studying the molecular mechanisms that enable a plant (*Arabidopsis thaliana*) to capture light. Their efforts are concentrated on a family of photoreceptors (proteins that capture light): the phytochromes. This same group, using genetics, molecular or biochemical methods, has also identified and described new genes that are involved in the transmission of the signal initiated by the phytochrome. The objective, as well, is to understand the mechanisms used by the plant to integrate all the signals processed by the different photoreceptors.

Jean-David Rochaix, professor of molecular and plant biology since 1981
Specialty: Molecular genetics of photosynthesis
University of Geneva

The cells of plants and algae possess a common characteristic: they contain three distinct genetic systems located in the nucleus, the chloroplasts (area of photosynthesis) and the mitochondria (responsible for respiration). Jean-David Rochaix and his colleagues are trying to understand the molecular interactions between these three cellular compartments. They are also studying the adaptation process of photosynthesis to changes in the colour or intensity of light. They make use of molecular genetic and biochemical tools in their approach towards studying the unicellular, photosynthetic alga *Chlamydomonas reinhardtii*.

Partners

Ecology's sweet tooth

In the Netherlands, a new research unit specialized in the study of plants and the organisms that feed upon them, was created in the year 2000. The research activities in the department of Multi-Trophic Interactions (MTI), at the Centre for Terrestrial Ecology in Heteren, are concurrent with certain projects of the NCCR *Plant Survival*.

The butterfly Pieris brassicae is harmful to cabbage crops.

There is nothing unusual about a butterfly gently landing on a plant in search of nectar, right? While we all know that plants employ floral nectar to attract pollinators, it is less well known that many plants use similar sugar-rich solutions to attract insects for their defensive services. For example, certain plants, such as cotton, will produce extra-floral nectar to lure predatory ants. These aggressive insects are effective body-guards, as they are known to devour herbivores that are natural enemies of cotton.

In keeping with the spirit of things, the researchers from MTI have also been interested in the natural defence mechanisms of cabbage, a widely spread crop if ever there was one. Threatened by pests such as the cabbage white butterfly *Pieris brassicae*, the vegetable uses the services of the parasitic wasp *Cotesia glomerata* to defend itself. The wasp will lay its eggs inside the pest's larvae thereby protecting the plant. A researcher at MTI, Felix Wäckers, and his colleagues have analysed the effects that sugars secreted by plants have on both pests and parasitic wasps. They have determined which sugars are valued by *P. brassicae* and which are favourable to its enemy *Cotesia*.

Fuel or poison

There is even better! During his work at the Swiss Federal Institute of Technology in Zurich (ETHZ), Felix Wäckers and his colleague, Joerg Romeis, revealed that certain sugars and essential amino acids found in the nectar of those plants or in the honeydew secreted by aphids selectively promote the beneficial parasitoid without benefiting the pestilent butterfly. It seems that melibiose diminishes the life expectancy and the fertility of the butterfly, whereas melezitose solely benefits the parasitoid.

However, the situation is not always as clear-cut as we would like. Sucrose, for instance, appears to surpress the egg laying by the butterfly, yet it strongly increases the life expectancy of the insect in question. Nevertheless, it is obviously more efficient to control the pest by diminishing its fertility even if, by doing so, we permit it to live a bit longer. Especially since its life expectancy will only increase by a few days, an effect to which the cabbage will definitely not take offence.

The authors of the study have also identified substances that, in contrast, favour the development of the herbivorous butterfly. Glucose acts as a double stimulant since it increases the life expectancy and also the fertility in females. Moreover, a diet consisting of sucrose supplemented with amino acids triples the rate of oviposition compared to that of female butterflies fed with only water or only amino acids.

Biological control methods

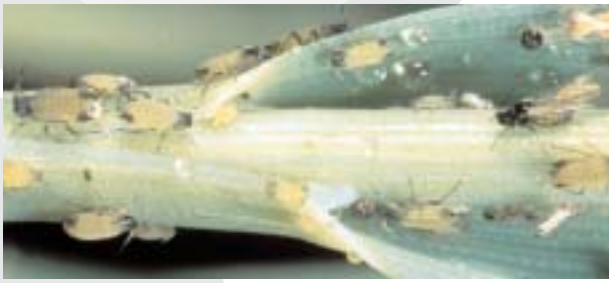
All of those elements, researchers say, could introduce new methods to support biological control agents in their fight against pests. "By studying nutritional requirements of both beneficials and pests", notes Felix Wäckers,"we intend to identify sugar sources that attract desirable insects while at the same time being unsuitable to pests. This information will help in designing flowering field border or other types of agricultural biodiversity."

The analysis of sugars is also part of ongoing research at NCCR *Plant Survival* that resulted in a collaborative effort with

the team in Heteren. Hence, Cristina Faria, PhD student at the University of Neuchâtel, spent a few days in the Netherlands in order to analyse the honeydew that she gathered from aphids found on corn stems. The goal is to determine whether the aphid honeydew can be an effective source of food for the parasitic wasps that are potential biological control agents against pests of corn.

Soil – swarming with activity

On another level, the MTI has coordinated a European project (*CLUE*) aimed at restoring biodiversity in agricultural land. In practice, it has been examined how plant species diversity on the soil surface influences soil biodiversity to assess which plant community produces the highest level of biodiversity by counting the different soil organisms present (bacteria, fungi, nematodes, micro-arthropods, insects and earthworms). It appeared that, whether the buffer zone was naturally established or by sowing a variety of plant species, there does not seem to be any noticeable impact on the population of the soil's micro-organisms living underground. On the other hand, the type of plot that is established directly affects the organisms found on the soil surface. This occurrence has aroused the interest of researchers who have observed these effects in five similarly designed field experiments across Europe, namely in the Netherlands, Sweden, Spain, the Czech Republic and the United Kingdom.



Aphids produce honeydew that attracts beneficial insects to maize.

To further this research, Wim van der Putten, head of MTI, Martijn Bezemer, the scientist responsible for the biodiversity experiments and their team are participating in a second European project (*TLinks*), which is coordinated by Valerie Brown of the Centre for Agri-Environmental Research in Reading, UK. The objective of the *TLinks* project is to define strategies that will optimise the biodiversity of arable lands converted into more natural systems to be used as biodiversity conservation areas. The project is carried out in the five countries mentioned above and in Switzerland. Heinz Müller-Schärer (University of Fribourg), who is also vice-director of the NCCR *Plant Survival*, leads the Swiss groups working on the *TLinks* project. The results of this research programme should be available by 2005.

Half a century of scientific ecology

Founded in 1954, the Centre for Terrestrial Ecology in Heteren, Netherlands, is one of the three sites that make up the Netherlands Institute of Ecology (NIOO). This institute is studying the ever-growing human impact on the environment and is attempting to evaluate the repercussions, from bacteria to mammals and plants, on land, lakes and aquatic environments, and always with the concern of promoting sustainable development.

In Heteren, four areas of interest are first and foremost. By studying the great tit in its natural habitat, specialists of animal population biology are trying to know more, for example, on the consequences of climate change on bird habitats.

From its side, the department of interactions between plants and soil micro-organisms is closely examining the numerous interactions occurring at the root level. Whereas the department of plant population biology is studying the way plants adapt to their environment.

Finally, the newborn of these research units, the department of multitrophic interactions (MTI), started its activities in 2000. Its area of interest is the interactions between plants, phytophagous organisms and their natural enemies, whether they are underground or airborne. What are the chemical signals and mechanisms used in these complex interactions? In what way does the plant use its system of defence against these pathogens and herbivores? These questions may seem to have a familiar ring to them, and that's because they are also part of NCCR *Plant Survival*'s agenda.

Upcoming events

Graduate School courses

Heavy Metals in Plants

April 3-4, 2003
Dr. Nathalie Verbruggen, Université Libre de Bruxelles (Belgium)
Dr. Catherine Keller, EPFL (Switzerland)
Prof. Enrico Martinoia, University of Zurich (Switzerland)

Introduction aux bases de données spatiales et SIG (in French)

May 5-9, 2003
Dr. Mahmoud Bouzelboudjen, Ing. Dipl. Université de Neuchâtel

Self-Leadership and Time Management

May 21 and June 11, 2003 - Course full
Dr. Sarah Shephard, ETH Zurich (Switzerland)

Joint course IIIe Cycle Romand and NCCR *Plant Survival*

Biodiversity and Species Interactions

October 15-17, 2003
Jordi Bascompte, Estación Biológica de Doñana, Sevilla, Spain
Charles Godfray, Imperial College at Silwood Park, Ascot, UK
Stephen Hubbell, University of Georgia, Athens, USA
Michel Loreau, Ecole Normale Supérieure, Paris, France
David Tilman, University of Minnesota, St. Paul, USA

Information and registration: www.unine.ch/nccr/
then click on
Education > Graduate School > Courses > Courses 2002-2003

Participants meeting

Introduction of alien genes and genotypes into ecosystems: sown wildflowers and GM crops (PS 8 and 11)

March 27, 2003
13:00 - 17:45
University of Neuchâtel, Uni Mail, Institut de chimie, room B1

Review Panel site visit

8 and 9 May, 2003

IMPORTANT: on May 9, all NCCR graduate students will be required to present a poster of their work.

Public event

Fête de printemps du Jardin botanique, 18 mai 2003
Inauguration of an exposition on the NCCR *Plant Survival* that will last until October 5, 2003.

Humour

Illustration: Denis Nobert

Last winter, it was so cold that even the mice left the glacial conditions of the Chemistry building, which houses the coordination team (MCU) of NCCR *Plant Survival*.

PS News

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

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