



Annual Report 2002

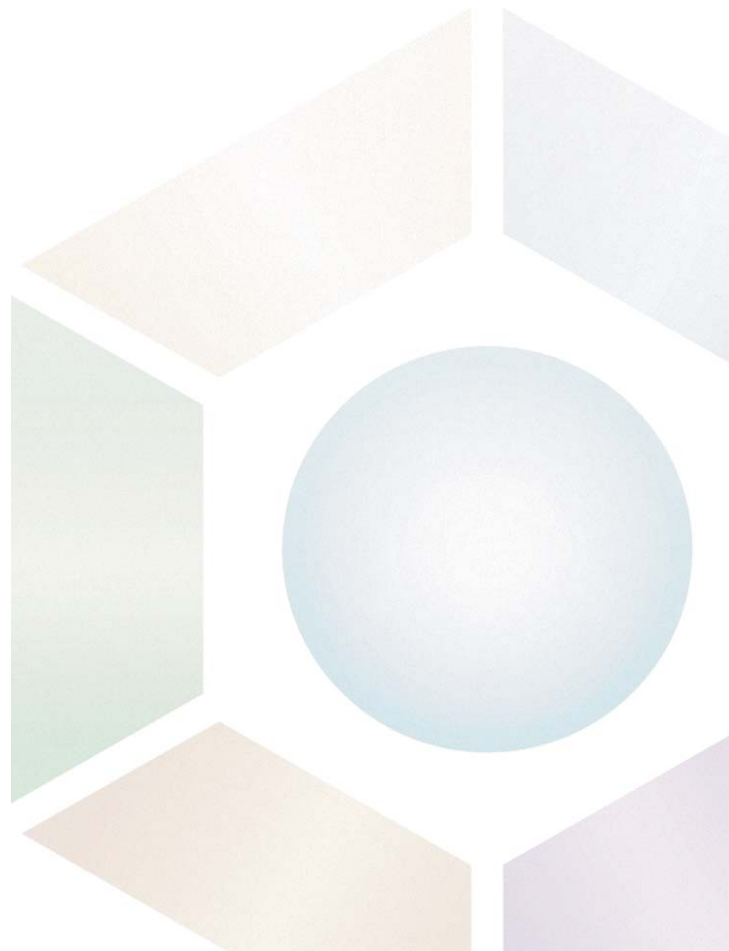


Centre de Recherche Public Gabriel Lippmann

Annual Report 2002



Centre de Recherche Public
Gabriel Lippmann

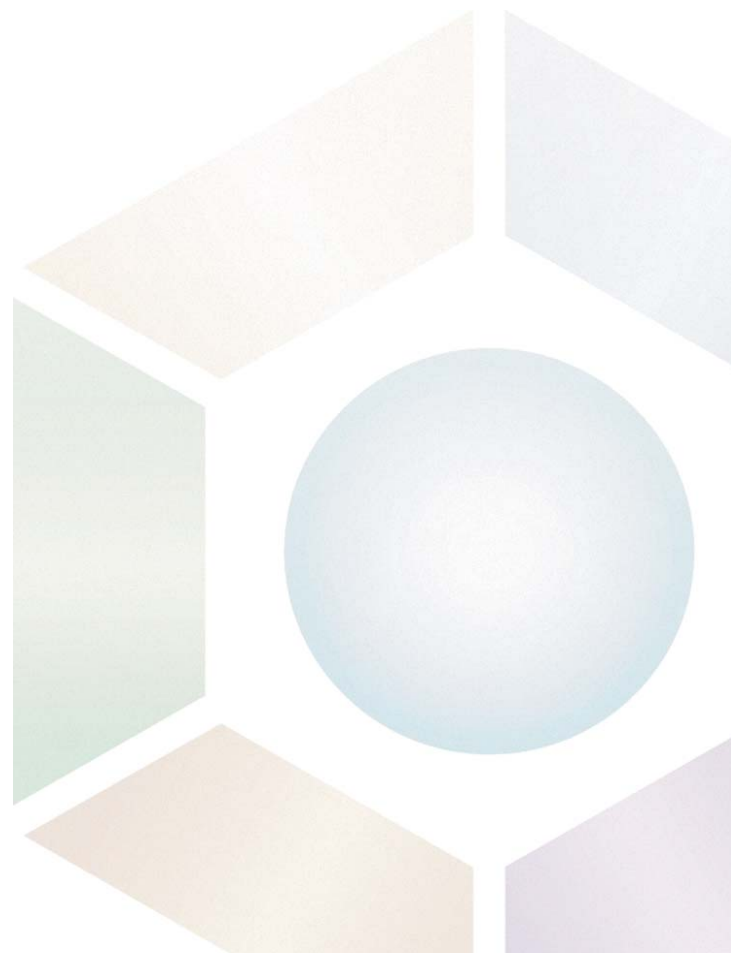
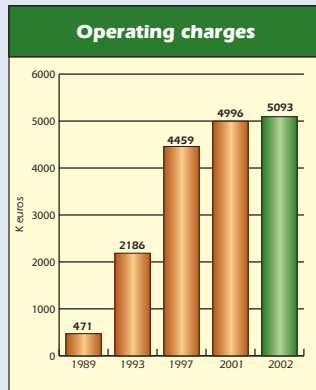
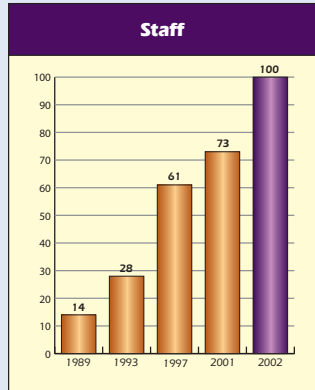
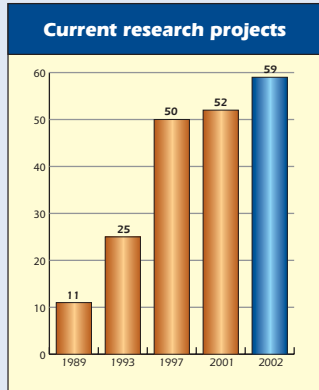




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Key figures of a positive development: 1987 - 2002





I. Introduction

The Centre de Recherche Public - Gabriel Lippmann celebrated its 15th birthday in 2002. Created in 1987, at a time when the new role of universities in the economic development of modern countries was widely discussed in Europe, the CRP - Gabriel Lippmann was given as its main mission the conducting of research known as “applied research” or more accurately as “oriented research”. While fundamental research comprises all scientific work devoted to pushing back the boundaries of knowledge, oriented research covers all scientific work initiated with a view to a future application. The centre is thus called upon to carry out technology transfers, an essential element in the innovation process, between universities, knowledge producers and the various economic players in the country using this knowledge. Although the result of the innovation activity is generally a product or a process, the activity itself essentially consists in selecting and mastering information. Universities are an important source of information for companies in this field. However, a given innovation provides the full measure of its benefits only when it has been completely integrated in all the component parts of manufacturing industry and the service sector, and this is where the CRP - Gabriel Lippmann comes in as a “missing link” in this innovation process by forging the link between universities and economic players in the country. With typical pragmatism, Luxembourg first equipped itself with these vectors for transmission of technological know-how and knowledge, before setting up the University which produces the knowledge. The recent courageous initiative of Mrs Erna Hennicot-Schoepges, the Minister of Culture, Higher Education and Research, with the purpose of creating the University of Luxembourg, will complete the chain of production, transmission and enrichment of knowledge.

Its role as a “missing link” between the university and the economic sector has naturally led the centre to comply with two essential principles in all its activities: partnership and scientific expertise.

The main purpose of the research is to obtain economic benefits for the country. Research, as understood and implemented at the CRP - Gabriel Lippmann, meets an economic necessity which involves partnership with the

private or the public sector.

Partnership cannot exist without collaboration, i.e. a pooling of efforts to successfully carry out the mission at hand. For the outside partner, it is a matter of enhancing his resources and expertise with the aim of lasting economic success. For the research unit, the aim is to increase its scientific expertise and valorize this expertise in a concrete field of application.

Collaboration is based on trust and reciprocity. Thus the means of financing an R&D project with an outside partner must reflect the principle of "shared risk" between the various partners.

All research projects must meet rigorous scientific criteria. The CRP - Gabriel Lippmann gives priority to research which develops know-how leading to future applications. The research conducted at the centre should preferably concern questions discussed within the international scientific community. Publications in international scientific reviews and participation in international scientific meetings are, to this extent, an integral part of the researchers' job.

From these two seemingly unexceptional principles arises a genuine challenge because they anchor the CRP - Gabriel Lippmann in two environments which have long been insulated from each other: the academic world, which generates knowledge, and the economic world, which generates a country's material wealth. The experience of the past fifteen years has demonstrated that this challenge has been successfully taken up by the CRP - Gabriel Lippmann. The key to this success was the constitution of multi-disciplinary research teams combining a variety of expertise or professions required in the innovation process with considerable flexibility in the management of this expertise.

The fact that this challenge has been successfully taken up is amply illustrated by the centre's key figures over the past fifteen years, figures which underline the spectacular growth of the centre's activities during this period. Even more than quantitative criteria, however, it is important to note a number of qualitative criteria which illustrate the adherence of the centre's research teams to the two principles indicated above:

- All the centre's research units have hosted doctorate students. In 2002, five doctorates prepared in the centre's various units were successfully completed. The "Laboratoire d'Analyse de Matériaux" (LAM - Material Analysis Laboratory) participates in a doctorate school with the



“Université de Metz” and is currently setting up a doctorate school on the European level.

- The success of the centre’s teams in national or European research programmes with scientific evaluation of the projects is exemplary: no less than eight projects were in progress in 2002 in European community programmes and ten in the various programmes of the “Fonds National de la Recherche”(FNR - National Research Fund).
- The financial contribution of outside partners represents between 40% and 50% of the centre’s budget, and the centre has signed long-term cooperation agreements with a number of industrial and state sector partners.
- More than 140 researchers have been offered a job contract after being trained in one leading-edge technology or another. This movement of specialists from the centre to the countries’ companies is one of the most effective vectors for the transfer of knowledge and expertise.

In addition, its flexibility and its pragmatic approach have enabled the CRP - Gabriel Lippmann to continually adapt its research policy to the needs of the Luxembourg economy. Thus, in 2002, the LAM began to develop, alongside the analytical and instrumental fields, a new area of expertise: surface treatment with CVD, PVD and MBE techniques, and plasma treatment. In addition, the “Hydrobiologie et Environnement” (Hydrology and Environment) subunit of the “Cellule de Recherche en Environnement et Biotechnologies” (CREBS - Environment and Biotechnologies Research Unit) was split into two new subunits, the “Géo-hydrosystèmes et Aménagement du Territoire” (Geohydrosystems and national and regional development) and the “Ecosystèmes Aquatiques et Terrestres” (Aquatic and terrestrial ecosystems). This new organization, the growth in the volume of activity and the diversity of the themes dealt with will be better taken into account, particularly as regards the quantitative and qualitative aspects of water and soil resource management.

The centre has always sought synergy with other players in the academic sector and in scientific research in Luxembourg in order to increase the complementarity between these various players. Thus, as part of various “FNR” programmes, projects have been conducted in cooperation with the CRP - Henri Tudor, the CRP - Santé and the CEPS/INSTEAD. The CRP - Henri Tudor LTI and CRP - Gabriel Lippmann LAM laboratories have begun to increase their

cooperation in the materials field, cooperation which will be concretised in 2003.

In the same context, in 2002 the centre signed a cooperation agreement with the "Centre Universitaire", one of the main players in the future University of Luxembourg. The aim of this agreement is to set up research teams in Luxembourg presenting a "critical mass" in a number of chosen fields of expertise, grouping together as far as possible the related human, infrastructural, technical and financial resources in the same structure. Thus the "Cellule de Recherche en Economie Appliquée" (CREA - Applied Economics Research Unit) and the research unit "Statistique et Décisions" (STADE - Statistics and Decision-making) of the CRP - Gabriel Lippmann have been transferred to the structures of the "Centre Universitaire" to reinforce the "Centre Interdisciplinaire des Etudes sur le Luxembourg", a research unit whose purpose is to study economic, sociological, historical and linguistic questions concerning Luxembourg. This agreement then outlines the development of complementary research activities, the participation of the CRP - Gabriel Lippmann researchers in training activities of the "Centre Universitaire", particularly in doctorate training, and the strengthening of the synergies between the research teams of the two institutions through the setting up of interdisciplinary research sections. The first synergy operations were materialized in 2002 in a number of "FNR" projects in the fields of computer security, environmental techniques and new technology law.

The outcome at the end of 2002 was that the CRP - Gabriel Lippmann had increased research and innovation potential in four fields of vital importance for improving the country's economic fabric with a view to sustainable development:

- material analysis, nanomaterials and surface treatment;
- environment technology and biotechnologies;
- new information technologies;
- financial law and new technology law.



Signing of the framework agreement for cooperation between the “Centre Universitaire” and the CRP - Gabriel Lippmann on the 26th of April 2002

From left to right: Mr Norbert Von Kunitzki, chairman of the “Centre Universitaire”, Mr Pierre Decker, first class Government Advisor at the “Ministère de la Culture, de l’Enseignement Supérieur et de la Recherche”, Mr Charles-Louis Ackermann, chairman of the CRP - Gabriel Lippmann



Arrival at the "Laboratoire d'Analyse des Matériaux" of the brand new Microlab 350 within the framework of the "European Centre specializing in characterization of materials on the nanometer scale"





II. Activities in 2002

A. Analysis of materials and new material technologies

The main purpose of the “Laboratoire d’Analyse des Matériaux” (LAM - Material Analysis Laboratory) is the characterization, at microscopic or even atomic level, of the solid materials produced in research centres or on industrial production lines.

To carry out these measurements as effectively as possible, over the past few years the LAM has acquired the following advanced scientific instruments:

- a scanning electron microscope;
- a transmission electron microscope;
- a secondary ion mass spectrometer operating in “static” mode;
- two secondary ion mass spectrometers operating in “dynamic” mode;
- a NanoSIMS 50.

To improve quantitative surface analysis, the LAM has also developed a new instrument within the framework of a project co-financed by the European Commission: the “Cation Mass Spectrometer”. This equipment, the characterization of which was determined in 2002, provides a considerable increase in sensitivity compared to the equipment currently on the market. These improvements are made by possible by new instrument developments carried out by the LAM teams, for which a patent has been registered in the United States.

These different items of equipment supply additional information and are used to characterize solid materials with a separating power ranging from one micrometer to one nanometer. This makes it possible to determine the elementary chemical composition, measure the various isotopes and characterize the present molecules and the crystalline structure of materials developed in research centres or on industrial production lines.

With the acquisition in 2002 of an Auger instrument capable of analysing the composition of surfaces with a lateral resolution better than 20 nm, the LAM is now one of the leading laboratories in the world.

It is, for example, the only laboratory offering NanoSIMS analyses to manufacturers. It is also the laboratory which carries out quantitative measurements of complex surfaces with the greatest sensitivity, since only a few laboratories in the world attain the performances of the LAM's Auger instrument. With the help of all these efficient scientific apparatus, the LAM can successfully implement its various missions:

- support to industries for the development of new materials and for the improvement of existing materials;
- analysis services for national and foreign industries.

Since its creation in 1992, the LAM has worked with more than 100 different industries or institutions. Thus in 2002 it carried out work for the following industries:

Luxembourg

CERAMETAL
CIRCUIT FOIL
GALVALANGE
GOODYEAR
IEE
LABORATOIRE NATIONAL DE SANTE
TEXTILCORD
VILLEROY & BOCH



Europe and Japan:

- ALCATEL OPTRONICS
- AMER-SIL
- COIL
- GLAVERBEL
- GUARDIAN
- HONEYWELL
- INPACT
- LEO
- L'OREAL
- LUXGUARD
- NICHIA CHEMICAL
- NOVASIC
- PECHINEY EUROFOIL
- SELFA VALVES & FITTINGS

In addition, the LAM coordinates a number of European research projects involving the following seven universities: Université Catholique de Louvain (B), Facultés Universitaires Notre-Dame de la Paix de Namur (B), Institut National Polytechnique de Lorraine (F), Université Henri Poincaré de Nancy (F), Universitaire Instelling Antwerpen (B), University of Oxford (U.K.), Université de Metz (F).

These academic activities have allowed two members of the LAM to defend their doctorate thesis on the following subjects:

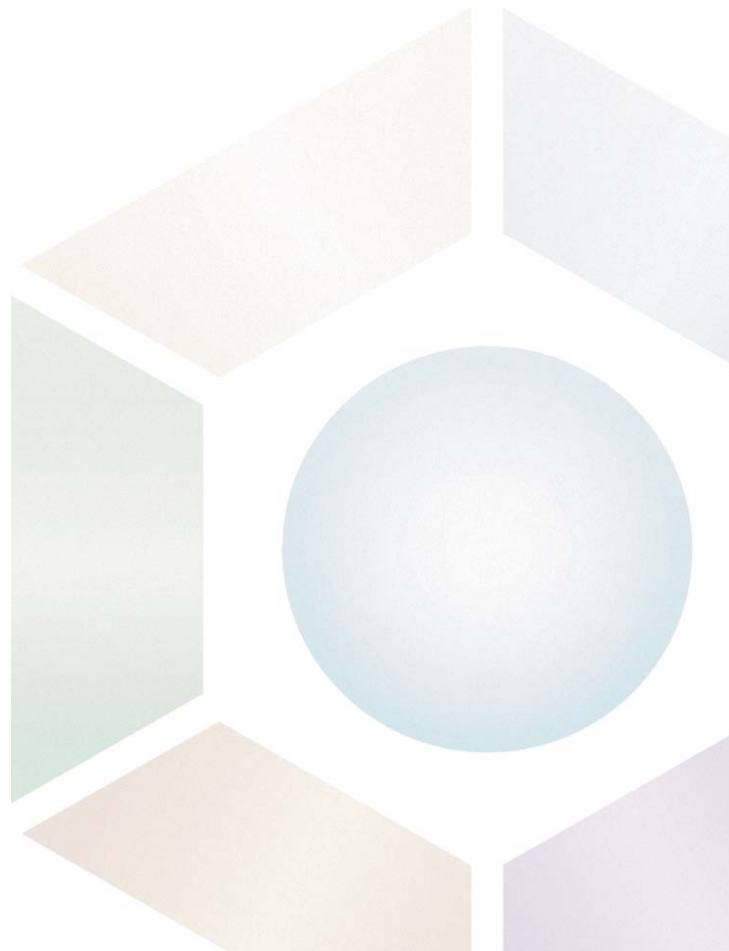
- Optimisation of quantitative material analysis using MCs_x+ aggregates: application to the development of the Cation Mass Spectrometry technique;
- Comparative study of polymeric and/or polysulfurated materials by laser ablation and ionic bombardment coupled with mass spectrometry: application to the characterization of vulcanized elastomers.

The LAM has also taken part in the development of scientific programmes for conferences: "European Research Area: towards an integrated infrastructure for measurements" (Warsaw, June 2002) and "SIMS Europe" (Munster, September 2002).

Furthermore, in addition to its material analysis and instrument development activities, in 2002 the LAM began setting up a new centre of expertise in surface treatment and coatings. Having been involved in this field since 2001 by way of three European research projects, in 2002 the LAM completed several feasibility studies in this area and defined the equipment required for the various techniques used in surface treatment:

- Chemical Vapour Deposition (CVD);
- Physical Vapour Deposition (PVD);
- Molecular Beam Epitaxy (MBE);
- plasma treatment;
- low-energy ion implantation/cleaning;
- diffusion (oxidation/nitriding).

The first equipment will be installed in the laboratory in 2003. In addition, the LAM played a decisive role in the development of the new "Surface Treatment" research programme (TRASU) of the "Fonds National de la Recherche".





B. Environmental technology and biotechnology

In the face of the major problems represented particularly by demographic growth and global changes for the functioning of natural ecosystems (both aquatic and terrestrial) or anthropic ecosystems (agro-ecosystems, forests), and in the final analysis, therefore, for the well-being of mankind, sustainable development has become since the United Nations Rio Conference on the environment and development (1992) one of the most fundamental aspirations of the 21st century.

A vital issue for the coming century, the sustainable management of natural resources demands a considerable scientific and technological effort, an effort which can only be carried out by a scientific multidisciplinary approach. What is required is nothing less than to apprehend the complex mechanisms of the functioning of natural or anthropic ecosystems and evaluate the means of safeguarding resources and protecting their quality. In the environment and ecosystem field, this will lead to develop new technologies which are a market which promises economic activity and jobs.

Within this context, in 2002 the “Cellule de Recherche en Environnement et Biotechnologies” (CREBS - Environment and Biotechnologies Research Unit) continued to develop its activities with a view to setting up a centre of multidisciplinary expertise in the environment and agro-biotechnologies sector, along three strategic lines of development and innovation:

- natural and anthropic environment;
- animal and plant biotechnologies and their applications in agro-forestry;
- food safety, food industry and human health.

This multidisciplinary subunit in the environment and agro-biotechnologies fields should in future group together the research conducted in Luxembourg relating to the “green” sector with a view to high-quality agricultural production within the framework of sustainable management of soil and water resources together with the harmonious use of the various functions of nature and environment. Such a grouping of themes is justified by:

- the obvious interactions which exist between agriculture, environment and the implications for human health;
- the fact that it corresponds to society’s growing demand for a new model which better integrates human activity and respect for nature in order to offer man a better quality of life.

Within this framework, 25 projects were carried out in the unit in 2002. This work notably includes not only four research projects carried out under the aegis of the European Union’s 5th framework program for research, but also five other projects which are parts of the FNR’s “Water resource management” and “Innovative materials and nanotechnology” programmes. This work has allowed both the obtaining of new scientific equipment for the unit (scintillator, mass spectrometry) and the development of new expertise, for example in the field of microbial ecology. Another project, concerning the study of the impact of climatic changes and occupation of territory on the management of regions vulnerable to flooding, was accepted as part of the FNR’s “VIVRE” programme and will begin in 2003. In addition, CREBS has made a major contribution to the definition of the “SECAL” programme on food safety which will be launched by the FNR in 2003.

The national importance of the CREBS activities has led to close collaboration between researchers and the various public bodies in Luxembourg (Administration de l’Environnement, Administration des Eaux et Forêts, Administration des Services Techniques de l’Agriculture, Protection Civile, Services de la Gestion de l’Eau). However, these research activities also reflect international concerns, as demonstrated by work with the “Centro Internacional de la Papa” and the International Plant Genetic Resources Institute. Since 1988, CREBS has thus progressively developed a number of areas of expertise in the environment and agro-biotechnologies field which have earned it international recognition.



CREBS researchers have also taken part in numerous scientific events, in the course of which they have been able to present the results of their research. Furthermore, CREBS researchers have played an active role in several international conferences, either as members of scientific committees or as moderators of special sessions at conferences, which testifies to their international reputation. In addition, around fifty works were published in 2002 or are currently under press. This includes the publication of the first experimental hydro-climatological atlas of the Alzette Basin, produced as part of the FRHYMAP European research project coordinated by CREBS. Moreover, several of the unit's researchers have taken on responsibilities in various international organisations (ADLAF, COST programmes, REFCOND, European Science Foundation, ERCIM, International Committee for Botanical Nomenclature, Belgian Plant Tissue Culture Group, Experimental Research Basins Network, etc.) or have sat on doctorate juries in foreign universities.

Alongside research, the passing-on of know-how through high-level training or specialized conferences has remained an important activity. In this area, we should note CREBS' organization, in collaboration with the Geography Section of "Centre Universitaire" and with the financial support of the FNR, of a series of conferences on 'Natural Hazards in Luxembourg and in the Greater Region'. As in previous years, special courses on diatom identification were organized for more than ten technicians involved in water monitoring in France. It is worth underlining that in 2002 CREBS once again took in a number of student trainees and foreign researchers (particularly through NATO scholarships) and that several students completed their scientific dissertation in the unit's laboratories. These include in particular a doctorate thesis in the field of plant pathology and the response of plants to external stresses, defended with the highest distinction at the "Université de Liège".

Since 1995, CREBS has comprised two subunits:

- the BIOFAR subunit "Biotechnologies Agricoles et Forestières" (Agricultural and Forest Biotechnologies) which was concerned with the application of new technologies, particularly biotechnologies, in the agricultural and horticultural production sectors;
- the HYDRE subunit "Hydrobiologie et Environnement" (Hydrobiology and Environment) which dealt with everything concerning the environment, and particularly the field of hydrobiology.

Considering the growth in the volume of activities and the diversity of the themes dealt with within CREBS, the HYDRE subunit was reorganized in 2002 into two new subunits, the “Géo-hydrosystèmes et Aménagement du Territoire” (Geohydrosystems and national and regional development) and the “Ecosystèmes Aquatiques et Terrestres” (Aquatic and terrestrial ecosystems). Thus the researchers are now organized in three groups to conduct research in the three main generic areas indicated above.

The “Biotechnologies Agricoles et Forestières” subunit pools together fundamental and applied research activities on agricultural and forest plants. In 2002, the bulk of the seven projects conducted within the subunit concerned the study of the adaptation and response of plants to external stresses. In addition, the subunit continued its research activities in the exploration and conservation of genetic resources, particularly in forests.

2002 also saw the development of new areas of expertise. The highly efficient proteomics equipment available has been complemented by a powerful imaging system, Typhoon, which notably has a fluorescent detection system. This has made it possible to begin analysis of the transcriptome thanks to a very modern technique, cDNA-AFLP, enabling analysis of the genes expressed under certain stress conditions, for example. With regard to the genome, it should be mentioned that the sequencer installed at the beginning of 2002 enabled an impressive number of around 1500 sequencings to be carried out.

Another notable event was the acquisition of a mass spectrometer. Coupled with high pressure chromatography (HPLC), this equipment enables a more accurate identification of the exact nature of the compounds separated in chromatography. Finally, training courses in biocomputing, which is now an essential tool, have made it possible to use the large databases available for nucleic acids to make the most of the results and successfully carry out analysis of the results obtained in the research projects. The acquisition of all this expertise has made it possible to increase the analytical power of the biotechnologies centre on the genome, the transcriptome, the proteome and the metabolome.



The “Ecosystèmes Aquatiques et Terrestres” subunit groups together research activities concerning the structural analysis, functioning and valorization of terrestrial and aquatic ecosystems with a view to their sustainable management. The eleven projects in progress in 2002 took place within the framework of four main lines of research:

- the first one concerns the study of the biodiversity of ecosystems and the use of this variable as an indicator of the quality of the environment;
- the second one developed by the centre concerns the fundamental and applied aspects of microbial ecology;
- ecotoxicological analysis constitutes a third line of research. The objective is to develop methods capable of estimating the impact of pollutants on ecosystems by analysis of natural living communities rather than by analysis of model species in the laboratory;
- the activities of the fourth one concern the sustainable management of natural (mainly aquatic) resources.

The “Géo-hydrosystèmes et Aménagement du Territoire” subunit groups together research activities concerning both the quantitative and qualitative aspects of water and soil resource management. 2002 was also marked by a noticeable increase in the number of measuring instruments in the basin of the Attert (a major tributary of the Alzette), which has been included since 2000 in the ERB (European Research Basins) Network.

Thanks to the financial support of the FNR, the centre’s activities have been extended to the analysis of hydrological processes at the micro-basin and parcel level (separation of flows, interception of precipitations by the canopy).

In collaboration with the “Université Louis Pasteur de Strasbourg” (F) and the “Centre National de Recherches Spatiales de Toulouse” (F), the integration of remote sensing in the improvement of high water and flood pre-alert systems is now one of the research fields covered by this centre.

C. Information technology

After years of irrational exuberance followed by equally excessive pessimism, the information and communication technologies sector seems to be heading for a healthier maturity. It should indeed be pointed out that these technologies are becoming increasingly essential in a host of fields. European and Luxembourg moves towards on-line administration bear witness to this in the public sector. At company level, information and knowledge are now considered to be two of the most crucial strategic assets. Even our individual living environment may soon no longer be conceivable without the use, conscious or not, of information and communication technologies. The “Cellule de Recherche, d’Etude et de Développement en Informatique” (CREDI - Computer Research, Study and Development Research Unit) is therefore working in a rapidly-expanding field of research.

In 2002, this research unit submitted several new research projects as part of various operations on the national level (the FNR’s “VIVRE” programme) or European level (European programmes Objectif 2 and Innovative Actions). For this purpose, it has stepped up its cooperation with various Luxembourg organizations: the CEPS/INSTEAD, the “Centre Universitaire”, the CRP - Henri Tudor, Luxinnovation. The corporate world has not been overlooked. Through the SICOV and COMELUX II projects, the unit has involved various private companies in its work: Astron Building Systems, the architects’ offices Valentiny and Beng, together with the PME Center recently created at the “Pole Européen de Développement”. A major project has also been carried out with the “Brasserie Nationale” in the company management systems field.

Various members of the unit have presented their results at international conferences in Ireland, Liechtenstein and Slovenia. In addition, numerous contacts have been made with researchers at the “Université de Grenoble” (F), the “Université de Paris Sud” (F), the Henley Management College (UK), the University of Lancaster (UK) and the National Research Council (CA). Members of the unit are also taking part in the work of the work group



“Geschäftsprozessmanagement mit Ereignisgesteuerten Prozessketten”. This group of researchers is based in Trier with the support of the organization GI-Gesellschaft für Informatik.

It should also be noted that, since the “Fonds National de la Recherche” (FNR - National Research Fund) joined the ERCIM (European Research Consortium for Informatics and Mathematics), two members of the unit have been chosen to represent Luxembourg in this organization.

In the course of this year, CREDI has confirmed its attachment to the study of the use of information and communication technologies in the training sector. The FORMCHCO II project aimed at computerizing the “Chambre de Commerce” new centre has continued. The audit of the computer training of the “Chambre des Employés Privés” was again successfully conducted by the unit. As a result of the relationship of trust built up with this partner, CREDI has been chosen to set up an Internet platform for management of training via the Internet as part of a new project.

The unit’s mission also includes organizing the CRP - Gabriel Lippmann’s training centre. In 2002, more than hundred people followed the unit’s various training courses, organized on its premises or at its partners’ sites. The following seminars were organized:

- Cobol application on the Web
- Knowledge Processing
- Introduction to Java
- Graphic applications in Java
- Introduction to VBA
- Access to databases in Java
- VBA applied to Excel, Delphi programming
- Introduction to UML
- Practical introduction to Internet tools
- Initiation in XHTML
- Search for information on Internet
- Introduction to PHP
- Introduction to XML
- Introduction to Javascript
- Introduction to XSL

- Internet from A to Z
- Advanced website creation
- E-business: strategic thinking elements
- RSA, the scientific and technical bases

The issue of on-line administration (eGovernment, eLuxembourg) is another of the unit's strategic lines of research. The RCS project perfectly illustrates its involvement at this level. Its purpose is to improve the internal and external coordination of the new "Registre du Commerce et des Sociétés du Luxembourg". Numerous partners in the public sector are associated with this work: the "Chambre de Commerce", the "Chambre des Métiers", the "Ministère de l'Economie", the "Ministère de la Justice", the "Administration de l'Enregistrement" and STATEC, the "Centre Informatique de l'Etat". This initiative fits in with the broader concept of "guichet unique" (virtual one-stop-shop) which the unit has been defending for many years.

CREDI has also undertaken a project with the "Ministère de la Fonction Publique et de la Réforme Administrative" in the field of on-line administrative forms. A project is also underway with the "Administration des Douanes et des Accises" to help it to define its needs with a view to the setting up of a new Internet site complying with the requirements of the eLuxembourg initiative.

In a related sector, one of the unit's teams has worked with the "Fonds National de la Recherche" to set up its computer infrastructure and create its website. This project was carried out in collaboration with the CiTi of the CRP - Henri Tudor.

Electronic commerce and e-business are the unit's third line of research. As part of the SE-COM project of the "Fonds National de la Recherche", the unit was chosen for two important long-term, high-budget projects. The SICOV project focuses on the study of virtual companies, in association with the CEPS/INSTEAD, while the CSI project, conducted in collaboration with the "Centre Universitaire", is concerned with computer security and cryptology.

A fourth area of research groups together activities linked to linguistic engineering. The series of CORTINA projects illustrates the unit's expertise in this field. The design and development of a spellchecker for the Luxembourg language is a remarkable success which has been widely publicized in the media.



These various fields of research are supported by a series of parallel technologies: cooperative computing (groupware, workflow systems, knowledge management), Internet technologies, databases, modelling. These tools and methods represent the unit's recognized expertise over the past fifteen years, documented by a long list of research projects conducted with over fifty different partners.

D. Economic, legal and social aspects of the contemporary world

Research Unit “Cellule de Recherche en Economie Appliquée” (Applied Economics Research Unit)

In April 2002, the “Centre Universitaire” and the Centre de Recherche Public - Gabriel Lippmann signed a cooperation agreement aimed at reinforcing the synergy between higher education and applied research by setting up strong research teams in the priority fields of activity for each of the two institutions. Within the context of this agreement, the boards of directors of the two institutions decided to transfer the activities of the “Cellule de Recherche en Economie Appliquée” (CREA) to the newly created research structures at the “Centre Universitaire” in the field of economics of small areas.

The two current projects concerning the competitiveness and modelling of the Luxembourg economy respectively have thus been continued since the 1st of June 2002 in this new framework.

Research Unit “Laboratoire de Droit Economique” (Economic Law Laboratory)

During the year 2002, the “Laboratoire de Droit Economique” (LDE) carried on its preparation work for several Green Papers in the field of economic law and more particularly in the field of corporate law and laws governing collective procedures and financial law.

Among this work, we should note the preparation of a major reform project concerning the restructuring of companies (mergers, splits, contributions of assets, branches of activity and universal assets, transfer of professional property) consecrated by the tabling at the “Chambre des Députés” of bill no. 4992 amending the law of 1915 on commercial companies. The laboratory also began the drafting of a draft bill on European company status.

In addition, following a lengthy consultation with the legal and professional circles concerned, the laboratory was able to finalize the draft bill on controlled management. The competition law project served in the preparation of two draft



bills, one on price freedom and the other on consumer protection in remotely-signed contracts. The work of the LDE in this field also therefore bore fruit in 2002.

The same goes for the draft bill on securitization now finalized and submitted to the “Ministère de la Justice”.

Finally, we should mention the starting of the major SECOM project. Financed by the FNR, this project concerns the legal aspects of electronic commerce. Several specialists in the field were recruited and began by making a survey of Luxembourg law which should lead to a detailed commentary of the law on electronic commerce.

Research Unit “Statistique et Décisions” (Statistics and decision-making unit)

In April 2002, the “Centre Universitaire” and the Centre de Recherche Public - Gabriel Lippmann signed a cooperation agreement aimed at reinforcing the synergy between higher education and applied research by setting up strong research teams in the fields of priority activity for each of the two institutions.

Within the context of this agreement, the boards of directors of the two institutions decided to transfer the activities of the “Statistique et Décisions” research unit (STADE) to the research structures of the “Centre Interdisciplinaire d’Etudes sur le Luxembourg” (CIEL) at the “Centre Universitaire”.

The two ongoing projects concerning respectively certain aspects of the 1999 elections and an urban social observatory for the town of Esch-sur-Alzette, have thus been continued since the 1st of May 2002 within this new framework.

Research Unit “Cellule de Sciences Humaines et Sociales” (Human and Social Sciences Cell)

In the field of human and social sciences, the only project in 2002 concerns the history of the iron and steel industry in Luxembourg. It brings together researchers from Luxembourg and abroad, enjoys financial support from the “Ministère de la Culture, de l’Enseignement Supérieur et de la Recherche” and from the “Fondation Bassin Minier” (Mining Basin Foundation) and is conducted in cooperation with the “Centre d’études et de recherches européennes Robert Schuman” (Robert Schuman European study and research centre).

III. Financial Policy

The annual accounts of the CRP - Gabriel Lippmann are prepared in accordance with generally accepted accounting principles. The CRP - Gabriel Lippmann uses commercial type accounting, following the rules and methods applicable to commercial and industrial companies, complemented by rules applicable to the specific operations of the CRPs. Without being obliged to do so by the law, the CRP - Gabriel Lippmann has had its annual accounts checked since 1987 by an external auditor; the reader will find the auditor's report later in this document. This report gives in particular the rules applicable to the specific operations of the CRP - Gabriel Lippmann.

The financial management policy of the CRP - Gabriel Lippmann is to seek balance and not profit, as is the case for commercial companies. In the annual accounts, this effort to achieve balance should be reflected by the equality between the total amount of operating charges and the total amount of operating income, so long as the financial contributions allocated by the State are sufficient.

The total amount of operating charges came in 2002 and 2001 respectively to 5.093.285,91 € and 4.995.961,29 € and comprises all the costs necessary for the execution of the various missions of the CRP - Gabriel Lippmann: implementation of research projects, training activities, technology transfer and scientific information distribution activities. The most important items are the personnel costs (representing in 2002 and 2001 respectively 62,9 % and 59,- % of the total amount of charges), together with the depreciation charges relating to the scientific equipment of the centre (representing 8% of the total amount of charges). At the end of 2002, the centre's scientific equipment had a purchase value of 5.542.700,- €.



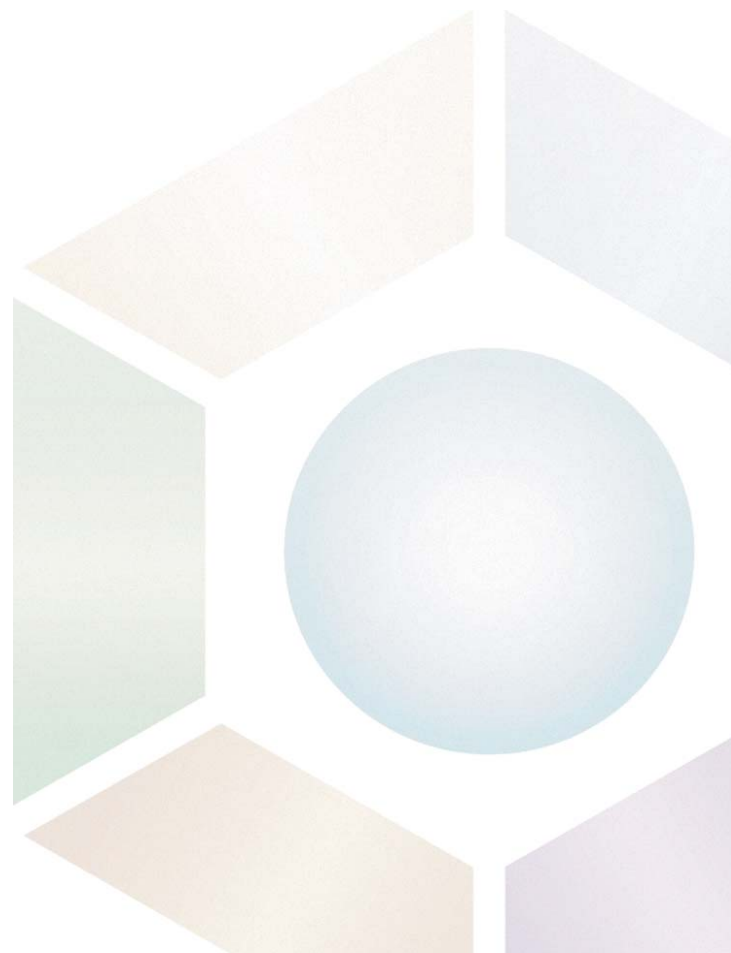
The total amount of operating income comprises the net amount of the centre's turnover, the operating income relating to the technological transfer and assistance activities, the contributions granted by the European Commission for participation in European projects, the co-financing granted by the "Fonds National de la Recherche" (National Research Fund) for the implementation of selected projects, the contributions of the Luxembourg state for participation in community structural fund programmes, together with the direct contributions granted by the Luxembourg state for the execution of the various technological assistance missions of the CRP - Gabriel Lippmann and for the implementation of the research projects.

With regard to the search for financial balance described above, it is the annual financial contribution of the State which should enable the total amount of charges to be balanced with the total amount of income. Now the annual contribution of the State, which came to 2.976.277,- € in 2002, has proved insufficient to attain this financial balance, for the eighth year in a row. Because of this, financial balance in terms of the operating result, which is essential to the normal operation of the centre, was impossible to obtain. In addition, for the third time, the CRP - Gabriel Lippmann was forced to carry forward a loss.

We should note finally that, as each year, the CRP - Gabriel Lippmann benefited in 2002 from an indirect contribution of the State corresponding to the provision of a number of teachers of the "Centre Universitaire"; this contribution can be evaluated at 68.435,95 €.



Interview with Mr Laurent Pfister, head of the subunit "Geo-hydrosystèmes et Aménagement du Territoire", on the subject of the flooding problem



IV. Appendix

A. Research projects and technological assistance activities



1. Cellule de Recherche en Economie Appliquée (CREA)

COMPET IV

title:

“Analysis of Luxembourg competitiveness - IV”

field:

economics applied to the Luxembourg economy

partners:

Centre Universitaire de Luxembourg
Service Central de la Statistique et
des Etudes Economiques (STATEC)

project leader:

Patrice Pieretti

period:

January 2002 - May 2002

objective:

COMPET IV is part of the continuation of the COMPEL projects which began in November 1994. The objectives of these projects were:

- to construct competitiveness indi-

cators for industry and for the service activities of the Luxembourg economy which can easily be calculated from national accounting data;

- to develop thematic analyses designed to measure the impact of these indicators on the performance of the Luxembourg economy.

The scientific interest of these projects lies in:

- their contribution to the study of the micro- and macro-economic mechanisms of small open economies;
- their assistance in analysis of the service economy;
- their analysis of competitiveness within a framework of globalized competition (competition of sites to attract outside investment).

The aim is therefore to give public and private decision-makers a tool for information and therefore for analysis by making synthetic measurements of the competitiveness of the Luxembourg economy.

These indicators must enable a better assessment of changes in the competitive situation and in the profitability of companies. The concepts and indi-

cators defined by this project must also serve STATEC, to ensure their statistical use with a view to a regular joint publication (particularly an annual report on the competitiveness of the Luxembourg economy, the first issue of which dates from November 1997).

This project was taken over by the research structures of the "Centre Universitaire" of Luxembourg on the 1st of June 2002.

MOD - OFFRES

title:

"Modelling of the "offer" aspects of the Luxembourg economy"

fields:

econometrics, macroeconomics, national accounting

partner:

Service Central de la Statistique et des Etudes Economiques (STATEC)

project leader:

Patrice Pieretti

period:

February 2001 - February 2002

objective:

Calculation of the output gap (gap between potential production and actual production) and NAIRU (Non-Accelerating Inflation Rate of Unemployment) indicators for the Luxembourg economy.

The research comprises two parts:

- the first consists in developing market tension indicators from Luxembourg;
- the second aims to evaluate two macroeconomic indicators: the NAIRU and the potential GDP in order to discuss, subsequently, the relevance of these measures for the Luxembourg economy.

MOD - OFFRES II

title:

"Modelling of the "offer" aspects of the Luxembourg economy - II"

field:

macroeconomics

partner:

Service Central de la Statistique et des Etudes Economiques (STATEC)

project leader:

Patrice Pieretti



period:

February 2002 - May 2002

objective:

The purpose of the MOD-OFFRE I project was to establish the potential GDP of Luxembourg and integrate it in the STATEC Modux econometric model. For the second part of the MOD-OFFRE project, the first tasks consist in:

- perfecting the calculation of Luxembourg's potential GDP using the PTF and NAIRU aggregates previously established;
- integrating the potential GDP and the output gap (the difference between the observed GDP and the potential GDP) in Modux as a tension indicator capable of measuring inflationist pressures from the supply side;
- testing the validity of these concepts (PTF, NAIRU, potential

GDP and output gap) as regards their concrete utility in the context of the use of Modux for simulation and inflation forecasting purposes in particular.

One of the main benefits of this research is the study of the underlying dynamics of inflation in Luxembourg and the detection of distinguishing features compared to Luxembourg's main economic partner countries.

A second area of research will complement the first one with regard to the study of inflationist dynamics. The aim will be to study the dynamics of short-term inflation using monthly data. The model worked out will be used by STATEC for short-term forecasting of inflation and index bracket dates.

This project was taken over by the research structures of the "Centre Universitaire" of Luxembourg on the 1st of June 2002.

POLECO

title:

"Development of structural macroeconomic indicators to be used in economic policy in the «new Luxembourg economy» "

fields:

macroeconomics, economic policy

partner:

Ministère de l'Economie du Luxembourg

project leader:

Patrice Pieretti

period:

June 2001 - May 2002

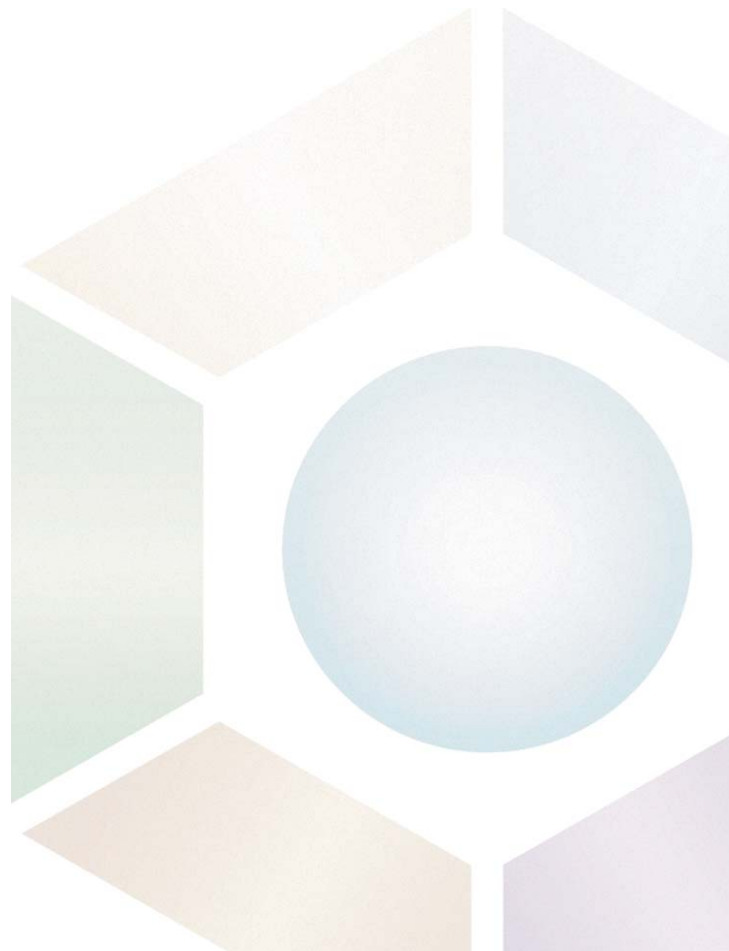
objective:

The purpose of this project is to analyse structural macroeconomic indicators and study the relevance of new growth theories for a very open small economy like that of Luxembourg.

This project was taken over by the research structures of the "Centre Universitaire" of Luxembourg on the 1st of June 2002.



Flow rate measurement for hydrological modelling of the Atttert Basin





2. Cellule de Recherche en Environnement et Biotechnologies (CREBS)

BACTODIVA

title:

“Factors controlling the diversity and the activity of bacterioplankton: seasonal study in lakes with differing various trophic levels”

fields:

microbial ecology, limnology

partner:

Université Blaise Pascal de Clermont-Ferrand (F)

project leader:

Henry-Michel Cauchie

period:

May 2002 - April 2006

objective:

This project is concerned with the interactions between planktonic bacteria, their resources and other planktonic organisms. The main objective is to determine the way in which the development of phytoplankton, protozooplankton and metazooplankton, and the availability of resources, influence the diversity and activity of

planktonic bacteria. From a strategic point of view, the study will be conducted in the biologically active upper layer of lakes with contrasting trophic levels, namely the Haute-Sûre dam lake (Luxembourg) and its main pre-dam (Pont-Misère), together with the “Oleftalsperre” reservoir (Eiffel, Germany) and the Differdange lagoon basin (Luxembourg).

From a methodological point of view, the diversity of the bacterioplankton will be studied by several molecular biology techniques (PCR, DGGE, FISH). Its metabolic activity will be determined by enzyme activity measurements, assimilation rate measurements and microscopic observations. All the data collected will be used for the creation of a conceptual model of the development of bacterioplankton in lacustrine ecosystems as a function of their trophic level.

results:

The first months of the project were dedicated to the development of the methods necessary for the study and

led to the drafting of a protocol manual, which will be used for the rest of the study. At the same time, the monitoring of the bacterioplankton dynamics was undertaken in two of the four reservoirs concerned by the study: the Haute-Sûre dam and its “Misère” pre-dam. This monitoring

now makes it possible to detect the abiotic and biotic variables liable to govern this dynamics: the temperature, algal development and zooplanktonic development. 2003 will be dedicated to the comparison of bacterial dynamics in the four chosen reservoirs.

BLIGHT

title:

“Characterization of differentially expressed genes during late blight disease development in potato”

fields:

phytopathology, molecular biology

partners:

Centro Internacional de la Papa (Perú)
Ministère des Finances

project leader:

Danièle Evers

period:

September 2000 - August 2003

objective:

Late blight of the potato, caused by *Phytophthora infestans*, is a very well-known pathogen which destroys numerous harvests every year. This problem is all the more worrying because increasingly virulent strains of the pathogen are appearing. Thus the use of resistant potatoes could represent an effective means of combating this pathogen. Now the processes regulating the level of resistance of a plant are not very well known. The aim of this project is to study the interaction between late blight and the potato in order to characterize the genes involved in resistance.



This resistance was studied in a potato population generated in the "Centro Internacional de la Papa" (Lima, Peru) and is of the horizontal type, i.e. it is controlled by a large number of genes known as "minor" genes.

In the first part of the project, a sensitive hybrid and a resistant hybrid were compared after infection and potential resistance genes were isolated.

The study now concerns new specific candidate genes of chromosome XII in the potato. A locus heavily involved in resistance to *P. infestans* has been discovered on this chromosome. Thus four genotypes differing in their degree of resistance to mildew will be compared after natural infection in the field in the Andes. The aim is to isolate new potential resistance genes linked to chromosome XII, and to study their expression kinetics after infection.

results:

The experiment concerns plants infected in the field by *Phytophthora infestans*.

It had been possible to compare four genotypes subjected to these conditions and sampled at four different times after this natural infection, by means of the fluorescent cDNA-AFLP

technique and by display of the products on the Typhoon imaging system. Approximately 300 bands presenting a differential expression either at genotype level or at the expression kinetics level, had been observed.

In order to identify these differential bands more precisely, they were extracted from the cDNA-AFLP gel, reamplified by PCR then cloned. After cloning, it was possible to determine the sequence of each of these bands by using in particular the ADN ABI 310 sequencer. The analysis of these sequences, by comparison with sequences present in databases on the Internet, made it possible to identify potential functions for these genes expressed differentially. We thus find genes that are apparently involved in the primary metabolism (photosynthesis, synthesis and breakdown of sugars, etc.), but also genes known to be expressed in response to a stress in the plants. It is interesting to note that certain results concur with those obtained during the first research project.

The objective is now to confirm the differential expression of the bands presenting the most interesting homologies by using the real-time technique RT-PCR, a technique by which it is possible to compare the level of expression of the genes in various samples.

CULTIVIT

title:

“Improvement of the performances of meristematic culture of the potato and production of mini-tubers”

field:

plant biotechnology

partners:

Syndicat des Planteurs de Pomme de Terre (Synplants)
Université Catholique de Louvain-la-Neuve (B)

project leader:

Jean-François Hausman

period:

September 1999 - December 2002

objective:

This research project proposes to improve the performances of in vitro potato cultures by focussing more specifically on the problems of acclimatization and tuberization of the shoots produced in vitro. As production techniques are changing rapidly, it has become necessary for the “Syndicat des Planteurs de Pommes de Terre” (Synplants) in Clervaux to adapt to competitors in an open European market. At present the use of mini-tubers is supplanting the use of potato germs as the starting point of seed production.

Within the framework of this new project, CREBS sets itself the objective of developing the protocols and methods necessary for producing

mini-tubers. These mini-tubers, together with control plants, will be supplied to Synplants, which will plant them in its installations and will carry out follow-ups from an agricultural and production point of view. At the same time, CREBS will attempt to identify tuberization markers in order to control this process systematically.

Certain aspects of plant tolerance to abiotic stresses, such as chilling which induces delays in growth and / or prevents the damage caused by a low ground frost, will be studied at the same time. This part of this project will be carried out in scientific collaboration with the team of Dr. S. LUTTS of the “Université Catholique de Louvain”, Belgium. This collaboration will make it possible to explore this path of tolerance to low non-freezing temperatures with a view to increasing yields and reducing losses in the event of climatological and / or environmental stresses.

results:

After the first phase of the project on microtuberization of the potato, emphasis was placed on the study of the effect of above-freezing cold (4°C) on a species of poplar. This study highlighted various changes of a physiological, biochemical and morphological nature. Thus, although photosynthetic capacity and growth are slowed down in plants subjected to cold, they adapt their carbonated metabolism. This adaptation leads to the production of sugars, which are



important for the survival of the plants (saccharose), and to an activation of certain paths involved in the energy metabolism. This metabolism is probably activated to ensure the renewed production of proteins possessing protective functions.

Changes in the protein composition have been observed by the two-dimensional electrophoresis technique between control plants and plants subjected to cold. Research

continued into the nature of the families of proteins whose expression is regulated by various environmental factors. Proteins of various families, including dehydrins and "stress-related" proteins, were identified by sequencing in MALDI-TOF type mass spectrometry. Kinetics of the proteomic patterns corresponding to two-dimensional electrophoreses was produced. In addition, the reality of acclimatization to cold was confirmed.

CYANOTOX

title:

"Study of toxic blue-green algae in stagnant water ecosystems: systematic, ecological and exotoxicological aspects"

fields:

hydrobiology, ecotoxicity

partner:

Agence de l'Eau Artois-Picardie (F)

project leader:

Lucien Hoffmann

period:

July 2001 - September 2004

objective:

Blue-green algae (Cyanophyceae, Cyanobacteria) can reach extremely

high biomasses in freshwater aquatic ecosystems. In our regions, these "blooms" appear particularly during the summer period in mesotrophic or eutrophic lakes in which the nutrient concentrations are not restrictive.

At the present time, it is well established that the development of Cyanophyceae is responsible for the mass death of numerous species of fish, birds and even human beings. Several species of Cyanophyceae synthesize toxins (neurotoxins and hepatotoxins). In addition, cyanotoxins have an obvious impact on the balance of aquatic ecosystems.

This study is in line with national and international concern over the appearance of toxic blue-green algae

in drinking water reservoirs. Various types of blue-green algae develop each year in the Esch-sur-Sûre lake.

The specific objectives of this project are to complete the inventory of toxic Cyanophyceae in the stagnant waters of the Grand Duchy of Luxembourg, the Artois-Picardie basin and the neighbouring regions (Wallonia, northeast of France, etc.), to specify the physico-chemical parameters which are involved in the appearance of Cyanophyceae blooms and study the ecology and (eco)toxicology of these Cyanophyceae.

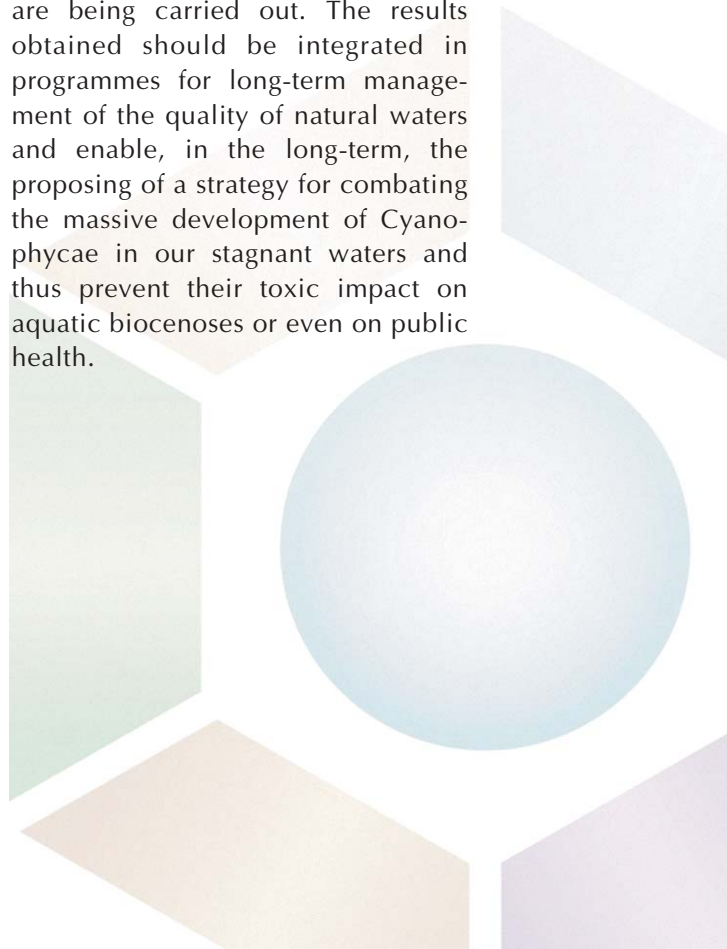
results:

Samples were taken from March to October 2002, at monthly or fortnightly intervals, in Lake Val Joly to monitor changes in the physico-chemical parameters of the water and the dynamics of the phytoplankton. The results show that the lake reacts very quickly to rain (dilution and homogenization of the surface waters) or in calm weather (stratification). Although the planktonic Cyanophyceae such as *Aphanizomenon*, *Anabaena*, *Planktothrix* and *Microcystis* appeared at the beginning of July, repeated rainy periods prevented the formation

of a stable medium conducive to the development of Cyanophyceae.

Because of their use for fishing or nautical activities, other lakes in the Artois-Picardie region were also sampled during the summer period to detect the presence of Cyanophyceae. Microscopic observations demonstrated the presence of Cyanophyceae in the majority of the stretches of water studied. Some of the Cyanophyceae revealed are potentially toxic. Among the Cyanophyceae most frequently encountered, we should mention the genera *Anabaena*, *Aphanizomenon*, *Gomphosphaeria*, *Limnothrix* and *Microcystis*.

Analyses of the samples to detect toxins and isolate blue-green algae strains present on the various sites are being carried out. The results obtained should be integrated in programmes for long-term management of the quality of natural waters and enable, in the long-term, the proposing of a strategy for combating the massive development of Cyanophyceae in our stagnant waters and thus prevent their toxic impact on aquatic biocenoses or even on public health.





CYCLEAU

title:

“Study of the components of the water cycle in the Attert Basin ”

field:

hydrology

partner:

Centre Universitaire de Luxembourg

project leader:

Laurent Pfister

period:

January 2002 - December 2004

objective:

The aim of this multidisciplinary project is to study the interactions between the various parameters of the water cycle from the parcel level up to the catchment basin level. The work will be centred on the Attert Basin, which has been chosen as part of the European Network of Experimental Research Basins (ERB).

The work on the hydrological balance will establish the general hydro-climatological framework in which all the hydrological processes operate. In addition, quantification of the terms of the hydrological balance will provide precious information on the spatio-temporal fluctuations of various synthetic hydrological variables, such as the flow rates for a given return period, the high water outflow coefficients or the extension of saturated zones.

The research work conducted on the hydrological balance should also lead to the creation of concrete tools for quantitative management of running waters (working out of operating thresholds in the generation of high water and floods, maps of hydrological and/or pluviometric hazards and risks, and easily transposable regionalized hydrological models). Study of the hydric balance (interception of precipitations, infiltration of rainwater, separation of outflows) at the parcel level will provide essential information for understanding the hydrological processes involved in the generation of high water and floods. It will be possible to use these results to create practical tools for the management of high water and floods.

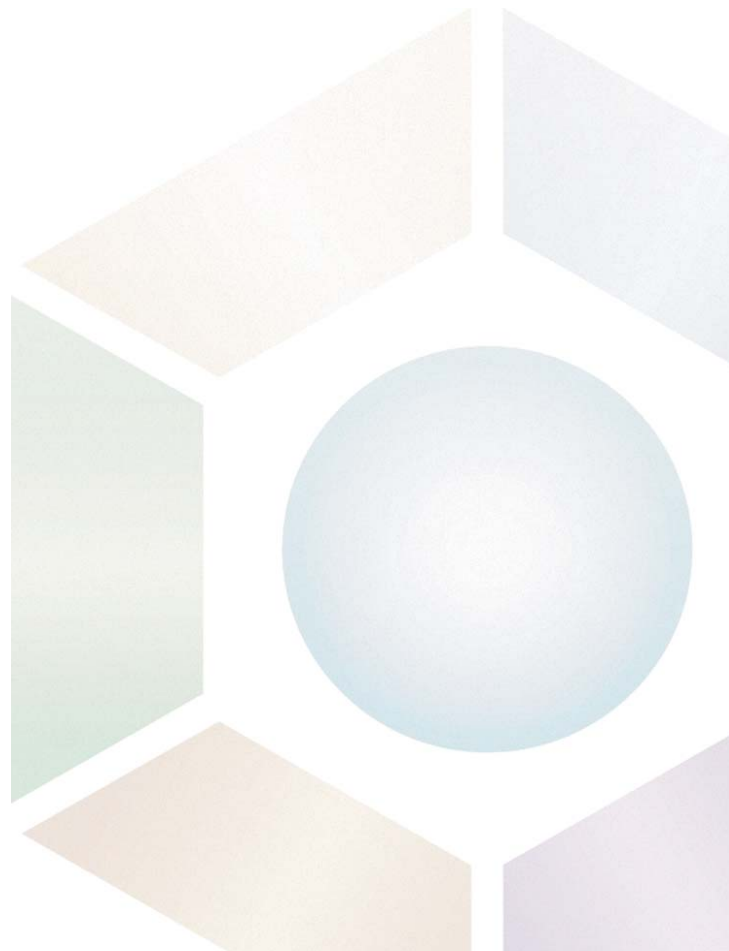
This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Sustainable management of water resources” programme.

results:

Experimental micro-basins were chosen by matching up intense terrain activity with the general physiographical characteristics of the Attert Basin. Three micro-basins were chosen: the Wollefsbach, a 4.4 km² marshy agricultural area, the Huelwelerbach, a 2.7 km² sandstone and forest area, and the Weierbach, a 0.4 km² schistose and forest area. A fourth basin, that of the DEA (Division des Eaux en Ardennes), was also initially chosen, but was abandoned following hydraulic development work. The first three were therefore equipped



Official launching of the CYCLEAU project in the presence of
Mrs Erna Hennicot-Schoepges, Minister of Culture,
Higher Education and Research, on the 17th of May 2002





with limnigraphs with a pressure sensor. Various flow rate measurements are made to establish the various calibration curves.

In the mid-1990s, the CRP - Gabriel Lippmann and the public authorities had installed four limnigraphs: two on the main tributaries (Roudbach and Pall) and two others on the Attert itself. The network was completed by two additional limnigraphs on the Attert and two on the other major tributaries (Schwebich and the Colpach stream). With CYCLEAU, the network now comprises eleven measuring instruments on basins of 0.4 to 310 km², all operating at 15-minute time intervals.

A first weather station has been in place since the end of December 2002 on the Huewelerbach, and a second is planned at the village of Roodt, on the plateau. They will enable precise calculation of the evapotranspiration, information essential for calculation of the hydrological balance.

Most of the activities in 2002-2003 will be concentrated on the Huewelerbach.

Following several prospective campaigns carried out from January to

December 2002, the various sources were identified and characterized, indicating a diversified imprint. These spatial differences are more marked in winter. During high waters sampled at the outlet of the basin since October 2002, the rainwater greatly disturbed the remarkable stability of the conservation parameters observed up to then. It was possible to determine a number of discriminating parameters. They will be used in the campaigns for the breakdown of the high water hydrograms.

Thus around ten major sources were chosen and will undergo sampling during event campaigns scheduled for 2003. Surface, run-off and canopy draining water points will also be added to them at that time.

Radon measuring instruments have been installed in situ for continuous monitoring of the outlet together with certain sources, by the Physical Radiations Laboratory of the "Centre Universitaire". Their development and their adaptation to the terrain conditions proved to be very costly and difficult. A few localized oxygen 18 measurements were carried out. These radioelements will also be used in the campaigns, in addition to the conventional chemical methods.

DIADÉCOL

title:

“Diagnosis of the state of lacustrine ecosystems by analysis of the biodiversity and functioning of the microbial loop”

fields:

microbial ecology, limnology

project leaders:

Henry-Michel Cauchie
Lucien Hoffmann

period:

January 2002 - June 2005

objective:

The purpose of this project is to establish the bases for a method of surveying lacustrine ecosystems of high socio-economic value (such as dam lakes) based on analysis of the ecological variables of the microbial loop (biodiversity, structure and interactions between the components of the microbial loop).

The development of this method necessitates a precise characterization of the diversity and dynamics of the planktonic microbial loop in accordance with the trophic level of the lacustrine ecosystem in question and the intensity of disturbances of anthropic origin (introduction of foreign organic materials). This is multidisciplinary work involving a wide variety of expertise (molecular biology, chemistry of water, ecology, biodiversity, statistics, etc.).

The theoretical foundations of the method will be based on the analysis of the microbial loop of the Haute-Sûre dam lake and its pre-dam built on the Sûre (Pont-Misère). These two waterbodies were chosen because they present the two trophic states most widespread in European dam lakes (hypereutrophic for the Pont-Misère pre-dam and meso-eutrophic for the terminal part of the dam lake).

The specific diversity of the microbial loop of the dam and the pre-dam will be studied by conventional identification techniques (photonic and electronic microscopy) and by the development of new molecular techniques (electrophoretic migrations, cloning and sequencing, and in situ molecular hybridizations).

The analysis of the functioning of the microbial loop of the Haute-Sûre lake supplied by this project may be used as the basis for establishing a conceptual model describing the impact of anthropic activities on the “health” of the dam lakes via monitoring of their microbiological components.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Sustainable management of water resources” programme.

results:

The first half of 2002 was devoted to conducting the first phase described in the project: “Methodological development of the new techniques necessary for conducting the project”.



The techniques concerned are measurement of the incorporation of organic molecules marked with ^3H (amino acids) and with ^{14}C (sugars) using a liquid scintillator financed by the FNR, measurement of bacterial enzymatic activity, detection of bacterial groups in fluorescent in situ hybridization (FISH) and monitoring of the total bacterial diversity by DNA fingerprinting. Detailed protocols have been established for each of these methods and compiled with a view to use during the other phases of the project.

At the beginning of 2002, monitoring of the in situ bacterial dynamics in the Pont-Misère pre-dam and in the Haute-Sûre dam at Lultzhausen, was carried out at fortnightly intervals from January to March and from October to December, and at weekly intervals from April to September.

The morphological identification of the micro-organisms was able to begin thanks to the acquisition of a "CDD cooled Peltier" camera and an image analysis system, both financed by the FNR. The picoplanktonic density appears to be influenced by the temperature, whatever the mass of water studied (Pont-Misère pre-dam - PM or Haute-Sûre lake - LHS). It is, however, generally higher in the eutrophic environment (PM) than in the meso-eutrophic environment (LHS).

Autotrophic picoplankton represents only a small part of the total picoplanktonic density (<10%). Seasonal variations in the picoplanktonic density are also influenced by zooplanktonic developments, which notably exert a trophic control on the picoplankton. A large difference in the zooplanktonic community was noted between the pre-dam and the dam itself, the former being rich in rotifers while the latter presents an abundant community of planktonic crustaceans. The heterotrophic planktonic activity, measured using radioactive tracers, indicates that glucose is the aldose with the highest assimilation. In combination with the other main aldoses (galactose, fructose, mannose) and amino sugars (glucosamine and N-acetylglucosamine), monosaccharides constitute one of the major sources of carbon for picoplankton.

The team conducting the DIADECOL project is now in a position to carry out the monitoring of the different variables associated with picoplankton during 2003 with a view to obtaining a typical dynamics of picoplankton in reservoirs of different trophic levels. In addition to the monitoring of Luxembourg reservoirs, a monthly inspection will be carried out at an oligotrophic drinking water reservoir (Oleftalsperre) located in the German Eifel region.

ECOLA

title:

“Biogeochemical and dynamic cycles of populations in a lake ecosystem ”

field:

limnology

partners:

Facultés Universitaires Notre-Dame de la Paix de Namur (B)
 Université de Liège (B)
 Université Libre de Bruxelles (B)

project leaders:

Lucien Hoffmann
 Isabelle Thys

period:

January 2000 - June 2002

objective:

Lakes are delicate aquatic ecosystems, which are particularly sensitive to natural or anthropogenic disturbances. The development of agriculture and industry and the growth of the population have considerably increased the supplies of nutrients to the lakes during the last three decades. The result is an increase in primary production or eutrophication, which can cause deep modifications in the quality of the waters leading to severe problems in the use of this resource.

Several campaigns of preliminary measurements of a number of physical, chemical and biological parameters were carried out on the Esch-sur-Sûre lake as part of the MODEL project

(January 1997 - December 1999). These first data showed the complexity of the system, characterized by a marked spatial and temporal heterogeneity linked to the seasonal evolution of the biological, chemical and physical processes involved.

The purpose of this project is to generate an ecological model of the Haute-Sûre lake. This model will help in the identification and understanding of the key physical, chemical and biological processes controlling the functioning of the ecosystem. In addition, it will constitute a precious tool for predicting, in the short, medium and long-term, the consequences of modifications or disturbances due to natural and anthropogenic causes.

For this purpose, CREBS has undertaken a quantitative analysis of the flows of material associated with the biological activities present in the lake (primary production, bacterial production, zooplankton, fish, phosphorus, nitrogen and carbon cycles). Biological activity is in fact an essential factor in controlling the quality of the waters of a lake. The data obtained will serve to develop and calibrate an ecological model, which describes the dynamic behaviour of the plankton in relation with the nutrient cycles in a lake.

results:

The biomass of the various pelagic communities living in the lake was estimated and the flows associated



with the biological activities were measured as part of the MODEL project and the ECOLA project. 2002 was essentially devoted to the synthesis of the results obtained.

The results show that the communities populating the Esch-sur-Sûre lake are to a large extent controlled by the resources, essentially phosphorus. This "bottom-up" effect, which is clearly visible on seston, is less marked on zooplankton because it is specific to cladocera; and more particularly the genus *Daphnia*.

Within the zooplanktonic community, the limiting effect of resources seems to be accentuated by a mortality factor resulting probably from predation. We observe a predation effect by fish on large zooplankton at the end of the spring and during the summer in the Esch-sur-Sûre reservoir. Among the vulnerable populations (particularly *Daphnia galeata*), we observe two strategies to avoid this predation: decrease in size at maturity, which leads to a reduction in the average size of the population, and increase in the average depth of residence with or without nocturnal migration into more favourable waters.

Zooplankton plays a decisive role in the transfer of energy to the upper levels of the trophic chain by consuming phytoplankton and bacteria and also ciliated and flagellated protists. Phytoplankton is their main resource for a large part of the year. However, when algae are rare (clear water phase and autumn) or inadequate (summer), heterotrophic plankton makes a large contribution to the carbon supply of these two crustaceans.

In conclusion, this study shows the simultaneous influence of the mechanisms of regulation of trophic networks by resources and by predators. The results show a marked limitation of phosphorus in the environment, which is passed on at several levels of the food chain (phytoplankton and zooplankton). The clear effect of fish on metazooplankton needs to be confirmed by direct observations. The interactions between metazooplankton and the other communities (phytoplankton, protozoa, bacteria) demonstrate the complexity of the trophic system in the Esch-sur-Sûre reservoir and the numerous indirect effects between its various constituents.

ESTABLISH

title:

“Molecular ecophysiology as a tool for the selection of highly stress resistant poplar species for multipurpose forests”

field:

plant biotechnology

partners:

Institut National de la Recherche Agronomique (F)
 Institute of Genetic Engineering (BG)
 Instituto Superior de Agronomia (P)
 The Hebrew University of Jerusalem (IL)
 Università degli Studi della Tuscia (I)
 University of Göttingen (D)
 University of Helsinki (FIN)
 University of Wales Bangor (UK)

project leaders:

Jean-François Hausman (CRP - Gabriel Lippmann)
 Andrea Polle (Coordinator of the ESTABLISH European project, University of Göttingen)

period:

January 2001 - December 2003

objective:

The major objectives are:

- identification of the morphological, physiological and molecular markers of resistance to salt and drought in ecosystems adapted to these stresses;
- increase in resistance to drought by using physiological and morphological traits and contribu-

tion of molecular markers for conventional or biotechnological improvement programmes;

- contribution of genotypes for plantations in unfavourable climates or soils;
- establishment of forest plantations and determination of the performance of the plants.

The aim of the CRP - Gabriel Lippmann's contribution to this project consists in working out in-field measurements in order to characterize the morphological traits linked to stress and apply stresses under controlled conditions with a view to identifying stress markers, and to study the specific involvement of roots in tolerance and resistance.

This project is financially supported by the European Commission as part of the 5th FP.

results:

Three different species of poplar, *Populus tremula* (common in northern Europe), *P. alba* (common in southern Europe and Italy) and *P. euphratica* (originating in desert regions and Israel), were compared from a physiological point of view during a saline stress. The aim is to identify the appropriate markers for tolerance to this stress to ensure more successful selection of suitable genotypes for reforestation in saline soils.

Poplars were cultivated in vitro on media containing increasing concentrations of NaCl (0 to 150 mM). The leakage of electrolytes and the lipidic



peroxidation markers were monitored to characterize the state of breakdown of the cellular membranes during the stress. Preservation indicators (compatible solutes), known to be involved in the mechanisms of resistance to hydric deficits or saline stresses, such as the endogenic level of prolines, polyamines and carbohydrates such as mannitol, trehalose or raffinose, were studied.

In addition, particular attention was paid to the metabolism of sucrose, both through measurement of the endogenic levels of sucrose, glucose and fructose and by assessing the activity of the enzymes involved in its synthesis or its breakdown, such as sucrose phosphate synthase, sucrose synthase and invertase. An accumulation of the endogenic level of free proline and carbohydrates such as mannitol or raffinose, a temporary increase in the level of spermine, the

increase in sucrose synthase activity and the decrease in invertase activity were able to be demonstrated in *P. tremula* cultivated under saline stress conditions. In two other species of poplar, CREBS was able to note a marked difference in behaviour with *P. tremula*: the sucrose level does not increase with saline stress, but decreases. The proline concentration increases in a similar way in *P. alba* and *P. tremula* whereas it is always very high in *P. euphratica*.

The results lead to the following conclusion: depending on the species, tolerance or susceptibility to saline stress is correlated with various modifications in the metabolism of the carbon but also in the specific involvement of certain substances known to have an anti-oxidant activity (proline), and therefore an activity which preserves biological membranes.

EUROHARP

title:

“Towards European harmonized procedures for quantification of nutrient losses from diffuse sources”

field:

hydrogeochemistry

partners:

ADAS Consulting Ltd. (UK)
 Alterra Green World Research (NL)
 Beture Cerec (F)
 Forschungsverbund Berlin (D)
 Kirk McClure Morton (IRL)
 Lithuanian Institute of Water Management (LT)
 National Environmental Research Institute (DK)
 National Research Council (I)
 National Technical University of Athens (GR)
 Norwegian Center for Soil & Environmental Research (NO)
 Norwegian Institute for Water Research (NO)
 Sveriges Landbruksuniversitet (S)
 Swedish Meteorological and Hydrological Institute (S)

project leaders:

Lucien Hoffmann (CRP - Gabriel Lippmann)
 Merete J. Ulstein (Coordinator of the EUROHARP European project, Norwegian Institute for Water Research)

period:

January 2002 - December 2004

objective:

The main objective of the EUROHARP project is to supply national and international administrators with suitable tools for quantification of diffuse nitrate pollution of continental and coastal surface waters. The aim is more precisely to make a scientific assessment of the capacities of the tools to quantify and predict precisely the losses of N and P. This assessment includes both their ease of use and their profitability.

The project must lead to an electronic decision-making aid tool serving to identify the best-suited tools in each specific case, with a view to quantification of the diffuse losses of nutrients under various environmental and administrative conditions in Europe.

EUROHARP aims to carry out a socio-economic analysis of the consequences of various scenarios of nutrient loss reduction measures, which will need to be implemented to meet the European framework directives concerning water and nitrates.

This project is financially supported by the European Commission as part of the 5th FP.

results:

The aim of the EUROHARP European project is to harmonize the methodologies and tools for quantification of



nutriment losses from diffuse sources of pollution. The phase of the project completed in 2002 was centred on the gathering of all the data necessary for the application of the models attributed beforehand to each participating basin. The Attert basin will be the subject of nitrogen and phosphorus export modelling using the quantification tools N-LES, Source Apportionment and Nopolu.

For this purpose, a programme of sampling and chemical analysis of the various forms of N and P from the Attert to Useldange enabled the characterization and precise quantification of the annual nitrogen and phosphorus exports. It was possible to determine the dynamics of these nutritional elements accurately thanks to the high density of samples made in 2001 and 2002.

At the same time, the work of the CRP - Gabriel Lippmann also consisted in gathering a very large volume of basic data concerning the Attert catchment basin. A very precise collection protocol had been worked

out by the "Scientific Management Committee" for optimum supply of the European database. The information was thus presented using two complementary supports:

- a GIS mapping support;
- an Excel support for the attributes according to a predefined database.

The various levels of information required concerned surface water, underground water and rainwater quality data, localized sources of pollution, data relating to agricultural practices, and climatological, hydrological, pedological, geological, geographic, administrative, ground occupation and water management data.

Through fruitful collaboration with the "Chambre de l'Agriculture, the "Services de la Gestion de l'Eau", ASTA and STATEC, it was possible to bring together and compile the required information adequately for the modelling work which will be carried out in 2003 and 2004 by the various designers of the quantification tools.

F R E N E

title:

“Contributions to the conservation of forest genetic resources: study of genetic diversity in the common ash”

field:

forest populations genetics

partners:

International Plant Genetic Resources Institute (I)
Université Libre de Bruxelles (B)

project leader:

Jean-François Hausman

period:

November 1999 - October 2002

objective:

Forest genetic resources constitute an essential element of humanity's patrimony and it is important to preserve them for future generations (Ministerial Conference for the protection of forests in Europe, Strasbourg, 1990). The genetic resources of our forests are influenced both by natural and by anthropogenic factors.

The long-term objective of any conservation programme is to create conditions to ensure the survival and adaptability of a target species in the context of an ever-changing environment. In order to attain this objective, the development of long-term conservation strategies and programmes ought to be founded on knowledge of the demographics and genetics of the

populations of a species. Now these elements are often little known and conservation measures for numerous species have had to be and must always be taken on the basis of the knowledge relating to a limited number of species. As regards forest essences, the genetic structures of certain species of conifers (pines, spruces) and broadleaves, such as white oak and beech, have been the subject of in-depth studies. For noble hardwood species (ash, maple, walnut tree, chestnut tree, etc.), which are thinly distributed notably because of their particular edaphic and ecological requirements, very few studies have been realised. It is in the frame of the conservation of the noble hardwood species that this research takes place.

The forest species chosen is the common ash, *Fraxinus excelsior L.*, a tree of great economic value, because of the quality of its wood, which presents excellent mechanical properties. The objective of the proposed research is analysis of genetic diversity in the ash in order to infer its demographic and biological characteristics and determine the distribution of its genetic resources. Its knowledge will be of great use for the development of strategies and methodologies for conservation of the species.

The target region for the study is southeastern Europe, chosen for its large reserve of native forests subjected to



very low-intensity management and very rich in both herbaceous and ligneous plant species. Thanks to this very low anthropic pressure, the distribution of species in these forests is likely to reflect a natural distribution of species; a situation which is rarely encountered in western Europe because of a more intensive management of forests.

results:

At the local level, the structure of the genetic diversity of the common ash in a mixed broadleaved forest in southeastern Romania was analysed and compared with the results of computer simulations in which the dispersion of the seeds and pollen was controlled. Comparison of these estimates with data on other broadleaved trees indicates very restricted seed flow and a moderate pollen flow in this very dense ash population.

At the regional level, in Bulgaria, a low consanguinity was detected in several ash populations, testifying to an essentially allogamic reproduction system with very little self-fertilization and little reproduction between related individuals.

At the European level, analysis of chloroplastic microsatellites confirmed the localization of glacial refuges for the ash in the Alps and in

the Balkan peninsula, suggested by fossil pollen data. The chloroplastic marker diversity patterns also agree with other refuges proposed in Italy and in the Iberian peninsula. Europe was recolonized from these glacial refuges.

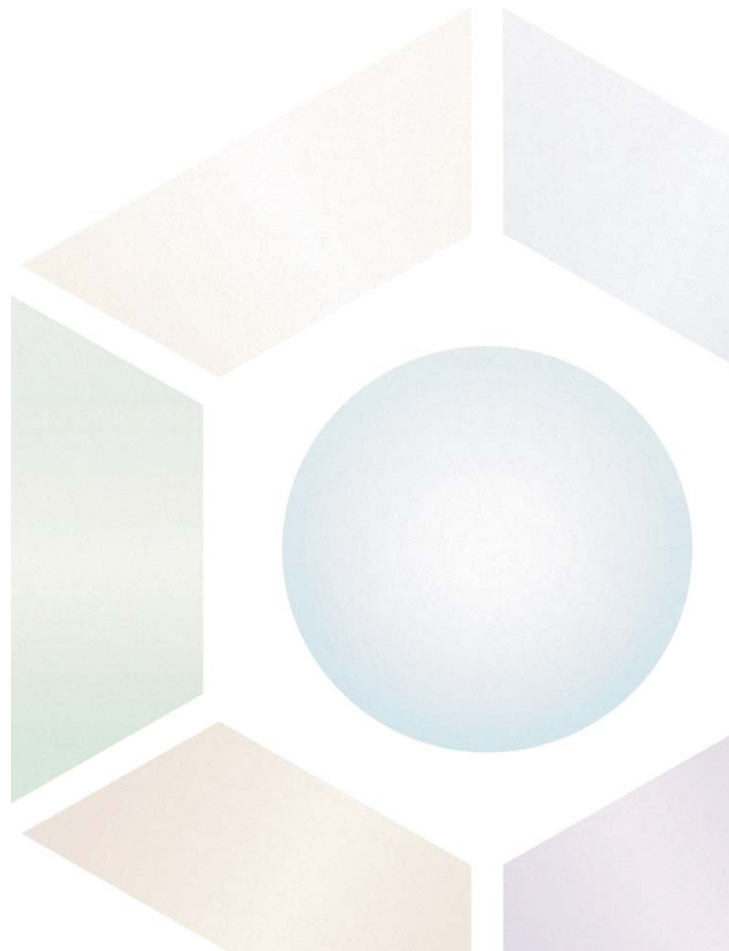
Nuclear microsatellites revealed various diversity patterns, with contrasting situations in particular in western and Central Europe, a high diversity, slight bottleneck imprints and a homogeneous gene pool throughout the region. These results indicate diversity contributions by colonizers from several differentiated glacial refuges and a considerable pollen flow homogenizing the respective gene pools. In southeastern Europe, a high inter-population differentiation, together with a relatively low intra-population diversity and the absence of signs of bottlenecks, were attributed to an expansion from several glacial refuges. A possible explanation for this diversity pattern is that a stable demographic situation with a high ash density would have rapidly been reached in southeastern Europe, limiting the geneflow between populations.

Overall, this project identified southeastern Europe and northern Central Europe as important centres for the conservation of genetic resources in the ash.



Official submission of the first experimental hydro-climatological atlas of the Alzette Basin to Mr Michel Wolter, Minister of the Interior

From left to right: Mr Fernand Reinig, managing director of the CRP - Gabriel Lippmann, Mr Michel Wolter, Minister of the Interior, Mr Charles-Louis Ackermann, president of the CRP - Gabriel Lippmann, Mr Lucien Hoffmann, scientific director of CREBS and Mr Henry-Michel Cauchie, head of the subunit "Ecosystèmes Aquatiques et Terrestres"





FRHYMAP

title:

“Flood Risk scenarios and Hydroclimatological Mapping: from field data to spatio-temporal modelling”

fields:

hydrology, cartography, modelling

partners:

Deutsches Zentrum für Luft- und Raumfahrt (D)

Ecole Polytechnique Fédérale de Lausanne (CH)

Universität Bonn (D)

Université Louis Pasteur de Strasbourg (F)

Université de Metz (F)

Vrije Universiteit Brussels (B)

project leaders:

Lucien Hoffmann (CRP - Gabriel Lippmann)

Ad van Os (Coordinator of the FRHYMAP European project, Netherlands Centre for River Studies)

period:

January 2000 - March 2002

objective:

This project fits into the general framework of programmes to combat flooding in the Rhine-Meuse basin. It aims to study the whole chain of events, which leads from simple swellings in the upstream parts of the basin through to flooding in the alluvial plains. Working on four different experimental catchment basins (Alzette, L; Fecht, F; Meuse, F;

Moselle, F), with very different biophysical conditions and sizes, the aim is to develop easily transposable hydrological and hydraulic models.

The Alzette basin, which has been equipped for several years with a hydro-climatological observation network with high spatio-temporal density serves as a common area of experimentation for all the teams of researchers involved in the FRHYMAP project. The transposed models constitute a major step towards wider management of the problem of flooding, including forecasting in flood pre-alert systems and simulation of the possible effects of future developments in the combating of floods.

This project is financially supported by the European Commission as part of the INTERREG programme.

results:

The project proved that a transnational and multidisciplinary approach is essential in the development of new techniques against flooding. The analysis of old hydro-climatological series, the monitoring of water level rise and flood generating processes in real time, and the simulation of exceptional water level rises (historical and theoretical), allowed new tools to be created which can be used in flood management in the future.

The development of simulation tools, combined with hydro-meteorological data drawn from an observation network with high spatio-temporal

density, will make it possible in the future to more effectively identify the areas generating the hydrological phenomenon. Better targeted interventions will then be possible in the upstream parts of the catchment area systems and will thus make it possible to reduce the downstream hydrological risk in the large alluvial plains.

As part of the FRHYMAP project, an outline of this type of application was supplied with the first experimental hydro-climatological atlas of the Alzette basin. This atlas groups

together data on the climatic and hydrological characteristics of the Alzette basin and also gives a glimpse of the spatial distribution of hydroclimatological phenomena and risks. The atlas was officially submitted to the Minister of the Interior, Mr Michel Wolter, on the 2nd of May 2002. For the information brought together in this experimental document to be able to play its full part as a high water and flooding management assistance tool, both immediately and in the future, it is imperative to keep the existing hydroclimatological observation network operational.

INDIA

title:

“Adaptation to rivers in Luxembourg and France of «diatom» biological indicators developed in Europe”

fields:

bio-indicators, hydrobiology

partners:

Agence de l’Eau Loire-Bretagne (F)
Conseil Général de la Haute-Loire (F)
Direction Régionale de
l’Environnement Pays-de-la-Loire (F)

project leaders:

Luc Ector
Lucien Hoffmann

period:

August 1999 - September 2002

objective:

Diatoms (siliceous algae) are among the bio-indicators most frequently used in Europe for evaluation of the biological quality of rivers and streams. Over the last few decades, following the proliferation of new pollutant substances and in the face of the need for closer monitoring of the quality of surface waters, around ten diatomic indices were developed in various countries bordering on Luxembourg.

The purpose of this project is to test the adaptability of European diatomic indices to rivers and streams in Luxembourg and in France. This work is in line with the European Community’s concern to harmonize



methods of evaluation of the biological quality of rivers intended for routine use under the framework directive establishing EC policy in the water field.

results:

The INDIA project is based on a set of data grouping together more than 800 floristic inventories carried out since 1999 on the measurement stations of the Luxembourg hydrographic network (445 inventories) and the monitoring stations of the Loire-Bretagne Water Agency (360 inventories). Microscopic observation of benthic diatom communities, together with the calculation of several European diatomic indices, were carried out for 1999 to 2001.

Despite a greater number of samples analysed, Luxembourg rivers present a biodiversity and floristic richness lower than those found in rivers in the Loire basin. The greater typological variability of the rivers sampled in France, from the sources to the estuary of the Loire, combined with a greater diversity of the ecoregions prospected, can explain this difference in biodiversity between the two basins studied.

The greater homogeneity of the Luxembourg hydrographic network results in a less diverse diatomic

flora, dominated by a small number of taxa. Despite a high taxonomic richness totalling 455 taxa, only 22 diatoms are abundant in Luxembourg rivers. These 22 taxa are also well represented in the rivers of the Loire basin because they are cosmopolitan diatoms with a broad ecological spectrum. Only 87 taxa listed in Luxembourg are absent from the Loire Basin, but their low abundance makes it impossible to define a particular diatomic flora solely confined to the rivers and streams of the Grand Duchy of Luxembourg.

In conjunction with the floristic study, a statistical comparison between 13 diatomic indices enabled a hierarchy of index methods to be established in accordance with their applicability in Luxembourg and in the Loire Basin. The Belgian Descy index and the Italian EPI-D index are inappropriate methods in the two basins studied. However, IPS (specific pollution sensitivity index), the EEC index (European index), IDAP (Artois-Picardie diatomic index) and IBD (diatom biological index) are the index methods which give the best results in the rivers of Luxembourg and the Loire Basin. Their routine use will have to be envisaged for an annual monitoring of the biological quality of surface waters in the Grand Duchy of Luxembourg.

INRA

title:

“Water table-river interactions in the Alzette basin: impact of renaturation and identification of the critical thresholds for the flooding pre-alert network”

field:

hydrology

partners:

Administration des Eaux-et-Forêts
Administration des Services
Techniques de l’Agriculture
Protection Civile

project leader:

Lucien Hoffmann

period:

November 2000 - October 2003

objective:

Through its very original configuration, characterized by two natural bottlenecks due to the Luxembourg Sandstone, the alluvial plain of the Alzette has a very specific form of hydrological operation. Surface water and ground water are slowed down in their progress at these bottlenecks. The evacuation of the ground water being very slow, the alluvial deposits of the Alzette lose their absorption capacity in the course of the pluviometric contributions, thus increasing the proportion of swelling outflow into the Alzette. Little is known as yet about the interactions between the groundwater table and the Alzette.

The purpose of this project is to:

- study these interactions with a view to future renaturations of the bed of the Alzette;
- study the possibility of using the follow-up of water table height variations as a tool for better forecasting of the flooding risk in the Alzette basin.

results:

A very dense network of piezographs, measuring the variations in the height of the water table at a time step of 1 hour, has been installed in the alluvial plain of the Alzette. Twenty-two measuring instruments thus monitor the beat of the groundwater table between Esch/Alzette and Ettelbruck. These instruments are coupled to the network of limnigraphs managed by the public authorities with a view to determining the groundwater table filling and drainage phases.

The comparison of hydrological balances calculated for the alluvial plain of the Alzette, upstream from Luxembourg City and upstream from Mersch with the measured piezometric heights confirmed the existence of saturation thresholds in the hydrological functioning of the Alzette.

A tool for evaluation of the risk of appearance of critical flows is currently being produced. The calculated values of the hydrological balance, together with the observed piezometric



heights, supply, with a critical flow rate (corresponding for example to the overflow flow rate set for a given limnometric station), the input for a series of statistical calculations. These calculations will supply the wave of rain required in a given period of time (for example 48 hours). The duration of the rainfall and the estimated wave of rain are then compared with an Intensity-Duration-Frequency (IDF) curve for the catchment basin studied. The danger is evaluated in accordance with the return period evaluat-

ed for the estimated wave of rain.

The results obtained up to now within the framework of the INRA project are the result of numerous localized observations made in the field. Transition to a 2D representation of the state of saturation of the catchment basin system is currently the subject of the TECSPIN project, the purpose of which is to use new remote detection techniques in the forecasting of conditions conducive to the generation of high water and floods.

LITSFLUIDISES

title:

“Application of modelling/simulation and flow analysis tools to fluidized bed technology: scientific monitoring of the implementation of a new wastewater treatment technique in Luxembourg”

fields:

microbial ecology, purification of the waters

partners:

Administration de l'Environnement
CRP - Henri Tudor

project leaders:

Henry-Michel Cauchie
Lucien Hoffmann

period:

January 2002 - December 2005

objective:

The purpose of this project, financed by the “Fonds National de la Recherche”, is to optimize a technique of fluidized beds installed in an activated sludge system with a view to increasing the capacities for treatment of this sludge. The technical

implementation of this project is scheduled in the Hesperange plant (Grand Duchy of Luxembourg) which is currently overloaded and which does not comply with the limits imposed by European Directive 91/271/EEC.

The project is of the multidisciplinary type, involving water chemists, microbiologists and mathematicians from various public research centres in close collaboration with certain Luxembourg design offices and the “Administration de l’Environnement”. The part of the project carried out by the CRP - Gabriel Lippmann concerns the development of molecular probes designed to detect bacteria involved

in the nitrogen cycle. These bacteria will be searched for both in the activated sludge basins and in the river receiving the effluents from the Hesperange plant.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Sustainable management of water resources” programme.

results:

The first phase of the project concerns the adaptation of the techniques of in situ fluorescent hybridization and electrophoreses on denaturing gels to the study of microbial films developing in water treatment plants. The optimum conditions for hybridization and microscopic observation are currently being defined.

MIDI-CHIP

title:

“Design and testing of DNA microarrays to monitor microbial diversity with adequate biodiversity indexes, using cyanobacteria in freshwater as a model system”

fields:

bio-chips, water quality, cyanobacteria

partners:

AMI - Azienda Multiservizi Intercomunale, Imola (I)
 CSMA - CNR, Firenze (I)
 Institut Environnemental (FIN)
 Institute for advanced Biomedical Technologies, Milano (I)
 Institute of Botany CAS, Trebon (Cz)
 Université de Liège (B)
 University of Helsinki (FIN)
 PISCES Conservation Ltd, Hants (UK)



project leaders:

Lucien Hoffmann (CRP - Gabriel Lippmann)

Annick Wilmotte (Coordinator of the MIDI-CHIP European project, Université de Liège)

period:

April 2000 - October 2003

objective:

For study of the biodiversity of micro-organisms, the use of molecular tools is essential given that the phenotype information is generally very limited. The purpose of this project is to develop biodiversity indicators which use the new bio-chip technologies and to compare their performances with conventional approaches.

The biological model chosen was the dynamics of cyanobacteria (blue-green algae) populations in freshwater where these micro-organisms are responsible for the development of "water blooms" which can cause nuisances (odours, toxins). The lakes chosen for the project include, among others, the Esch-sur-Sûre dam lake.

This project is financially supported by the European Commission as part of the 5th FP.

results:

The dynamics, both qualitative (identification of species) and quantitative (biomass of the various species), of the cyanobacteria of the Esch-sur-Sûre

dam lake, and also of an Italian lake and a Finnish lake, was monitored until the end of April 2002. The dynamics of the three lakes was compared with molecular detection results showing a recurrent seasonal succession.

The counts and identifications carried out in collaboration with the various partners in the project have revealed the presence of at least fifty-two different morphotypes, from the north to the south of Europe, of which only four are common to the various latitudes.

In addition, thanks to the numerous strains isolated during the first two years of the project, a more detailed study was initiated for certain genera with a view to their taxonomic revision. Morphological measurements and observations were thus made on fresh collections and on isolated strains of the genera *Anabaena* and *Aphanizomenon* from lakes in Luxembourg, Belgium, France, Italy, the Czech Republic and Finland. This made it possible to highlight the intra- and infraspecific variability of morphological characters such as the dimensions of plant cells, heterocysts and akinetes.

In parallel, 16S rRNA gene sequencings were carried out. These made it possible to validate the taxa previously defined solely on the basis of phenotypic criteria.

MILOO

title:

“Importance of the microbial loop in the Esch-sur-Sûre dam lake”

field:

limnology

partners:

Administration de l’Environnement
Université de Liège (B)

project leader:

Lucien Hoffmann

period:

July 1999 - December 2002

objective:

The microbial loop, consisting of heterotrophic bacteria, cyanobacteria and small eucaryotic algae, together with a variety of amoeboid, flagellated and ciliated protists, is an important component of aquatic nutritional networks. Planktonic protozoa maintain the metabolic activity of bacteria and themselves serve as food for zooplanktonic organisms. The proliferation of micro-organisms (including toxic cyanobacteria), which can occur in the summer period in the Esch-sur-Sûre reservoir (the main drinking water resource of the Grand Duchy of Luxembourg), can have harmful effects both for health and for tourism.

Suitable management of this resource therefore implies global knowledge of the structure and functioning of

this ecosystem. As a complement to the physico-chemical monitoring of the waters of the Esch-sur-Sûre lake and of the dynamics of large zooplankton, this project is aimed at highlighting the role and importance of protists and cyanobacteria.

results:

The monitoring of planktonic protists carried out between 1999 and 2001 showed that, under the complex influence of abiotic and biotic factors, the distribution of these communities is relatively unpredictable from one year to the next. However, the density, the taxonomic composition and the seasonal dynamics of the flagellated and ciliated protists observed in the Esch-sur-Sûre reservoir are the reflection of a mesoeutrophic lake.

Study of the vertical distribution of these protists has shown - both on an annual and on a daily basis - that all of these communities are essentially located in the upper stratum of the water column. Dependent on light energy, autotrophic nanoflagellates are concentrated in the epilimnion. The vertical distribution of flagellated and ciliated protozoa depends on the position of their resources (bacteria, algae, etc.) in the water mass and their mode of nutrition. Heterotrophic nanoflagellates (bacterivores), are more widely distributed in the metalimnion, particularly in mid-summer.



Following the increase in temperature and heating of the surface of the water, ciliates (with dominant prostomatids and oligotrichs) are the first organisms to respond to the spring algal growth. They occupy the whole water column in spring and are concentrated in the epi- and metalimnion during the summer period. In summer, the hypolimnic deficit of dissolved oxygen is unfavourable to them. The impact of predation of flagellated and ciliated protists on bacterioplankton varies from 0.3 to $6.5 \cdot 10^6$ bact.l⁻¹ h⁻¹, the maximum being noted in spring, and the minimum during the clear water phase. In addition, on average, 74% of this impact is linked to the activity of heterotrophic nanoflagellates.

In spite of their low speeds of ingestion, but because of their high density, these protozoa are thus the main consumers of bacteria. However, at the beginning of the destratification period, a considerable bacterial consumption by ciliates (*Epistylis*, *Vorticella*, *Halteria*, *Strobilidium*) was observed. The CREBS' work nevertheless demonstrated the moderate role of planktonic flagellated and ciliated protists in the regulation of bacterial communities, the protists consuming the bacterial production without necessarily reducing the stock.

Thus, these results suggest that protozoa are not regulated by food, but probably by the predation of zooplankton. With regard to the algivorous activity of protozoo-

plankton, the highest consumption was also recorded in the spring period, algae of size < 30 µm (Cryptophyceae, diatoms) being preferentially ingested; cyanobacteria contribute to their diet in summer.

These experiments have shown that algivorous protozoa can regulate algal communities, illustrating their important role in the functioning of the system studied. During the summer periods studied, cyanobacteria reached fairly limited densities compared to other phytoplanktonic groups. Indeed, the biovolumes they reach are around $1.5 \cdot 10^6$ µm³/ml, or on average five times less than the dominant groups (Chlorophyceae and Bacillariophyceae). *Anabaena*, *Aphanizomenon* and *Planktothrix* are the three genera, which dominate the waters of the lake during the summer period.

The autumn period, meanwhile, is characterized by the proliferation of *Woronichinia naegeliana*. Even though the densities of cyanobacteria are fairly limited, they are sufficient to generate efflorescences.

Analysis of the cyanotoxins of samples taken from these proliferations clearly shows the presence of microcystins (hepatotoxins), the concentrations of which can reach 1000 µg of toxins per dry weight gram of algae. These massive developments of potentially toxic cyanobacteria have a harmful effect on planktonic organisms and also constitute a real public health risk.

MODEL-ECOTOX

title:

“Development of a fauna and flora prediction model to evaluate the ecological quality of rivers in Luxembourg: impact of pollutant and toxic substances on aquatic communities”

fields:

ecotoxicology, bioindication, hydrobiology

project leaders:

Luc Ector
Lucien Hoffmann

period:

April 2002 - March 2005

objective:

The quality of the water in numerous European rivers has deteriorated over the last few decades as a result of human activities. In the face of this situation, the member states of the European Community adopted in 2000 (2000/60/EC) a directive establishing a framework for a community policy on water. One of the main aims of this directive is to evaluate the ecological quality of a running water site in terms of deviations with respect to what ought to be expected for the highest ecological quality (reference conditions).

The selection of reference sites therefore constitutes a crucial element for the establishment of quality criteria. To attain this objective, the directive recommends the use of predictive

models, which, based on physical and chemical habitat variables, make it possible to predict the biological communities expected on an undisturbed running water site.

The first objective of this project is the development of a prediction model for fauna (macroinvertebrates) and flora (diatoms) for evaluation of the ecological quality of Luxembourg rivers. One of the main themes of the same directive is also the control of toxic products dumped by industry and agriculture. A list of priority substances for water monitoring has been drawn up. Ecotoxicological evaluation of the impact of these toxic and dangerous substances on the aquatic environment is necessary.

The second objective of this project is the ecotoxicological evaluation of some of these priority toxic substances by microcosm tests.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Sustainable management of water resources” programme.

results:

2002 was devoted to the conducting of a large part of the first phase of the project, which concerns more particularly the evaluation of the impact of polluting and toxic substances on aquatic communities. Two complementary approaches were adopted to carry out this evaluation.

Firstly, natural communities of diatoms were moved from a site subject to



one type of anthropic pressure to another site characterized by different physico-chemical conditions. The evolution of the algae communities was monitored with a time interval of 20 days in order to determine in situ the sensitivity of the diatoms to disturbances of the environment.

Secondly, samples of living periphyton were brought back to the laboratory in order to test the specific action of the pollutants under controlled conditions in thermostat-controlled chambers. Eighty-five translocations of algal biofilms were carried out in June 2002 between seven sites in Gutland (six sites characterized by high levels of anthropic pollution, and a reference site). Sandstone slabs were used as supports for all the biofilms.

The microscopic analyses of the epilithon, which developed on the slabs indicate that the composition of the diatom communities changed considerably after 40 days, and that the communities tend to become similar to the indigenous community. Diatoms therefore seem to confirm

their status as good bioindicators, which rapidly integrate environmental changes.

In order to be able to determine the impact of one of the priority substances frequently encountered in Luxembourg rivers, fluoranthene, a microcosm experiment was conducted in the laboratory on algal biofilms from a reference station (Rollingerbaach in Rollingen). Analysis of the algal communities in a culture chamber after a period of 14 days under controlled temperature and light intensity conditions enabled evaluation of the impact of this micropollutant at various concentrations. The analyses indicate that fluoranthene significantly disturbs algal communities and causes morphological anomalies in several species of benthic diatoms.

Finally, around forty diatom clones were successfully isolated and are maintained in pure cultures in the laboratory. These clones will be used to carry out genetic and morphological analyses in scanning electron microscopy to improve knowledge of the taxonomy and ecology of diatoms.

NANO-ENVIRON

title:

“Analysis of environmental samples on the nanometer scale”

fields:

Nano-SIMS, environment

project leaders:

Lucien Hoffmann
Henri-Noël Migeon

period:

October 2002 - September 2005

objective:

At present, analysis techniques based on the use of an electron beam enable a resolution of about one nanometer. Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) have therefore largely been used for the study of biological tissues and environmental samples. However, by their very nature, TEM and SEM do not provide organic or isotopic information and remain limited to the study of the major elements constituting biological tissues.

Secondary ion mass spectrometry (SIMS), in addition to analysis of major elements and also traces, allows isotopic markings to be monitored. It can also provide organic information.

However, SIMS has up to now been limited to a spatial resolution of 300-500 nm, which is insufficient to carry out pertinent studies requiring determination of intracellular distributions or distributions at the

extreme surface of contaminated environmental samples.

The CENTREURO project, specialized in the characterization of materials on the nanometer scale, which has begun in July 2001 as part of the NANO programme, envisages the acquisition of new equipment and improvement of actual SIMS equipment to attain 30 nm resolution. Such a resolution coupled with complementary techniques will enable the development and application of measurements at the nanometric level based on mass spectrometry, particularly secondary ion mass spectrometry (SIMS).

The study may then look at biological systems and environmental samples, particularly for work on micropollutants and their accumulation on and in living tissues.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Innovative materials and nanotechnology” programme.

results:

To begin with, a bibliographical study was conducted to determine the possibilities and potential applications of secondary ion mass spectrometry. The various SIMS techniques (static and dynamic states, Nano-SIMS imaging) all represent complementary and innovative tools in a number of fields of environmental chemistry:

- firstly, Static-SIMS (or Time-of-Flight SIMS) will be used to detect



and quantify polar pesticides from aqueous solution. The organic information obtained by S-SIMS, together with its great sensitivity, will make it possible to analyse molecules usually incompatible with conventional analytical techniques. Previous studies have shown that the glyphosate and 2,4,5-T detection limits could reach 10 ppb using this technique;

- secondly, Dynamic-SIMS, which produces elementary and isotopic information, will be used to characterize the mineral phosphorus particles present in waters, in order to determine their origin;
- finally, the possibilities of elementary

“mapping” and the high spatial resolution of Nano-SIMS will be put to use to study the sub-cellular distribution of metallic and/or organo-halogenated pollutants in living tissues of vegetable or animal origin.

In addition to the SIMS analyses, a mass spectrometer for gaseous phase chromatography has been acquired, together with a high-pressure extractor. This equipment will reinforce the analytical potential of the “Laboratoire d’Analyse des Matériaux” and will enable the study of numerous types of pollutants (PCB, PAH, pesticides, dioxins) contained in a wide range of samples (waters, soils, plants).

PAEQANN

title:

“Predicting Aquatic Ecosystem Quality using Artificial Neural Networks: Impact of environmental characteristics on the structure of aquatic communities (algae, benthic and fish fauna)”

fields:

structure of communities, health of aquatic ecosystems, ecology, hydrobiology, modelling, management

partners:

Cemagref, Unité de Recherche sur la Qualité des eaux, Cestas (F)
Facultés Universitaires Notre-Dame de la Paix, Namur (B)
Institute for Forestry and Nature Research, Wageningen (NL)
Österreichisches Forschungszentrum Seibersdorf, Seibersdorf (A)
The Royal Danish School of Pharmacy, Copenhagen (DK)
Università di Bari, Bari (I)
Université Paul Sabatier, Toulouse (F)

project leaders:

Luc Ector (CRP - Gabriel Lippmann)
 Lucien Hoffmann (CRP - Gabriel Lippmann)
 Sovan Lek (Coordinator of the PAEQANN European project, Université Paul Sabatier, Toulouse)

period:

March 2000 - February 2003

objective:

This project fits perfectly into the framework of the European directive establishing a community policy in the water field. One of the main aims of this directive is to evaluate the ecological quality of a running water site in terms of deviations with respect to what ought to be expected for the highest ecological quality.

The objective of the PAEQANN project is to develop general methodologies based on new modelling techniques for forecasting the structure and biodiversity of the main aquatic communities (diatoms, macro-invertebrates and fish) subject to natural disturbances (i.e. not altered by human activities) or subject to alterations of human origin (i.e. subject to various types of pollution, flow regulations, etc.).

The purpose of this European methodology is the development of a set of methodologies, which will make it possible to:

- supply predictive tools which can be easily applied to define the most pertinent policies and the institutional arrangements for

- management of water resources;
- apply the most relevant and innovative techniques (mainly artificial neurone networks) to identify problems in the operation of ecosystems as well as the results of their deterioration following human impact, in order to be able to model the appropriate biological resources. Artificial neurone networks are particularly appropriate for establishing the relations between the variables in natural processes which form aquatic ecosystems, because these relations are frequently non-linear;
- fully exploit the existing information, reducing the quantity of work on the ground (laborious and expensive) required in order to be able to evaluate the state of health of fresh water ecosystems;
- study the specific actions to be taken for restoring the integrity of the ecosystems.

This project is financially supported by the European Commission as part of the 5th FP.

results:

An initial evaluation of the European benthic diatom database identified an under-representation of certain types of rivers in several regions. In order to develop a reliable predictive model, it proved to be necessary to integrate new data from the biotopes poorly represented in the database.

CREBS has therefore significantly enriched the European database by integrating new data on diatoms from



various rivers in the regions of France and Luxembourg. In Luxembourg, only diatoms in streams were represented in the database. CREBS has integrated in it sixty-two new inventories of benthic diatoms from rivers in the Grand Duchy of Luxembourg.

Given that the European database was characterized by an under-representation of slightly polluted rivers in the Rhone-Mediterranean-Corsica basin, CREBS set itself the task of taking forty-nine new diatom samples in the clean rivers of the Alps and the Cévennes.

Several "Directions Régionales de l'Environnement" and the "Conseil Général des Alpes Maritimes" were contacted in order to be able to gather together the diatom samples taken since 1995 in stations with little or no pollution in various French regions: 40 samples in Burgundy, 13 in Lower Normandy, 21 in Rhône-Alpes and 32 in Alpes-Maritimes. The physico-chemical data were also gathered or measured and the 106 samples of periphyton were examined under the microscope in order to homogenize the taxonomy of the inventories before integrating them in the international database.

In collaboration with the various partners of the PAEQANN project, CREBS has carried out several studies. An initial analysis was carried out in collaboration with the Université Paul Sabatier in Toulouse on the data from Luxembourg streams. Techniques using self-organising maps (Kohonen maps) and networks of neurons were used to establish a predictive model of diatom assemblies in the rhithral parts of the Luxembourg hydrographic network.

In collaboration with the University of Bari (Italy), a second study was conducted on the data from the Loire Basin. Independent models based on neuron networks were developed for the most abundant diatoms in the basin in order to be able to predict their presence in accordance with physical chemistry.

A third section of research work was carried out on the data from the Rhone-Mediterranean-Corsica basin using an artificial intelligence technique (Mir-max) developed by mathematicians from Stafford University (Britain). This study identified the typical diatom assemblies in low-pollution sites in several regions of the Rhone-Mediterranean-Corsica basin.

POTAMON II

title:

“Study of the aquatic microflora and macrofauna of Luxembourg rivers with a view to the development of a global ecological Quality Evaluation System (SEQéco) - II”

fields:

hydrobiology, environment

partners:

Musée National d’Histoire Naturelle
Administration de l’Environnement

project leaders:

Alain Dohet (CRP - Gabriel Lippmann),
Lucien Hoffmann (CRP - Gabriel Lippmann)
Marc Meyer (Musée National d’Histoire Naturelle)

period:

September 2001 - August 2003

objective:

The new European directive defining community policy aimed at sustainable development of aquatic resources, since 2001, requires member states to establish operational programmes of surveillance of hydrographic basins and particularly to draft an overall report on their ecological quality. This project lies within the framework of this directive and its purpose is to study the ecological quality of Luxembourg rivers.

The main objective is to establish, on the basis of the study of the microflora

(essentially diatoms) and macro-invertebrates, and on the basis of results obtained in other projects (Atlas of fish and aquatic birds, habitat for the otter), a global Ecological Quality Evaluation System (SEQéco) applicable to the whole of the Luxembourg hydrographic network.

This interdisciplinary study, which covers the rivers of the whole Luxembourg hydrographic network (Our, Sûre, Bledes, Wiltz, Woltz, Clerve, Syre, Alzette, Eisch, Mamer, Attert, Moselle, Ernze Noire, Ernze Blanche, Gander), comprises two sections:

- faunistic inventory of macro-invertebrates and floristic inventory of diatoms. These groups of organisms are recognized to be good bio-indicators and are currently used for surveillance of rivers in most European countries;
- inventory of the chemical quality of the water.

This data will make it possible to establish correlations between the presence of certain species and the quality of the water. On the basis of this knowledge, a Luxembourg river biomonitoring network can be planned and set up.

The samples collected can also be used to complete the National Reference Collection of aquatic organisms dependent on Luxembourg fresh water ecosystems.



results:

In 2002, diatoms (spring) and macro-invertebrates (spring and autumn) were sampled at the last thirty stations scheduled on the following rivers: Alzette, Chiers, Gander, Ernzt Blanche, Ernzt Noire, Pétrusse and Syre. A total of 96 stations will thus have been sampled in the POTAMON project.

As regards diatoms, the thirty samples of periphyton taken in September-October 2002 are being prepared. The floristic inventories of benthic diatoms collected in August 2001 were finalized and the calculation of the diatomic indices allowed the biological quality of thirty sites distributed in the Bledes, the Clerve, the Sûre and the Wiltz to be defined.

The best biological quality was observed in the Sûre just downstream from the Esch-sur-Sûre dam. The other sites of good biological quality are: the Sûre at Martelange, Dirbach and Eilerhaff, and the Wiltz at Kautenbach upstream from Goebelsmühle. According to the specific pollution sensitivity index (IPS), the majority of the stations studied in 2001 are of passable to bad quality:

- excellent biological quality 3%
- good biological quality 20%
- passable biological quality 47%
- bad biological quality 30%
- very bad biological quality 0%

As regards macroinvertebrates, the determinations specific to larvae and adults are being completed for the

2000 and 2001 campaigns, for all the groups collected. Compared to the results obtained on streams located at the head of the basin (RHITHRAL project: 1994-1998), the data available up to now for the rivers sampled in the POTAMON project are characterized by a general reduction in biodiversity, this reduction being particularly clear in the groups most sensitive to environmental conditions (Plecoptera, Trichoptera).

Conversely, certain groups generally considered to be more tolerant to deteriorations of the environment, such as oligochaeta for example, are far more diversified in wide rivers in the plain than at basin heads. However, this may be, in numerous groups studied, new species of Luxembourg fauna have been added to the existing inventories and helped to increase knowledge of the aquatic diversity of rivers in the Grand Duchy of Luxembourg.

During the last year of this project, the researchers' task will consist in completing the identification of benthic organisms and the coding of all the results. At the end of this year, this will result in particular in the publication of a complete volume of the review "Ferrantia" (the new review of the MNHN) containing general information on the project: description of the various sites studied, methodology, lists of taxa observed, general floristic and faunistic comments, ecological quality maps of the Luxembourg hydrographic network based on the evaluation of various biotic and abiotic indices on

255 sampling stations (RHITHRAL + POTAMON). Then, the publication of seven new volumes of “Ferrantia” devoted to the various groups studied

(taxon distribution atlas, comments on remarkable species, ecological interpretation, typology, bioindication, etc.), will be scheduled.

PROT

title:

“Conservation, cleaning and certification of the quality of potato by meristematic culture. Proteic characterization of phyla”

fields:

biotechnology, agriculture

partners:

Centro Internacional de la Papa (Perú)
Ministère des Finances

project leader:

Lucien Hoffmann

period:

October 1999 - September 2002

objective:

Late blight of the potato is currently one of the most devastating diseases for this crop world-wide. This work in cooperation with the CIP (Centro Internacional de la Papa) is part of the GILB: Global Initiative against Late Blight. The need for knowledge

of the mechanisms of resistance is indeed making itself increasingly felt to improve selection and creation of resistance to this disease.

Plants defend themselves against pathogens and the development of diseases by various mechanisms, including the localized death of cells, the accumulation of phytoalexins or the synthesis of proteins linked to pathogenesis (PR).

This group of PR (Pathogenesis Related) proteins, defined by their induction following an attack by a pathogen and linked to the acquired systemic resistance, is composed of various families. Some contain enzymes capable of degrading the wall pathogenic fungi (β -1,3-glucanases: PR-2, chitinases: PR-3), but few have been characterized in vivo for *Phytophthora infestans*, the oomycete responsible for late blight of the potato. The PR-1 protein shows an anti-fungal activity against this



pathogen in the in vitro tomato and on leaf disks. Its overexpression in a transgenic tobacco led to a tolerance to infection by oomycetes. The gene PR-1 is therefore an interesting candidate gene for resistance to late blight of the potato. The objective of this work is to characterize this gene PR-1 from a resistant clone of *Solanum phureja*, including its cloning, its sequencing and testing of its activity in vitro against the pathogen.

results:

Hybridizations by southern blot confirmed the presence of the gene PR-1. This gene appears as a small multi-genic family both in *S. tuberosum*, which is sensitive to late blight, and in *S. phureja*.

The induction of PR-1 was verified by northern blot. It was demonstrated that the gene PR-1 is expressed more strongly in plants infected by *P. infestans* than in uninfected plants. The expression appears on the first day after infection and is still strong after two or three days.

A cDNA bank was then constructed from the infected resistant clone and riddled with PR-1 probes of *S. tuberosum* and tomato. Positive phage clones were converted into plasmid and sequenced. 10 complete PR-1 sequences were successfully analysed. According to their coding part, these clones can be divided into two types with 9% difference. A representative of each type was recorded in an international database (EMBL) under the names PR-1 b1 and PR-1 b2. The deduced amino acid

sequence comprises 159 residues, of which the first 24 form a putative signal peptide. It is of the same size as the PR-1 clone of *S. tuberosum* already published, with which b1 shares 98% homology and b2 91%. The pI of these proteins is slightly basic. It is estimated at between 8.4 and 8.8 for mature proteins. It was also possible to show by PCR on genomic DNA that there are no introns in these PR-1 sequences. The coding sequences of PR-1 b1 and PR-1 b2 without signal peptid are cloned in a plasmid designed for expression, which is induced in the BL21 strain (DE3) by the addition of IPTG. The resulting fusion protein contains a poly-histidine tag at the N-terminal end which facilitates purification and for which anti-bodies exist.

Small-scale analyses allowed the presence, cellular location and solubility of the proteins produced to be determined. The fusion proteins are located in the insoluble cytoplasmic fraction for both types; variation of the culture and extraction conditions did not increase their solubility. They appear as a single band on SDS-Page gels and on western blots hybridized with anti-poly-histidine antibodies or with antibodies directed against a tomato PR-1. As the proteins are located in the insoluble fraction, they must be denatured to be solubilized. Purification is then carried out by affinity on a nickel resin where the protein is eluted, either directly under denaturing conditions and subsequently renatured by dilution in an appropriate buffer, or after changing of the buffers by gradient on the col-

umn in order to promote refolding.

In both cases, the fusion protein is indeed purified on the column, but no tested method allowed verification that the protein returned to its native configuration and that the refolding and formation of the di-sulphide bridges between the cysteine residues are correct.

The two isoforms of PR-1 were therefore certainly produced, but it is difficult to test their folding and therefore to know the reason for the lack of effect on the pathogen shown by the tests with the first purifications. The tests on *P. infestans* (germination of the zoospores under the microscope and hyphal growth on a Petri dish) are operational.

PROTEXPRESS

title:

“Study of gene expression and protein accumulation of PR-1 in potato plants”

fields:

biotechnology, phytopathology, molecular biology

partners:

Centro Internacional de la Papa (Perú)
Ministère des Finances

project leader:

Danièle Evers

period:

December 2002 - November 2003

objective:

Late blight of the potato is one of the most important pathogens for this

crop. Various approaches are possible to study the interaction between late blight and potato. One possible approach is the study of certain genes known to play an important role in the interaction.

This project is part of the world global initiative on late blight (GILB) launched by the “Centro Internacional de la Papa” (Lima) and continues the activities of the PROT project. In this project, CREBS isolated, cloned and sequenced the PR-1 protein from *Solanum phureja*, a potato native to the Andes, which is resistant to late blight. PR-1 is part of the family of PR proteins, which are proteins linked to pathogenesis. It is particularly interesting in the study of this interaction because it has shown an anti-fungal activity against oomycetes, to which late blight belongs.



The main objective of the PROTEX-PRESS project is to characterize PR-1 with regard to its expression. To begin with, the aim will be to complete the study of its anti-fungal activity against *Phytophthora infestans* in vitro. Then its expression will be studied in two stages.

First of all, tests will be carried out to see whether PR-1, present in several forms, shows a differential expression for these forms in plants infected by mildew. To do this, molecular techniques such as northern blots or the Real-time PCR technique will be employed. Following this, CREBS will continue its expression in terms of

proteins by immunolocalization methods conducted on infected potato leaf cuttings.

results:

The tests on the anti-fungal activity of the PR-1 protein on late blight are currently being conducted.

Membranes have been produced with various extracts of RNA from infected potatoes resistant and sensitive to mildew and are currently being hybridized by the northern blots technique in radioactivity with specific short probes for two PR-1s. The Real-Time RT-PCR technique is currently being finalized.

R A P

title:

"Improving Fraxinus (Ash) productivity for European needs by testing, selection, propagation and promotion of improved genetic resources"

field:

plant biotechnology

partners:

Coillte Teoranta - The Irish Forestry Board (IRL)
Consiglio Nazionale delle Ricerche (I)
European Forest Institute (FIN)

Forestry Commission Research Agency (UK)
Forstliche Bundesversuchsanstalt (A)
Horticulture Research International (UK)
Institut National de la Recherche Agronomique (F)
Instituut voor Bosbouw en Wildbeheer (B)
Niedersaechsische Försstliche Versuchsanstalt (D)
Région Wallonne (B)
Teagasc - Agriculture and Food Development Authority, Dublin (IRL)
Université de Paris-Sud XI (F)
Vitroform (DK)

project leaders:

Gerry Douglas (Coordinator of the Rap European project, Teagasc)
Jean-François Hausman (CRP - Gabriel Lippmann)

period:

February 2001 - January 2005

objective:

The major objectives are:

- characterization of the genetic diversity and genetic structure of populations of *Fraxinus excelsior* on the regional and European scale, in order to assist the certification of the populations and contribute to the decision for developing conservation of the genetic resources of the Ash;
- provision of technological solutions for the multiplication of effective specimens by vegetative or sexual means;
- identification of the most effective means for using the genetic potential of the ash.

The contribution of the CRP - Gabriel Lippmann to this project is to establish cultures of *F. excelsior*, to study the effect of culture conditions on rooting and the level of stress, to establish an optimum culture protocol for the multiplication, rejuvenation and acclimatization of healthy plants for commercial partners, and to identify the biochemical markers characterizing the various physiological states corresponding to rooting, rejuvenation and resistance to the stresses linked to micropropagation.

This project is financially supported by the European Commission as part of the 5th FP.

results:

Several tests were conducted to promote the introduction and multiplication of selected new ash genotypes in vitro. Introduction tests were conducted after sterilization using dormant winter buds, buds on rapidly-growing shoots and mature embryos. It appears that only buds on rapidly-growing shoots and embryos are easily introduced in vitro. Embryos offer the additional advantage over buds of not producing phenolics during their development and thus allowing better later growth.

The multiplication of the new genotypes introduced, together with that of the five genotypes already present in the collection, continued. The rate of multiplication is relatively low, which for certain clones constitutes a problem for their survival. Test must be undertaken to solve this problem.

Rooting tests were also carried out. It appears that rooting in the in vitro cultivated ash is more abundant on a culture medium without activated charcoal containing auxin (NAA, 0.5 mg.l⁻¹). Other tests were carried out ex vitro, in collaboration with Dr Douglas's team (Teagasc, Dublin, Ireland), on the rooting of various selected clones.

The role of the CRP - Gabriel Lippmann in this collaboration is to look for variations in the endogenous levels of carbohydrates (sucrose, glucose, fructose, mannitol and raffi-



nose) during rooting. The researchers were able to note certain differences in the quantities and in their varia-

tions depending on the genotype or their multiplication origin (in vitro or otherwise).

RECEGON

title:

“Development of techniques for ex situ conservation of leafy forest essences”

field:

forest biotechnology

partners:

International Plant Genetic Resources Institute (I)
Ministère des Affaires Etrangères, du Commerce Extérieur et de la Coopération
Ministère des Finances

project leader:

Jean-François Hausman

period:

January 2001 - December 2003

objective:

The socio-economic importance of forests for mankind needs no further demonstration. And forest genetic resources are threatened both in tropical regions (deforestation) and in industrialized countries in temperate regions (atmospheric pollution). The conservation of forest genetic

resources, in vitro or in situ, is the best means of guaranteeing their availability for future generations. To do this, it is important not only to be able to characterize this genetic diversity but also to have the tools needed for their conservation.

The objective of this project is to participate, under the auspices of the “International Plant Genetic Resources Institute” (IPGRI) in an international project to maintain the genetic diversity of leafy forest ligneous plants, such as the ash and the oak. The techniques, which are developed, essentially use in vitro culture, but also physiology, biochemistry or molecular biology techniques.

The role of CREBS in this project is to develop, in the medium-term but above all in the long-term, techniques for the conservation of these plants. This essentially concerns techniques for cryopreservation or conservation in liquid nitrogen, i.e. at very low temperatures.

In addition, this project will make it possible to refine the knowledge of

the CRP - Gabriel Lippmann researchers in the field of encapsulation and therefore of artificial seed production, techniques newly applied to ligneous essences. This project will also enable exchanges between CRP - Gabriel Lippmann researchers and confirmed researchers from other European research institutes.

results:

One aspect of the project concerns the participation of Luxembourg researchers and Ukrainian researchers in various common experiments whose purpose is to improve strategies for conservation of ex situ forest ligneous plants, mainly using the in vitro culture technique. Research on the quality and survival of shoots or cryo-preserved ligneous embryos was also conducted.

In addition, in the course of this year, a new aspect has been developed.

The aim is to sketch out, in collaboration with teams of Georgian, Armenian, Ukrainian and Moldavian researchers, a strategy for conservation and purification of populations of natural relatives of the vine. The northeast region of the Black Sea is one of the cradles of civilisation for the vine. Natural populations of relatives of the vine constitute an important reserve of genetic resources, which may in the long-term make it possible to improve certain aspects of cultivated vines, such as better resistance to various pathogenic agents.

Finally, improvement of the molecular biology techniques applied to population genetics is part of this research project. Short stays by visitors from the region at the CRP - Gabriel Lippmann are also scheduled, which will allow them to evaluate the possibilities offered by these new technologies.

TECSPIN

title:

“Integration of spatial techniques in flood management”

fields:

hydrology, climatology and remote sensing

partners:

Centre National d’Etudes Spatiales (CNES, Toulouse, F)
Service Régional de Traitement d’Image et de Télédétection (Université Louis Pasteur de Strasbourg, F)



project leader:

Laurent Pfister

period:

October 2002 - September 2004

objective:

By covering broad areas at regular intervals, earth observation systems allow input of numerous biophysical variables with broad spatial coverage. Even if the operational deployment of earth observation systems is still insufficient to meet all flood management needs, it is important and necessary to improve the use of existing resources and in particular to begin the integration and use of new earth observation systems (such as ENVISAT or SPOT5 launched in 2002) to improve the contribution of spatial techniques to flood management.

In this project, the information obtained via various spatial remote detection tools will be applied to the Alzette catchment basin equipped with a hydro-meteorological observation network of high spatio-temporal density with the aim of calibration and validation of these new methods. The project comprises three main sections:

- analysis of the possibility of detecting the degree of saturation of hydro-systems via radar images obtained by satellite with a view to the development of pre-alert tools and high water and flood management assistance tools;
- statistical analysis of flood extensions in the alluvial plain of the Alzette. This analysis will be

used to evaluate flood risk changes within a context of confirmed changes in rainfall in the winter semester in the study zone.

Determined by hydraulic modelling, the extension of the flood zones will be validated by extensions obtained via satellite images;

- development of a new method of breakdown of socio-economic data in the information obtained from earth observation. This approach will serve as a basis for the creation of new tools for rapid assessment of vulnerability in flood risk areas.

The project will allow the evaluation of an "all spatial" approach in high water and flood management for zones not equipped with conventional measuring networks.

results:

Three different themes have up to now been dealt with in the TECSPIN project.

The reaction of a catchment basin to rainfall of a given magnitude varies according to the degree of saturation of the soil at the beginning of the downpour. By means of the hydrological balances calculation, which gives information on the quantity of water stored in the basin, and real-time monitoring of the height of the groundwater table in the alluvial plain, it was possible to illustrate the relationship which exists between the run-off measured and the antecedent humidity conditions in the basin. This relationship will be very useful for

anticipating flooding risks by making it possible to estimate the quantities of rain liable to produce critical flow rates at the outlets of the various catchment basins for a given degree of saturation.

Hydraulic models simulating the overflow heights for various outflow scenarios have been set up in two separate areas of the Alzette catchment basin: upstream from Luxembourg City, in the alluvial plain of the “Roeserbann” linking the localities of Livange and Hesperange, and downstream from Luxembourg City in the alluvial plain of the Alzette between Steinsel and Mersch. Analysis of the flooding fields simulated for the period between 1986 and 2001 made it possible to establish the flooding fre-

quencies in the various parts of the alluvial plain and deduce from them the flooding risks for the infrastructures located in the valley.

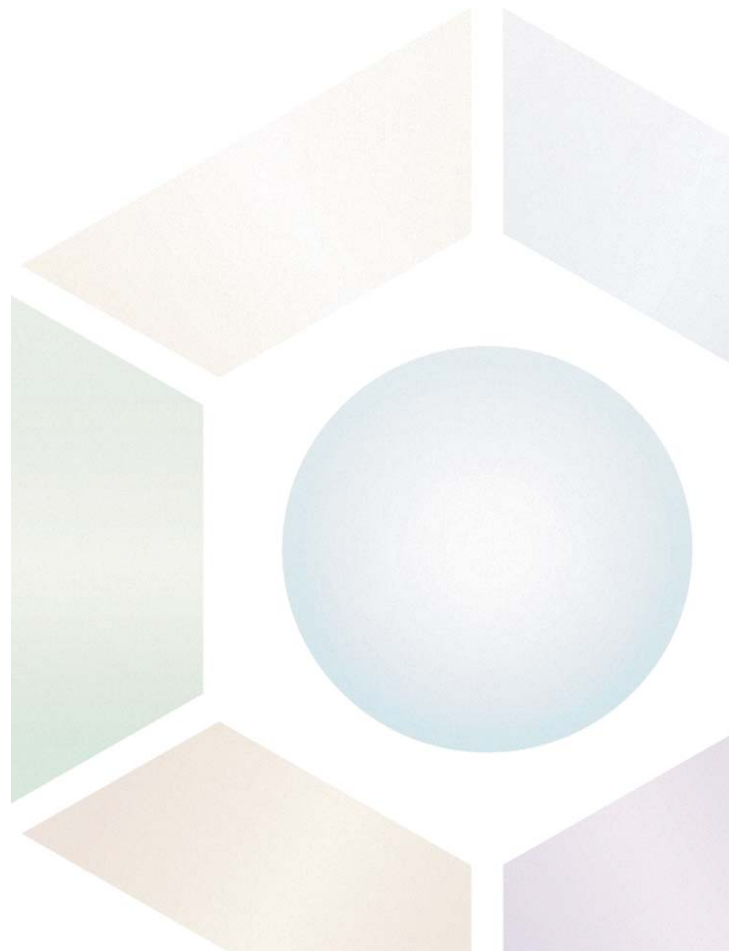
For these two sections of the project, satellite images will help to improve the reliability of the preliminary results. By establishing a relationship between the radar wave back-scattering coefficient and the soil humidity indicators, radar pictures taken at regular intervals allow the degree of saturation at the catchment basin level to be monitored. In addition, the radar pictures will be used to mark off the flooded areas observed by the satellites during the high water days. This will allow adjustment of the hydraulic models set up in the flood risk areas.







Meting in the “Cellule de Recherche, d’Etudes et de Développement en Informatique”





3. Cellule de Recherche, d'Etude et de Développement en Informatique (CREDI)

ACE

title:

“Comparative Analysis of the ERPs of the Bofferding Brewery and Munhowen”

fields:

analysis and modelling of information systems, enterprise resource planning (ERP)

partner:

Brasserie Bofferding, Bascharage

project leaders:

Francis Barba (CRP - Gabriel Lippmann)
Georges M. Lentz (Bofferding Brewery)

period:

September 2001 - January 2003

objective:

Due to a very decisive collaboration at the time of the SIMBA (“National Brewery Information System”) project from January 1997 to February 1998, the “Brasserie Nationale” (Bofferding)

is again turning to the CRP - Gabriel Lippmann to find the assistance and expertise necessary for a tricky analysis.

Indeed, since the merger at the end of July 2000 between Hippert Distribution S.A. (a 100% subsidiary of Bofferding) and Munhowen Distribution S.A., the Management of the “Brasserie Bofferding” has been studying very concretely the possibilities of synergy at all levels:

- infrastructure;
- human resources;
- material resources.

In this context, it is clear that a global and coherent strategy must be set up.

Thus, as a complement to the material restructurings already carried out, it is now necessary to delve into the most complex part of bringing together the computer systems of the two companies: the detailed study of the existing ERPs (Enterprise Resource Planning) and computer needs of the

“Brasserie Bofferding” and Munhowen in order to identify in them the possible comparisons and improvements.

results:

The ACE project fully and amply met the objectives which had been set for it and now provides the means required by the Bofferding Brewery and Munhowen to begin the second stage of their re-engineering, i.e. the implementation of a new ERP. In this project, the functions of the respective ERPs were closely analysed on the basis of numerous interviews, the associated documents and workflows were studied, the interfaces of the

existing ERPs were documented, the calculation rules were (when necessary) broken down, the flowcharts were modelled and in fact facilitated the reorganization of these two companies, and, lastly, the global activity was modelled (functional and dynamic views modelled under Aris).

In parallel with this analysis, the project team assisted the two companies in their steps to identify the ERP supplier best suited to their needs. This choice having now been made, and on the basis of the results of the ACE project, the implementation of the new ERP can now begin.

COMELUX II

title:

“Impact of electronic commerce technologies on the relationships between construction companies in the Grand Duchy of Luxembourg”

fields:

e-business, exchange of computerized documents, small businesses, standardization, XML (eXtensible Markup Language), Java

partners:

players in the construction industry

project leader:

Benoît Otjacques

period:

July 2000 - December 2003

objective:

The project aims at determining how Internet technologies may improve the competitive position of Luxembourg construction industry players. The project encompasses theoretical work aiming to study subjects like the fundamental characteristics of computerized commercial documents or the standardization problem.

These efforts will be complemented with the development of a prototype, using Java and XML technology, which will be tested by pilot companies in real life situations.

results:

As a reminder, several publications have been produced since the begin-



ning of the project. The first concerned the results of the survey on the state of e-business in Luxembourg. It is available on the centre's website. Then, analysis of the specific characteristics of the construction sector led to a presentation at a scientific conference in Beijing, China. Thirdly, the problem of standards in e-business was the subject of an article in "Electronic Markets".

At the operational level, the experimental protocol for study of information flows between partners in a construction project is currently being used in two real projects. Prototype project management software has been developed in Java language. It enables secure exchange of messages which include a whole set of metadata. Various original functions have been integrated in the prototype, such as structured management of the various information flows or a graphical representation of the conversa-

tions during which messages are exchanged.

A description of the concepts on which the prototype is based was given at a specialized conference in Slovenia in September 2002.

In addition, demonstrations of the prototype were given at open days with professionals from the construction industry. The project team also welcomed three trainees who notably developed a light version of the prototype which can be executed on mobile equipment (GSM, PDA). In the last phase of the project, it is planned to give several architects the opportunity to test the prototype and note their appraisal of it.

Lastly, we should recall that the experience acquired in the course of the project enabled the design of a course on the strategic aspects of e-business, which was taught at the CRP - Gabriel Lippmann Training Centre.

CONCEPT

title:

"Optimized and innovative cooperation at the «Chambre des Employés Privés» via information technologies"

fields:

CSCW (Computer Supported Cooperative Work), e-learning, blended learning

partner:

Chambre des Employés Privés - Luxembourg (CEP•L)

project leaders:

Pascal Bauler (CRP - Gabriel Lippmann)
Roger Melmer (CEP•L)

period:

November 2002 - October 2004

objective:

The proposed project aims to set up an Internet cooperation platform designed to bring into contact the instructors, students, auditors and personnel of the CEP•L. The main emphasis will be on computer training.

In the first phase, the hardware and software architecture will be defined to adapt as effectively as possible to the needs of the CEP•L. This stage will include in particular an evaluation and testing of various solutions which can be envisaged. The problem of the future maintenance of the system will also be taken into account. The scientific aspect will concentrate on studying the modes of management of a community communicating via electronic means.

In the second phase, the chosen platform will be implemented. It must allow communication between each of the various groups of people involved. For example, relations between instructors and students will be favoured through discussion forums and on-line availability of corrected exercises and models of examination papers.

In the third phase, the platform will be progressively used to offer operational services. In scientific terms, it will be instructive to observe how people adapt to the use of New Information and Communication Technologies (NICTs) as a means of cooperation.

The project also comprises a section devoted to e-learning. It will strive to define a coherent strategy in this area which takes into account the situation of the CEP•L. A differentiated approach will be used for the various courses in order to offer solutions which take into account elements such as the level of acclimatization of the students to NICTs, the compatibility of the course content with electronic formatting, or the cost of the solution compared to the number of students enrolled. It is planned to test a few solutions in a limited number of courses. From this point of view, the scientific aspect will concentrate on the contribution of the NICTs within the framework of basic computer learning.

results:

As regards the computer-assisted learning part, a preliminary study was conducted and certain ideas, which seem to be worthwhile within the very specific framework of the CEP•L, were adopted. Based on the results obtained, certain functions were identified and are going to be integrated in the future computer-assisted learning platform. It was also possible to identify a number of standard working tools which are essential for preparing computer-assisted courses or for reworking existing courses.

The rest of the project consists in setting up the computer-assisted learning platform, followed by the practical application of these new technologies as part of the continuous training provided by the CEP•L.



CORTINA II

title:

“Electronic spellchecker for the Luxembourg language - II”

field:

linguistic information technology

partner:

Conseil Permanent de la Langue
Luxembourgeoise (CPLL)

project leaders:

Pierre Mousel (CRP - Gabriel
Lippmann)
Georges Wirtgen (CPLL)

period:

July 2001 - June 2002

objective:

In order to strengthen the status of the Luxembourg language in its written form, CPLL decided in 2000 to develop a suite of computer tools enabling users to process the Luxembourg language on a computer.

To begin with, the CPLL addressed the CRP - Gabriel Lippmann to entrust to it the computer implementation of a spelling correction program which could be integrated in various text processing tools. This project, known as CORTINA (Computer spelling correction applied to the Luxembourg language), is completed and has fully achieved its objectives (cf. <http://www.crpgl.lu/cortina>). The encouraging results obtained in this project and the favourable response from the public for the spellchecker led the CPLL managers to attempt to

push the production of the spellchecker beyond the prototype stage.

The objective of the CORTINA II project is to continue the developments started in the course of the past year and to:

- extend considerably the coverage of the dictionary integrated in the spellchecker;
- extend the functions of the spellchecker;
- improve its performances as far as possible;
- and intensively test the spellchecker in order to increase its sturdiness and study the ideal material sizing for operation in a production environment.

results:

The following results were obtained:

- the dictionary has been extended to 123,000 words;
- the dictionary has been made secure (encrypted) in order to enable downloading of the correction server while at the same time however limiting the possibilities of abusive use;
- a client version of the spellchecker for the StarOffice software has been implemented;
- a client version of the spellchecker for the Word:mac software has been implemented;
- the protocol for communication between clients and the correction server has been extended;
- the performance of the spellcheck server has been noticeably improved.

CSI

title:

“Cryptology & Security Initiative: Organization and setting up of an interdisciplinary cryptology and computer security platform”

fields:

e-commerce, computer security

partner:

Centre Universitaire de Luxembourg

project leader:

Jean-Claude Asselborn

period:

October 2001 - September 2004

objective:

Cryptology is the scientific discipline which is devoted to all theories, methods and processes related to the keeping of secrets and original documents, both during the transmission and during the storage of documents.

It constitutes a key technology on which the whole security of e-business is based, notably through the mechanisms of electronic signature, electronic payments, encryption of messages, remote identification of commercial partners and authentication of contractual documents and artistic works.

The project aims to make Luxembourg capable of participating in the international cryptology research drive and create a favourable framework for the implantation in Luxembourg

of companies operating in the field of e-business and computer security.

For this purpose, it proposes to set up a multidisciplinary team of specialists (mathematicians, computer specialists, legal experts) in order to create solid national expertise, which should lead to results at various levels:

- reach a level of scientific expertise enabling participation in international research projects in cryptology;
- create teaching structures enabling the training of cryptology experts in accordance with the needs of the “net economy”;
- set up a network of cooperation between all cryptologists working in Luxembourg companies;
- develop national methods of evaluation and certification of cryptological products in cooperation with foreign institutions operating in this field;
- advise the government, companies and even the general public in matters of cryptological process security.

At the end of the project, there should be solid structures able to continue to exist autonomously, finding external sources of funding, by providing cryptology services to all interested organizations.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Safety and effectiveness of new e-business practices for all socio-economic players” programme.



results:

The project began its activities on the 1st of October 2001, thus entering its initial six-month phase devoted to the collection of basic knowledge in cryptology and the setting up of a bank of knowledge of this subject. Between the 1st of October and the 31st of December 2001, the team of researchers produced a series of computer tools which could be used to manage both the project and the knowledge relating to cryptology.

The work of setting up a documentation centre progressed and many specialized volumes devoted to cryptology and its applications are now accessible to the research team and all the cryptologists concerned.

The team also compiled all the references of works devoted to cryptology and its applications currently available on the market. In the same way, it manages a database of articles published in this field which allows thematic searches.

With a view to using this raw information, the team defined a thematic classification enabling keywords to be associated with each element of knowledge. A prototype knowledge base was developed and the members of the team continued to supply the database, one of the keystones of the project. At the end of December 2002, it comprised the following elements:

- Articles Module: (204 Mb) corresponding to 1114 foreign research articles published in 110 different reviews;
- Books Module: (113 Mb), corresponding to 498 descriptions of books (or similar documents) and 191 copies of works available for those interested in the project library;
- Knowledge Module: (32 Mb) corresponding to 160 articles currently being drafted by the CSI group, 1606 acronyms and 626 dictionary entries;
- Object Identifiers (OID) Module: (1.9 Mb) corresponding to 470 entries.

E-DOUANES

title:

“Recommendations associated with the internet/intranet presence of the «Administration des Douanes et Accises»”

fields:

content management systems, eGovernment, internet application architectures

partner:

Administration des Douanes et Accises

project leaders:

Pascal Bauler (CRP - Gabriel Lippmann)
Patrik Hitzelberger (CRP - Gabriel Lippmann)
André Schott (Administration des Douanes et Accises)

period:

November 2002 - May 2003

objective:

The project consists in analysing, within the limits of the resources available, the services provided by the “Administration des Douanes et Accises”, and in drafting specifications enabling a service company to create two websites: one being accessible internally (intranet) and the other from the outside (internet).

Emphasis will be placed on the definition of the general architecture (site map, navigation) of the two sites and will concern the six divisions of this administration.

As regards the internet site, different special access points must be available for clearly-defined different types of customers (transport companies, citizens, etc.). The specifications must include a list of these types of customers and a description of the links between the special access points and the various items of information which are useful in this context.

results:

Among the key results of the E-DOUANES project, we should mention:

- the setting up of a “Corporate Identity” group whose job is to define and manage the image which the “Administration des Douanes” wishes to convey to visitors to the Internet site;
- definition of an internal organization of the “Administration des Douanes et Accises” suitable for maintaining the site.

In addition, recommendations concerning the setting up of multilingual sites have been drafted.

With regard to the publication of addresses of “Administration des Douanes et Accises” workers, a compromise between personalized contact and availability of contact points has been found. The decision has been taken to manage contact by electronic means, mainly by group addresses. By using advanced functions incorporated in electronic mes-



saging tools, a reliable and user-friendly solution has been proposed.

One of the key points in the setting up of an Internet site is the collection of the content proper. A systematic method for content collection and classification has been set up. The collection proper is currently being executed.

From a technical point of view, the tree structure of the "Administration

des Douanes et Accises" Internet site was defined with the aim of meeting the requirements of future visitors to the site rather than following the internal organization of the "Administration des Douanes et Accises". In this context, a series of ideas for practical productions and paging were adopted. On the basis of these recommendations, a service company will be given the task of creating the Internet site proper, in compliance with the 'eLuxembourg' charter.

E - FORMS

title:

"Recommendations associated with placing administrative forms on line"

fields:

eGovernment, electronic forms, remote procedures

partner:

Ministère de la Fonction Publique et de la Réforme Administrative (MFPPRA)

project leaders:

Francis Barba (CRP - Gabriel Lippmann)
Ralph Letsch (MFPPRA)

period:

August 2002 - January 2003

objective:

As part of the 'eLuxembourg' action plan and its 'eGovernment' section, the MFPPRA has entrusted CREDI with

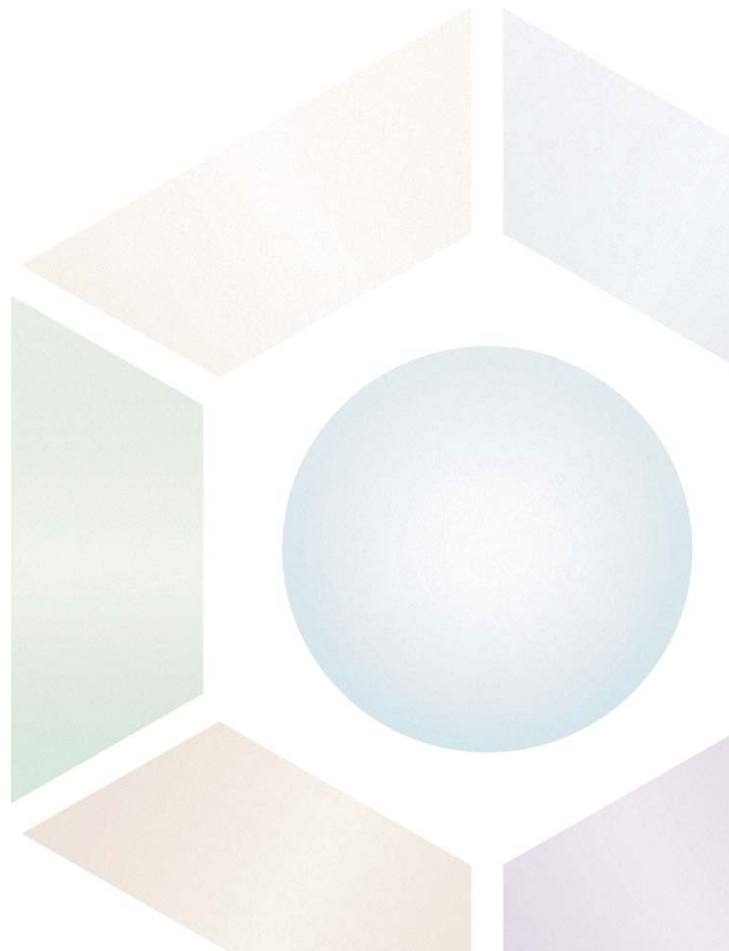
a new study designed to prepare the integration of the various administrations' electronic forms within the future Luxembourg administration portal.

results:

Ten administrations were interviewed, allowing identification of their needs, their possible work or results in the field, their constraints and the solutions envisaged or tested. On the basis of these interviews, and because of the diversity of the persons concerned (political figures, 'eLuxembourg', technical and functional personnel), it was possible to summarize objectively their opinions which correspond, obviously, to all aspects of the question of placing electronic forms on line: attached documents, electronic signature/PKI, security, storage, legal aspects, confidentiality, languages used and cross-border use.



Visit to the building site of the new training centre of the “Chambre de Commerce”
(FORMCHCO II project)





FORMATION CEP•L

title:

“Assessment of the computer courses organized by the «Chambre des Employés Privés», Luxembourg”

field:

training

partner:

Chambre des Employés Privés - Luxembourg (CEP•L)

project leaders:

Corinne Lœsel (CRP - Gabriel Lippmann)
Roger Melmer (CEP•L)

period:

March 2002 - September 2002

objective:

To validate the quality of the computer classes organized by CEP•L and to make proposals as regards the future contents of the classes.

results:

A limited number of improvements and new courses were suggested by CRP - Gabriel Lippmann and have been implemented by CEP•L.

FORMCHCO II

title:

“Computerization of the new training centre in the enlarged premises of the «Chambre de Commerce» - II”

fields:

CSCW (Computer Supported Cooperative Work), e-learning

partner:

Chambre de Commerce du Grand-Duché de Luxembourg

project leaders:

Steve Breier (Chambre de Commerce)
Fernand Feltz (CRP - Gabriel Lippmann)

period:

May 2001 - November 2003

objective:

The project deals with the computerization of the new training centre of the “Chambre de Commerce”. This new centre should be operational in September 2002 and will be used by several organizations. In order to satisfy future needs, the “Chambre de Commerce” will need to equip itself with new software that can meet the requirements of the partners involved in the training centre.



Computerization of the "Registre de Commerce et des Sociétés" by a CREDI research team





CRP - Gabriel Lippmann is supposed to facilitate the choice of software, to ensure that it is sufficiently configurable and to develop interfaces that meet the users' needs by using information management methods. In addition, the new e-learning, enterprise simulation, and electronic meeting assistance concepts will be studied and compared with the traditional training methods of the "Chambre de Commerce".

results:

A comparative study based on a number of software packages adapted to the management of a training centre was carried out. Elements of the

research field of the Computer Supported Cooperative Work (CSCW) were compared with the aspects of management of the resources of the new centre and the organization of training cycles.

Following the comparative study, a management software package was selected. The installation of this application is underway. This system will deal with the functions relating to the organization of the training offered in the new training centre of the "Chambre de Commerce". In addition, the concepts and tools of the e-learning field have been studied.

RCS

title:

"Improvement of internal and external coordination of the new «Registre de Commerce et des Sociétés»"

fields:

modelling of organizational processes, CSCW (Computer Supported Cooperative Work), knowledge engineering

partners:

Centre Informatique de l'État
Chambre de Commerce du Grand-Duché de Luxembourg

Chambre des Métiers du Grand-Duché de Luxembourg

Ministère de la Justice

RCSL - Groupement d'intérêt économique

Service Central de la Statistique et des Etudes Economiques (STATEC)

project leaders:

Fernand Feltz (CRP - Gabriel Lippmann)

Yves Gonner (RCSL - Groupement d'intérêt économique)

period:

January 2001 - May 2004

objective:

This project is part of the fundamental reconfiguration of the “Registre de Commerce et des Sociétés”. A new structure is set up in the form of an Economic Interest Group (RCSL).

An internal reorganization concerning the whole register is aimed at a transition from the existing paper system to a computer application and an improvement of the working procedures. In this context, the project team will carry out modelling of the internal processes and of the interaction with outside players such as the other administrations.

The resulting models must cover the whole cycle of reorganization of the register and will be related to a more generalized concept of a future “guichet unique” (virtual one-stop shop) based on increased inter-administrative cooperation.

In addition, the new concepts of the research fields of CSCW (Computer Supported Cooperative Work) and knowledge engineering will be compared with the process models in order to determine the best possible internal and external coordination. The players in the project will be able to measure

the impact of these new tools on the functioning of the register processes.

results:

A detailed analysis of all the existing processes of the register has been completed, and the interactions between the various administrations have been modelled. Using the results of the modelling, various scenarios for cooperation between the administrations have been proposed. The modelling of the processes at counter and “back office” level has been completed.

A cooperative working environment on the basis of a generic platform was introduced for the register. Specific first applications aimed at improving the internal coordination of the RCSL were set up and are already yielding the first benefits of computerization.

The preparatory work for the starting of the new register of commerce, scheduled for the beginning of February 2003, is underway. This involves the successive achievement of the procedures and the creation of the interfaces between the groupware type applications and database applications of the “Centre Informatique de l’Etat”.

SAMI**title:**

“Solution for a unique access to multiple sources of information”

fields:

groupware/knowledge management, integration of operational systems



partner:

Administration des Douanes et
Accises

project leaders:

Corinne Lœsel (CRP - Gabriel
Lippmann)
André Schott (Administration des
Douanes et Accises)

period:

March 2001 - February 2002

objective:

In the course of their duties, personnel in the "Administration des Douanes et Accises" need to access many types of information. As this information comes from various sources, it comes in as many different formats and must therefore be consulted using different software programs and different interfaces. This naturally penalizes the users, not only in terms of information search time and of time devoted to the study of the different interfaces and in terms of potential errors. Thus, an article of the law which is vital or important for the file being handled can easily be overlooked by the officer in charge of the case.

The project consists in studying an architecture making it possible, starting from a single graphic interface (ideally, a universal browser such as Netscape Communicator or Microsoft Internet Explorer), to consult this host of different sources of information and present the results in a form which can easily be used by the user. The technical solution will enable easy extension, by the computer

specialist or even, in certain cases, by the user himself, of accesses to other sources of information. It will be implemented in the form of an advanced prototype.

results:

In the SAMI project, CREDI conducted a study of the various portals available on the market. It emerged from this study that the quality of the existing products was such that in the end the production of a prototype by CREDI was unnecessary. The report sent to the "Administration des Douanes et Accises" enabled them to choose a portal tool adapted to their needs and which could easily be administrated by them.

The project also enabled the unit to familiarize itself with the information and with the tools and methods in place at the "Administration des Douanes et Accises". CREDI thus defined various items of information to be integrated in the portal. The CRP - Gabriel Lippmann also increased its expertise in the area of knowledge management.

On the basis of the results obtained in the SAMI project, CREDI prepared a second project. The objective of this project will be to extend the work carried out, integrating in it both a workflow tool to model and automate the existing procedures and also applications existing within the "Administration des Douanes et Accises", while at the same time attempting to retain a certain harmony with the choices made in other administrations.

SICOV

title:

“Creation of a System based on new Information and Communication technologies facilitating the electronic business of virtual organizations.”

fields:

e-commerce, CSCW (Computer Supported Cooperative Work)

partner:

CEPS/INSTEAD

project leader:

Fernand Feltz

period:

November 2001 - October 2004

objective:

The research project aims to facilitate the cooperative work of several economic players through the specification, design, development and operation of an electronic platform. This platform should enable companies and public administrations to function in a network and represent a virtual organization to the external world.

The basis of the platform will be an information space common to all players. Tools of the CSCW (Computer Supported Cooperative Work) type used up to now for assistance in internal cooperation in companies will be analyzed with a view to enriching the platform of the virtual organization.

To locate a Luxembourg sector which has a development potential for the virtual organization operating mode, the CEPS/INSTEAD must assist the project with surveys in the field. The results of the surveys must supply information on the needs of companies and thus influence the design of the platform.

The knowledge of the “Chambre de Commerce” regarding nationals will be used to orient the survey and the design of the platform.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Safety and effectiveness of new e-business practices for all socio-economic players” programme.

results:

Following the project start-up work conducted in 2001, 2002 was dedicated to the specification of the SICOV platform. For this purpose, an analysis was conducted to determine the processes of creation of a virtual organization. This analysis led to an inventory of existing resources in the virtual management field (research projects, existing virtual organizations, theories, scientific publications) and to the acquisition of knowledge concerning the phases of the life cycle supporting this new form of organization, from its formation to its disbandment. This work continued with the drafting of a functional specification for the SICOV platform. The production of this specification will be finalized in 2003.



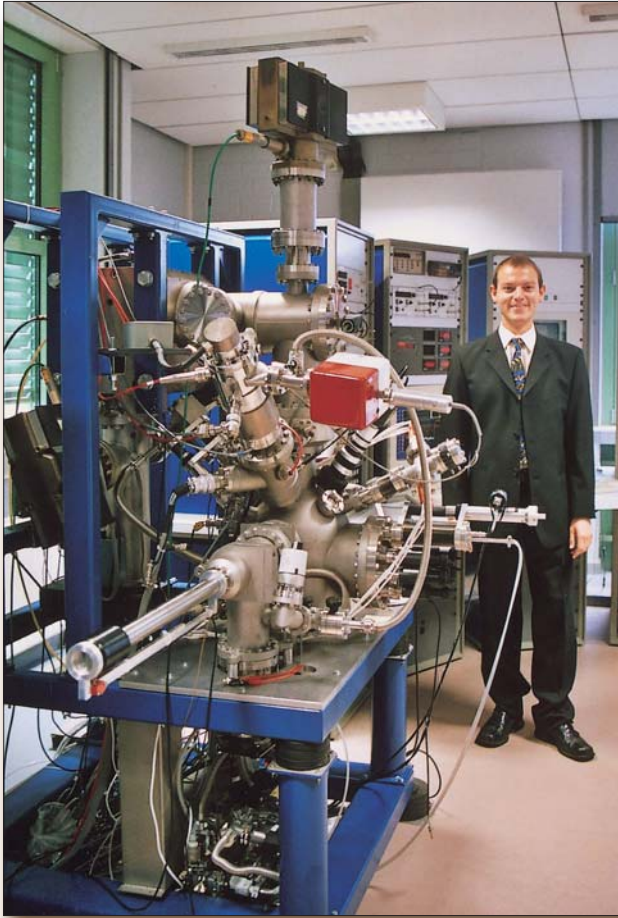
To identify and involve potential partners, the SICOV project plans the setting up of a public Internet site which will serve as a source of information and as an entry to the platform. Conceptual and technical studies have enabled the architecture and structuring of the site to be determined. For this purpose, commercial and open source technologies have been considered. The Internet site is scheduled to be on line at the beginning of 2003.

Technical studies have also been conducted with a view to the setting up of the platform: various CSCW tools have been installed in the laboratory, and functionality and integration tests have enabled the identification of several interesting tools for inclusion in the platform. More particularly, the SSO (Single Sign On) technique, enabling single identification of a

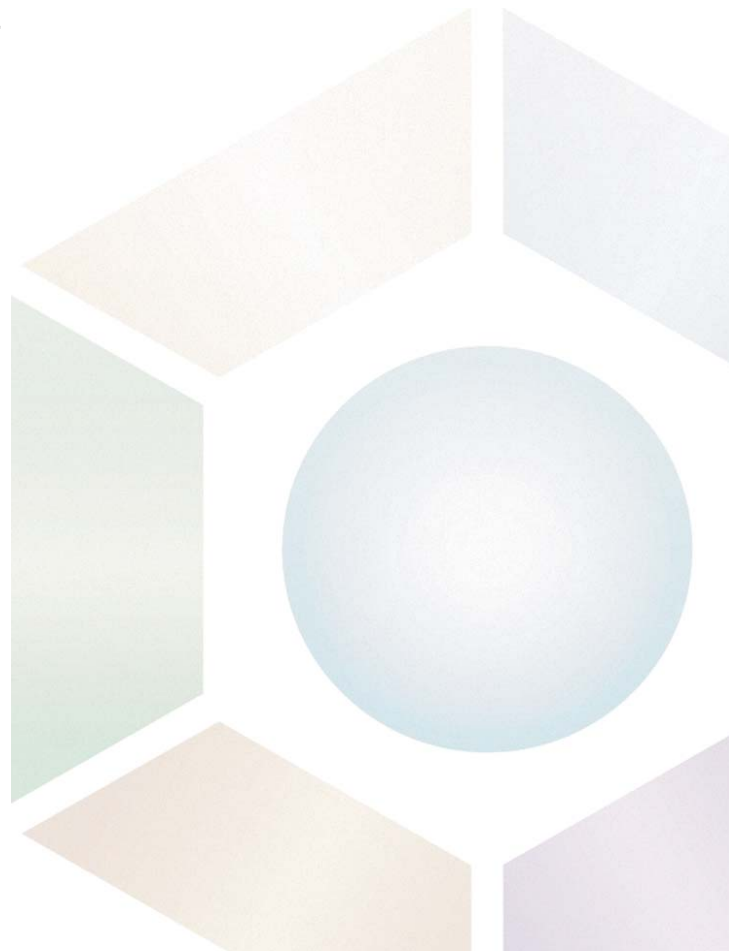
user in a heterogeneous environment, has been studied with a view to better integration of the applications.

The project team has attended numerous training courses and conferences to update and extend its expertise in the field of collaborative computing. A first scientific publication, which discusses the reduction of transaction costs and project work by several organizations in the face of NICTs, has been produced.

In order to better understand the real needs of a virtual organization, contacts have been initiated with organizations in the public and private sector. A survey questionnaire has been finalized in collaboration with the CEPS/INSTEAD. The ground has been prepared to start the implementation and analysis of the survey in 2003.



Presentation of the CMS prototype for defense of a thesis by Mr Tom Wirtz, a researcher at the LAM.





4. Laboratoire d'Analyse des Matériaux (LAM)

CENTREURO

title:

"European centre specialized in the characterization of materials on the nanometer scale"

field:

materials science

partners:

Céramétal (L)
Circuit Foil (L)
Ecole des Mines de Nancy (F)
Facultés Universitaires Notre-Dame de la Paix (B)
Goodyear Technical Center (L)
Pechiney-Eurofoil (L)
Université Catholique de Louvain-la-Neuve (B)

project leader:

Henri-Noël Migeon

period:

July 2001 - July 2004

objective:

Developments in the field of nano-materials imply an improvement in the performances of existing analysis techniques together with the development of new techniques. The "Laboratoire d'Analyse des Matériaux" (LAM - Material Analysis Laboratory) is developing three new techniques via European projects:

- Cation Mass Spectrometry
- Storing Matter
- Micro-XRF on synchrotron.

Financed by the "Fonds National de la Recherche" (FNR), CENTREURO complements the earlier projects on several levels:

- from an instrumental point of view, it will make it possible to attain, for the first time and routinely, a lateral resolution of 30 nm in SIMS;

- it will also enable SIMS and Auger to be combined at 30 nm. This new SIMS will then be very close to the final physical limits of this technique, the performances of which will have to be determined;
- it will enable feasibility studies for Luxembourg industries to be conducted using the complementarity potential of the SIMS, CMS, TEM, SEM, and micro-XRF techniques on synchrotron and Storing Matter;
- finally, it plans to make scientific equipment available for the biology/environment projects of the FNR.

All of these projects will enable the creation at the CRP-Gabriel Lippmann of a European Centre specialized in the characterization of materials on the nanometer scale. The centre will accommodate European physicists specialized in the design of new equipment together with users for the biological, medical

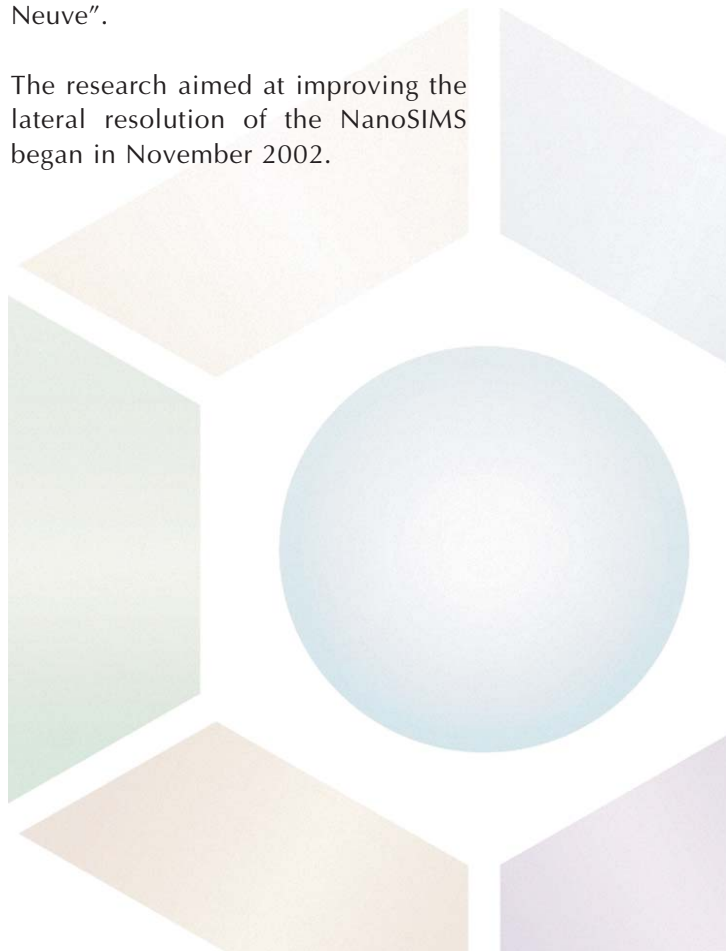
and material science applications.

This project is financed by the "Fonds National de la Recherche" (FNR) as part of the "Innovative materials and nanotechnology" programme.

results:

The NanoSIMS and NanoAuger equipment installed at the LAM have achieved the expected initial performances. The lateral resolutions of 50 and 20 nm are obtained respectively in SIMS and in Auger. The training of the LAM analysts on this equipment has been completed, which allows the first research to be carried out in particular with Céramétal, Circuit Foil, Goodyear, Pechiney-Eurofoil, the "Ecole des Mines de Nancy", the "Facultés Universitaires Notre-Dame de la Paix de Namur" and the "Université Catholique de Louvain-la-Neuve".

The research aimed at improving the lateral resolution of the NanoSIMS began in November 2002.





CMS

title:

"Cation Mass Spectrometry (CMS):
surfaces and interfaces"

fields:

scientific instruments, materials
analysis

partners:

Cameca (F)
Ecole des Mines de Nancy (F)
Ion ToF (D)
Orsay Physics (F)

project leaders:

Henri-Noël Migeon (CRP - Gabriel
Lippmann)
Hubert Scherrer (Ecole des Mines de
Nancy)

period:

April 1996 - December 2002

objective:

The work on cationization performed
by a growing number of laboratories
specialized in SIMS has made possi-

ble to update the analytic potential of
this technique, in particular for the
quantitative analysis of complex
materials.

The LAM, which works actively in this
field, has developed a new instrument
entirely designed to form cationized
species under optimum conditions:
the Cation Mass Spectrometer (CMS).

results:

2002 was devoted to completing the
characterization of the CMS equip-
ment. The neutral caesium jet devel-
oped by the LAM has yielded very
good results on this machine and the
CRP - Gabriel Lippmann has regis-
tered a patent in this field in the
United States. The same patent will
be extended to Europe and Japan.

This equipment, which is consider-
ably more sensitive than the current
market equipments, is now opera-
tional for the service analysis of
industrial samples.

MICRO - XRF**title:**

“Synchrotron Microanalysis: accurate elemental analysis on the microscopic level”

fields:

scientific instruments, materials analysis

partners:

Atomic Energy Research Institute, Budapest (HU)
 European Synchrotron Radiation Facility, Grenoble (F)
 Institute of Nuclear Research of the Hungarian Academy of Science (HU)
 Joint Research Centre, Geel (B)
 Karlsruhe Research Centre (D)
 University of Antwerp (B)
 University of Oxford, Materials science (UK)
 University of Southern Denmark (DK)

project leaders:

Freddy Adams (Coordinator of the MICRO – XRF European project, University of Antwerp)
 Henri-Noël Migeon (CRP - Gabriel Lippmann)

period:

January 2001- June 2004

objective:

This European project is aimed at chemical analysis of traces (ppm and sub-ppm) in microscopic particles. For this purpose, the “Microbeam synchrotron radiation X-Ray Fluorescence (m-SRXRF)” method will be developed as the primary reference method. This will be used to validate other analysis techniques and manufacture standard samples which can be used on the microscopic scale. This project envisages the comparison of m-XRF with the SIMS, XPS, m-PIXE and AES techniques. It will result in the setting up of a new European network for analysis on the microscopic scale.

This project is financially supported by the European Commission as part of the 5th FP.

results:

2002 was essentially devoted to m-XRF measurements on the ID18F line of the Grenoble synchrotron. The results are in good agreement with the simulations carried out beforehand. In 2003, the work package “comparison of m-XRF with SIMS, XPS, m-PIXE, AES techniques” will be carried out under the coordination of the LAM.



NANO - ENVIRON

title:

"Analysis of environmental samples on the nanometer scale"

fields:

Nano-SIMS, environment

project leaders:

Lucien Hoffmann
Henri-Noël Migeon

period:

October 2002 - September 2005

objective:

At present, analysis techniques based on the use of an electron beam allow a resolution of about one nanometer. Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) have therefore largely been used for the study of biological tissues and environmental samples. However, by their very nature, TEM and SEM do not provide organic or isotopic information and remain limited to the study of the major elements constituting biological tissues.

Secondary ion mass spectrometry (SIMS), in addition to analysis of major elements and also traces, allows isotopic markings to be monitored. It can also provide organic information.

However, SIMS has up to now been limited to a spatial resolution of 300-500 nm, which is insufficient to carry out pertinent studies requiring determination of intracellular distri-

butions or distributions at the extreme surface of contaminated environmental samples.

The CENTREURO project, specialized in the characterization of materials on the nanometer scale, which has began in July 2001 as part of the NANO programme, envisages the acquisition of new equipments and improvement of actual SIMS equipment to attain 30 nm resolution. Such a resolution coupled with complementary techniques will enable the development and application of measurements at the nanometric level based on mass spectrometry, particularly secondary ion mass spectrometry (SIMS).

The study may then look at biological systems and environmental samples, particularly for work on micropollutants and their accumulation on and in living tissues.

This project is financed by the "Fonds National de la Recherche" (FNR) as part of the "Innovative materials and nanotechnology" programme.

results:

To begin with, a bibliographical study was conducted to determine the possibilities and potential applications of secondary ion mass spectrometry. The various SIMS techniques (static and dynamic states, Nano-SIMS imaging) all represent complementary and innovative tools in a number of fields of environmental chemistry:

- firstly, Static-SIMS (or Time-of-

Flight SIMS) will be used to detect and quantify polar pesticides from aqueous solution. The organic information obtained by S-SIMS, together with its great sensitivity, will make it possible to analyse molecules usually incompatible with conventional analytical techniques. Previous studies have shown that the glyphosate and 2,4,5-T detection limits could reach 10 ppb using this technique.

- secondly, Dynamic-SIMS, which produces elementary and isotopic information, will be used to characterize the mineral phosphorus particles present in waters, in order to determine their origin.
- finally, the possibilities of

elementary “mapping” and the high spatial resolution of Nano-SIMS will be put to use to study the sub-cellular distribution of metallic and/or organohalogenated pollutants in living tissues of vegetable or animal origin.

In addition to the SIMS analyses, a mass spectrometer for gaseous phase chromatography has been acquired, together with a high-pressure extractor. This equipment will reinforce the analytical potential of the LAM and will enable the study of numerous types of pollutants (PCB, PAH, pesticides, dioxins) contained in a wide range of samples (waters, soils, plants).

OPTIMAT

title:

“Optimization of the materials produced by Goodyear, Céramétal and Pechiney-Eurofoil using material analysis techniques on the nanometer scale”

field:

materials science

partners:

Céramétal (L)
Goodyear Technical Center (L)
Pechiney-Eurofoil (L)

project leaders:

Gérard Barbier (Céramétal)
Benoît Charrier (Pechiney-Eurofoil)
Henri-Noël Migeon (CRP - Gabriel Lippmann)
René Zimmer (Goodyear)

period:

March 2002 - February 2005

objective:

This project deals with material analysis on the nanometer scale for the three partner industries:



- in-depth "academic" knowledge of the material, of the manufacturing process and of the state of the art of "material analysis on the nanometer scale";
 - optimization of analysis equipment for each material, together with the development of procedures enabling quantitative measurements;
 - production of a database and preparation of standards for each material;
 - setting up of procedures enabling good reproducibility of short-term and long-term measurements.
- results:**
confidential

POLYMERES

title:

"Study of the relationships existing between the structure of polymers as a starting product and their degree of reticulation in the finished product"

field:

materials science

partners:

Goodyear Technical Centre (L)
LSMCL de l'Université de Metz (F)

project leaders:

Henri-Noël Migeon (CRP - Gabriel Lippmann)
Jean-François Muller (Université de Metz)
René Zimmer (Goodyear)

period:

January 1999 - December 2002

objective:

Polymers such as those used by Goodyear as starting products for the production of tyres can vary considerably:

- different polymers (synthetic or natural);
- different degrees of polymerization;
- different microstructures (structural sequence, molecular weight, tacticity).

The objective of this project is to study the effect of these parameters (in particular the terminal groups of the polymer chains, the tacticity and the monomer blocks) on reticulation. As this reticulation has a crucial effect upon the mechanical properties of tyres.

It has been planned to study various polymers, before and after vulcanization, with or without mineral loads, polymers grafted or adsorbed on the mineral loads, in order to understand the deterioration tendencies of these polymers.

results:
confidential

STORING MATTER

title:

“Sputtering matter onto storage plates for delayed quantitative investigations, against fraud, of organic and inorganic samples”

fields:

scientific instruments, materials analysis

partners:

Cameca (F)
Facultés Universitaires Notre-Dame de la Paix, Namur (B)
Goodyear Technical Centre (L)

project leader:

Henri-Noël Migeon

period:

July 2001 - June 2005

objective:

This European project aims to develop a new technique for analysis of solids. For this purpose, equipment will be developed at the LAM and

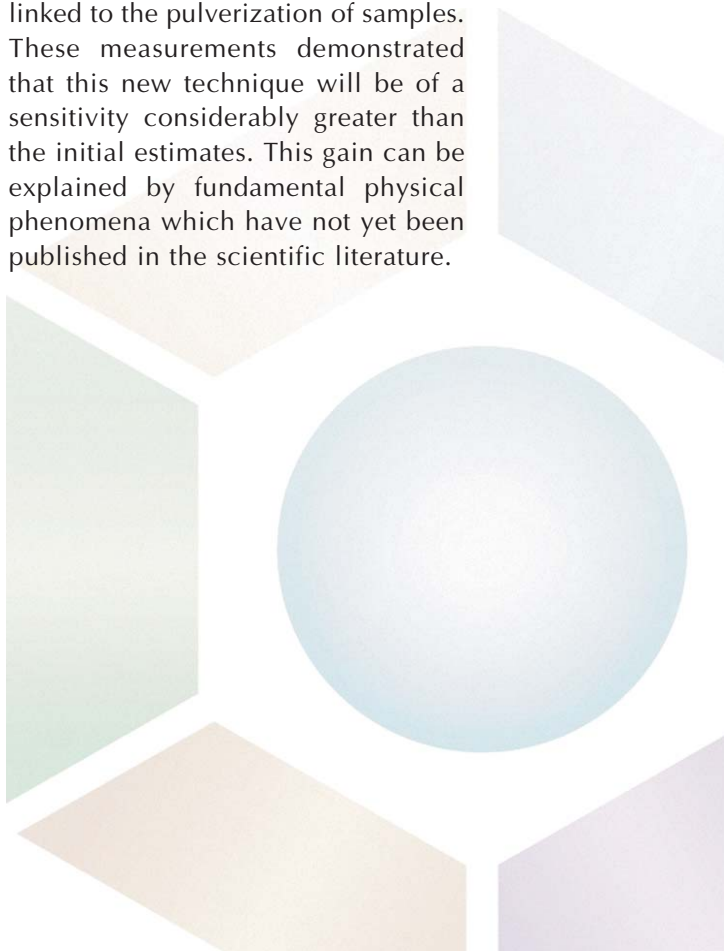
will essentially be composed by three ultra-vacuum chambers:

- chambers enabling the production of the storage plates by MBE, CVD, ionic descaling and heat treatment;
- a (confidential) chamber for pulverization of the samples to be analyzed;
- chambers for transfer to the surface analysis techniques of the LAM and the “Facultés Universitaires Notre-Dame de la Paix”.

This project is financially supported by the European Commission as part of the 5th FP.

results:

2002 was devoted to experimental determination of important parameters linked to the pulverization of samples. These measurements demonstrated that this new technique will be of a sensitivity considerably greater than the initial estimates. This gain can be explained by fundamental physical phenomena which have not yet been published in the scientific literature.





TEM - AFM

title:

“Development of analytical methods based on atomic force microscopy (AFM) and transmission microscopy (TEM) for the characterization of tyres on the nanometer scale”

field:

materials science

partner:

Goodyear Technical Center (L)

project leaders:

Henri-Noël Migeon (CRP - Gabriel Lippmann)
René Zimmer (Goodyear)

period:

July 2002 - March 2003

objective:

The aim of this project is to contribute

to the improvement of tyre properties. To do this, it is necessary to combine the information supplied on the nanometer scale by the AFM (Atomic Force Microscopy) and TEM (Transmission Electron Microscopy) techniques with the macroscopic characteristics of tyres.

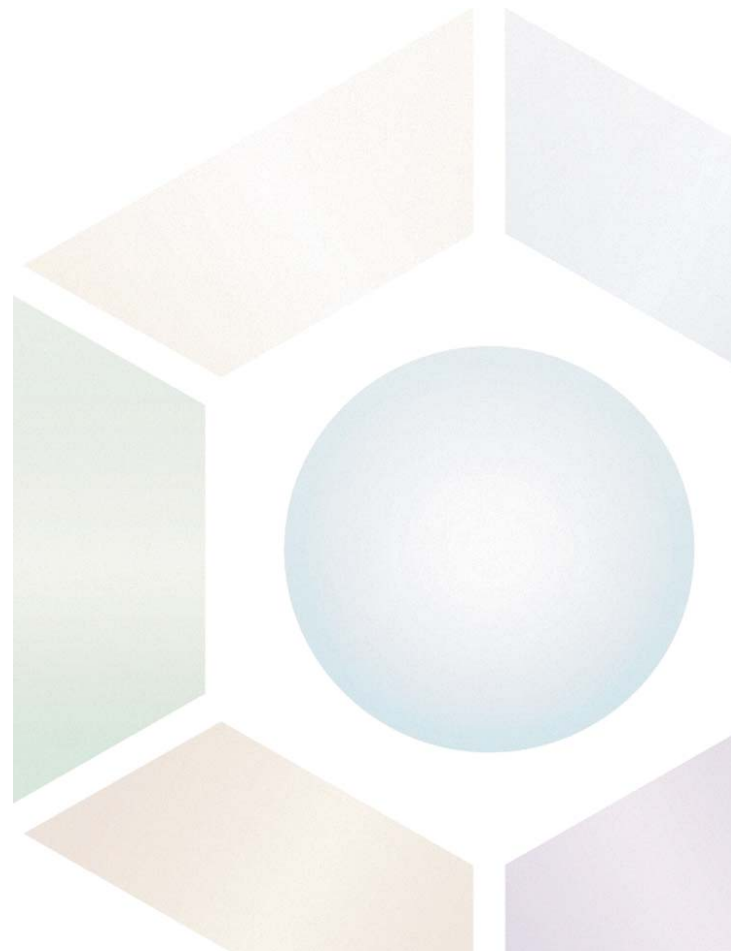
The innovative part of this project lies in the use of the additional information supplied by the AFM and TEM techniques in order to correlate the molecular properties with the macroscopic characteristics of the end product. The knowledge provided by this project will be used to determine the role of each polymer in the tyre manufacturing formula.

results:

confidential



Meting in the “Laboratoire de Droit Economique”





5. Laboratoire de Droit Economique (LDE)

A E D B F

title:

“The legal aspects of financial Europe”

field:

banking and financial law

partner:

Association Européenne pour le Droit Bancaire et Financier

project leader:

André Prüm

period:

July 2000 - June 2002

objective:

The creation of a large market for financial, banking and investment services is one of the European Union's priorities. Several directives govern the operations of credit companies, investment houses, and the financial markets. The Economic and Monetary Union, the growth in electronic commerce, the concentration trends, and the increased integration of the financial markets all promote the attractiveness to players of having a “European passport”.

In its action plan of 11 May 1999, the European Commission set itself the objective of adopting a series of short-term measures aiming at improving the single market in financial services over the next five years.

The plan proposes indicative priorities and a schedule for the measures (statutory and other) that should make it possible to attain three strategic goals:

- set up a single market of wholesale financial services;
- ensure that the retail markets are accessible and reliable;
- modernize the prudential and surveillance regulations.

In order to monitor the programmed changes in standards regulating the activity of banks and investment companies and the functioning of financial markets, the “Laboratoire de Droit Economique” (LDE - Economy Law Laboratory) and the “Association Européenne pour le Droit Bancaire et Financier” have decided to jointly create a vast database of knowledge on European banking and financial

law accessible on the Internet. The database when complete should list all the community texts (extracts from treaties, directives, proposals and draft directives), together with information for their precedential, doctri-

nal and administrative interpretation.

Furthermore, a discussion forum will be offered to the public in order to promote discussion on European banking and financial law.

CYBERBANK

title:

“Cyberbanking and Law”

field:

new information technologies

partner:

Universität des Saarlandes (D)

project leader:

André Prüm

period:

December 2000 - January 2002

objective:

Creation of a platform for technical and legal monitoring of “online” banking and stock market activities

results:

At the end of 2000, LDE and the “Institut für Rechtsinformatik” of the “Universität des Saarlandes” (IRI) jointly embarked upon a project aiming at examining and presenting the main

legal issues arising from the use of the Internet by banks for customer relations purposes. The study has led to the development of a prototype Internet site available at www.cyberbanking-law.lu. The site presents the results of the study broken down by sections according to the various legal sources (statutes and other forms of regulation, jurisprudence, doctrine...) as well as according to themes (security issues).

A regular publication (Cyberbanking & Law Journal) adds analyses on current issues. All the information is presented in summary form to make it easily accessible to anyone (engineers, managers, legal professionals...) interested in the subjects covered. References to more complete sources make it possible to find more information on the subjects.

Considering the success of this project, LDE now proposes that the prototype site be made permanent.



EFFICIENT

title:

“Efficient: e-business framework for an efficient capture and implementation of end-to-end transactions”

fields:

e-business, legal feasibility of transactions

partners:

CRP - Henri Tudor
Institut Supérieur de Technologie

project leaders:

Eric Dubois (CRP - Henri Tudor)
André Prüm (CRP - Gabriel Lippmann)

period:

November 2001 - October 2004

objective:

The aim of the EFFICIENT project is to study and facilitate:

- the identification of e-business transactions with high added value

for the economic players concerned (small businesses, companies, individuals, administrations);

- the logical representation of the contents of the transaction in terms of messages exchanges and rules applied, in order to be able to verify its feasibility before its implementation and its deployment in the applications.

All of the tools will allow any company or administration to validate, both at the business level and in terms of organizational feasibility, the imagined B2B and B2C transactions.

In scientific terms, this cooperation will be extended by the development of plans for use of the results in a national e-business expertise centre.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Safety and effectiveness of new e-business practices for all socio-economic players” programme.

FAILLITE

title:

“Introducing a bankruptcy prevention system to Luxembourg law”

field:

commercial law

partner:

Ministère de la Justice

project leaders:

Françoise Pérochon (Université de Montpellier)

André Prüm (CRP - Gabriel Lippmann)

period:

January 1997 - December 2002

objective:

Upon the demand of the “Ministère de la Justice”, the “Laboratoire de Droit Economique” is preparing a reform of the Luxembourg laws concerning bankruptcy and protection of companies in difficulties.

The project consist of, in the first instance, preparing a draft law that modernizes the “controlled management” procedure, created by a decision of the Archduke on 24 May 1935. The aim of the new law is to provide increased protection against bankruptcy and liquidation to companies whose financial situation has not yet become completely hopeless.

This first study will be followed by an analysis of the bankruptcy law aiming at making judicial liquidation more

effective and to fight fraudulent bankruptcies.

It has been planned to add to this law a simplified contractual procedure for amicable settlements intended for companies that are experiencing temporary financial difficulties without having suspended payments.

results:

The LDE has contributed to the drafting of the law of 31 March 2000 concerning the effects of property reserve clauses in sales contracts and which modified some sections of the commerce law.

Following this, it prepared a first draft of a law reforming the controlled management procedure. This draft is seeking to expand the options for adopting restructuring plans for companies, either by sale of its business or all or part of its assets to a third party under conditions more favourable than in the event of bankruptcy. With this goal in mind, the draft creates a new balance between the rights of different categories of creditors and increases the intervention powers of the courts. This proposal is in line with recent trends in comparative law and in particular it is influenced by the new Belgian laws on judicial concordat and, to a lesser degree, by the French law on bankruptcy reorganization proceedings.

A first version of this draft bill was submitted to the “Ministère de la



Justice" and to the working group on bankruptcy law of the "Commission d'Etudes Legislatives" instituted with the "Ministère de la Justice". The proposals of the LDE were closely examined within this framework. Discussions were conducted with the working group on bankruptcy law, chaired by Maître Jacques Delvaux and composed of members of the Bench and public prosecutors, together with representatives of the bar and the professional chambers. These discussions enabled the proposed text to be compared with the expectations and needs not only of the courts but also of practitioners, and led to numerous new suggestions.

To take into account these suggestions, in 2001 the LDE drafted a new version of its project. New discussions with the "Ministère de la Justice" and the working group on bankruptcy law, completed in the first

half of 2002, enabled the preparation of a considerably modified version of the draft bill. This was submitted to the "Ministère de la Justice" in December 2002 and should soon lead to the official tabling of a bill.

In addition, the LDE research team worked out a series of measures aimed at preventing over-rapid deterioration of the financial situation of struggling companies:

- by introducing greater transparency in securities and privileges liable to put a strain on their capital;
- by enabling the court to take note sufficiently early of payment incidents or debt accumulations so that it can decide on the necessary measures;
- by encouraging debtors to seek a safeguard measure before their situation becomes hopeless.

SECOM

title:

“Legal security of electronic commerce, particularly of signatures and electronic payments”

fields:

e-business, legal security of electronic signatures

partner:

Centre de Recherche Informatique et Droit des Facultés Notre-Dame de la Paix de Namur (B)

project leaders:

André Prüm
Valérie Raynaud

period:

October 2002 - October 2005

objective:

The proposed research project consists in examining the legal risks linked to the development of electronic commerce and studying the various modes of regulation possible to ensure its security in legal terms, and more particularly the questions linked to the use of electronic signatures in the various forms of “on-line” commerce and to electronic payment solutions.

All of these fields will be examined in technical and organizational as well as legal terms, within the framework of a multidisciplinary approach.

The research is intended to lead to precise suggestions to increase the legal security of electronic commerce through legislative reform proposals, and the creation of models for codes of good conduct and models for organization of contractual relations. Technological monitoring of ongoing research and the solutions envisaged at the international and comparative level will be proposed on an Internet site.

This project is financed by the “Fonds National de la Recherche” (FNR) as part of the “Safety and effectiveness of new e-business practices for all socio-economic players” programme.

results:

In the first two months, the LDE devoted itself essentially to forming the hard core of the team dedicated to this project, obtaining the necessary documentary resources and conducting an examination of the clauses of Luxembourg positive law designed to provide a certain legal security for on-line transactions.



SOCOM II

title:

“Modernization of the law of 10 August 1915 on commercial enterprises - II”

fields:

company law, finance law, securities law (contracts)

partner:

Ministère de la Justice

project leaders:

Isabelle Corbisier
André Prüm

period:

July 2001 - June 2004

objective:

The mission taken on by the LDE has the double objective of informing and assisting the “Ministère de la Justice” in Luxembourg corporate law reform work. The first task, presently completed, entailed developing an information tool for the public on current Luxembourg company law with a presentation making it possible to compare this law with those of Belgium and France, which represent the most direct sources of inspiration for Luxembourg legal experts. In 2000, a publication with the results of this project was published within the framework of the first SOCOM project.

The second task builds upon the first and entails assisting the Luxembourg government with the drafting of reform

projects aiming at modernizing the company law in line with the developments in neighbouring countries.

results:

After finalising the comparative study of corporate law in Luxembourg, Belgium and France in 2000, the LDE team undertook in-depth discussions with the corporate law working group linked to the “Ministère de la Justice” concerning the advantages and inadequacies of Luxembourg positive law.

Moreover, the Internet site of LDE contains a wealth of documentation on the subject, including the updated versions of Luxembourg, Belgian and French company statutes.

In 2001, the LDE met on numerous occasions with the corporate law working group of the “Commission d’Etudes Legislatives”, chaired by Maître Jacques Loesch. The discussions concerned the orientations to be adopted for a future bill. Several priorities were defined and the LDE was invited to submit text proposals.

The team thus worked on a project for reform of company merger, division and restructuring law. The envisaged reform is ambitious since it aims to introduce, in Luxembourg company law, fully new legislation for transfers of universalities, branches of activities and professional assets in general, while at the same time making substantial modifications to certain existing rules.

After discussions with the corporate law working group, the draft bill produced by the LDE was submitted to the “Ministère de la Justice” which presented it to the Cabinet. The proposal received a very favourable reception leading to the tabling, at the “Chambre des Députés”, of bill no. 4992 amending the law of 1915 on commercial companies, comprising far-reaching reform of Luxembourg law on company restructuring (mergers, splits, contributions of assets, branches of activity and universal assets, transfer of professional property).

Apart from this, in addition to the continuation of the huge work of

global reform of corporate law, carried out using the comparative table of legislations drafted by the LDE, efforts were concentrated this year on the adoption of measures designed to ensure the implementation of European regulations concerning European company status.

Given that Luxembourg wishes to be among the first states in the European Union to have a functional status for this new community-level entity, the LDE drafted two extremely detailed memoranda on this subject. These have been discussed and reworked, and the preliminary work should be completed at the beginning of 2003.

SÛRETES

title:

“General evaluation of real securities and privileges in Luxembourg law”

fields:

commercial law, banking and financial law

partner:

Ministère de la Justice

project leader:

André Prüm

period:

May 2001 - April 2002

objective:

- preparation of an annotated collection on the various legal texts in effect in the fields of bankruptcy, composition, and controlled management;
- analysis and summary of the jurisprudence relating to these texts.



results:

The financing of companies, like the financing of private individuals, largely depends on the guarantees they can obtain. In this respect, the transparency of the capital situation of the borrowers and of their guarantors is considered to be absolutely essential. Now such transparency is far from being guaranteed under Luxembourg law because of the many privileges and securities liable to cripple, in a more or less concealed way, the capital of any person (concealed privileges and mortgages of the Treasury, failure to publicize property reserve clauses or leasing contracts).

For many years this situation has seemed all the more regrettable because of the increasing numbers of texts instituting new privileges or guarantees. Since the beginning of the fifties, no less than 300 legislative texts have been adopted which provide for such rights of preference. At the same time, case law no longer seems capable of ensuring the consistency of these countless texts.

The LDE has carried out in-depth research on all the texts concerned in order to draw up a precise assessment of positive law.

TITRISATION

title:

“International securitization”

period:

July 1998 - June 2002

fields:

financial law, banking law and comparative law

objective:

Development on behalf of the Luxembourg association of banks and bankers (ABBL) of a draft law aiming at organizing and regulating securities operations.

partner:

Association des Banques et Banquiers Luxembourg (ABBL)

results:

The text of this draft law was prepared. It stipulated a fair balance between the interests of the economic players wanting to free their balance sheet of certain assets or free them-

project leaders:

Alain Couret (Université de Paris I / Sorbonne)
André Prüm (CRP - Gabriel Lippmann)

selves of the expense of certain risks, and the interests of investors financing the acquisition of these assets or risks.

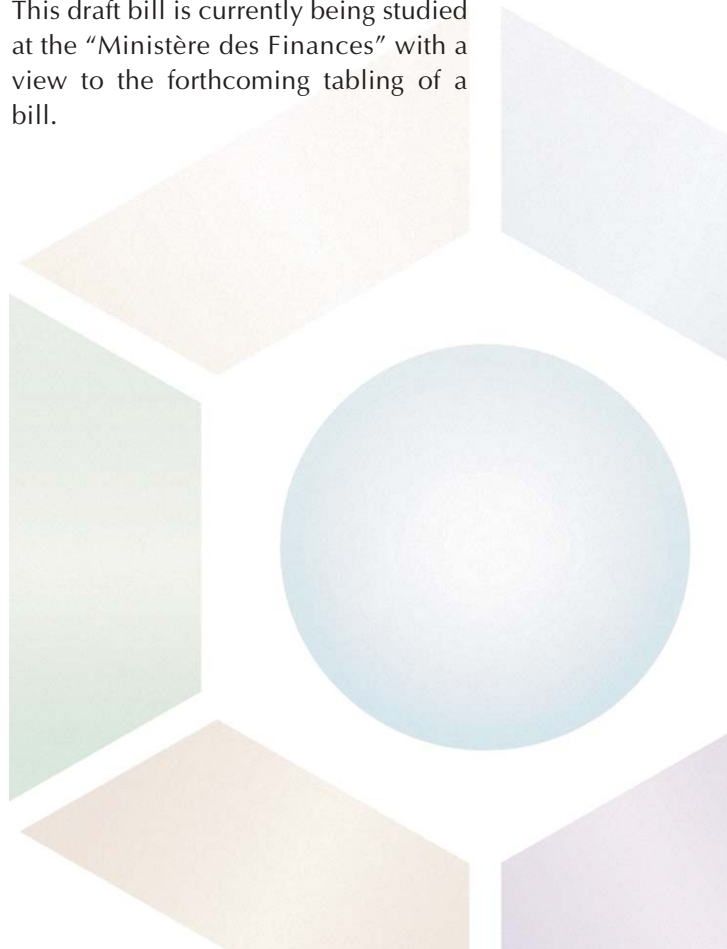
In order to attain maximum flexibility, it has been suggested that the “vehicle” can take the form of an investment company or a purely contractual form based on the fiduciary technique. In the same vein, it has been suggested to establish the lightest possible rules for securities firms that do not publicly appeal to savers.

Although the operation shares some of the characteristics of other forms of collective savings management, the special economic features of securities do not enable them to be considered as simple savings collection operations. Rather than adapting OPC rules, the researchers have preferred to suggest a separate regulatory framework. Nevertheless, the surveillance authority remains greatly influ-

enced by that existing for OPCs.

During 2000, the draft law has been submitted to the “Ministère des Finances” and to the “Comité pour le Développement de la Place Financière” (CODEPLAFI) for discussion. The CODEPLAFI legal experts' committee met on numerous occasions with the LDE in 2001 and 2002 to examine the project in detail. Important amendments were made to this project, notably to accommodate new activities liable to be developed in the financial market. In parallel with this, the tax and accounting system for securitizations was defined.

Following these discussions, the LDE prepared for CODEPLAFI a new version of the draft bill comprising a detailed commentary of all the clauses. This draft bill is currently being studied at the “Ministère des Finances” with a view to the forthcoming tabling of a bill.





6. Cellule "Statistique et Décision" (STADE)

ELUES

title:

"Expectations and experiences of women and men elected in 1999-ELUES"

fields:

gender studies, political science, sociology, statistic

partners:

ILReS
Ministère de la Promotion Féminine

project leader:

Fernand Fehlen

period:

December 2000 - April 2002

objective:

The purpose of the ELUES project was to perform a follow-up study of the women and men elected to communal councils in order to identify and analyse their experiences, expectations and hopes.

The project will provide a complete and detailed description of the women currently active in politics. It will assess their activities and positive and negative experiences in

order to understand the causes of under-representation of women in politics (while taking into account both cultural and political aspects). The project will attempt to identify family and professional backgrounds that tend to promote political involvement. This will lead to practical recommendations for the legislator, on the one hand, and for political parties that may develop codes of good conduct for the promotion of female participation in politics, on the other.

The methods used are numerous and include qualitative and quantitative methods of analysis of the data collected by semi-directive interviews, standardized questionnaires and participant observation. A particularly innovative methodological aspect, which is part of the CRP's mission of technological surveillance and diffusion of leading-edge expertise, will be computer-assisted qualitative data analysis (CAQDA) thanks to the QSR Nvivo software.

This project was taken over by the research structures of the "Centre Universitaire" of Luxembourg on the 1st of May 2002.

OSU

title:

“OSU: an Urban Social Observatory for the town of Esch-sur-Alzette”

fields:

social sciences, spatial data analysis

partners:

Centre Universitaire de Luxembourg (Projet GER FOREG, Forschungsstelle für regionale Jugendhilfeforschung, Université de Trèves, D) Ville d’Esch-sur-Alzette

project leader:

Fernand Fehlen

period:

August 2001 - April 2002

objective:

Even though Luxembourg is a rich country, it is faced with situations of social distress perceived by the people concerned as being all the more degrading because they feel marginalized by the context of prosperity in which they live.

Following to the Nice summit, all the member countries of the European Union will work out a national plan of action against poverty and social exclusion (PNAincl) and in this context Luxembourg must both apprehend the exclusion problem and develop strategies to combat all forms of it. The proposed project fits into this perspective while at the same time offering an original

approach which has already proved itself in neighbouring countries.

It is at the urban level, both in traditional towns and in the new urban communes, that social problems are articulated today. It was for this reason that, in Germany, the “Soziale Stadt” programme (Bund-Länder-Programm “Stadtteile mit besonderem Entwicklungsbedarf-die soziale Stadt”) and, in France, the municipal contracts to promote urban social development, were introduced. A corollary and prior condition for such programmes is knowledge of the social situation at the urban level.

It is above all in Germany that there is a forty-year-old tradition of social relations at the communal level (kommunale Sozialberichterstattung) which can inspire this work.

The unit proposes to study the transfer of this model to Luxembourg. Alongside the theoretical section produced in collaboration with the “Forschungsstelle für regionale Jugendhilfeforschung” located at the University of Trier, the project will also include the practical implementation of the concept by a concrete study carried out for the town council of Esch-sur-Alzette.

To produce the model report, the project will use two completely opposing and complementary methods:



- a statistical approach which will describe as accurately as possible the situation of the town on the basis of the existing data:
 - IGSS files containing socio-demographic and socio-economic variables of employees and employers
 - ADEM files to describe job seekers
 - SNAS files grouping together information on persons receiving "RMG" benefit
 - the results of the 2001 census which constitute an incomparable source because of this census's detailed and up-to-date nature.
- a qualitative approach which will use field surveys conducted both among the administration and among the population to expand the statistical analysis. It will use both semi-directive interviews and other research-action methods (such as group discussion between the various players involved).

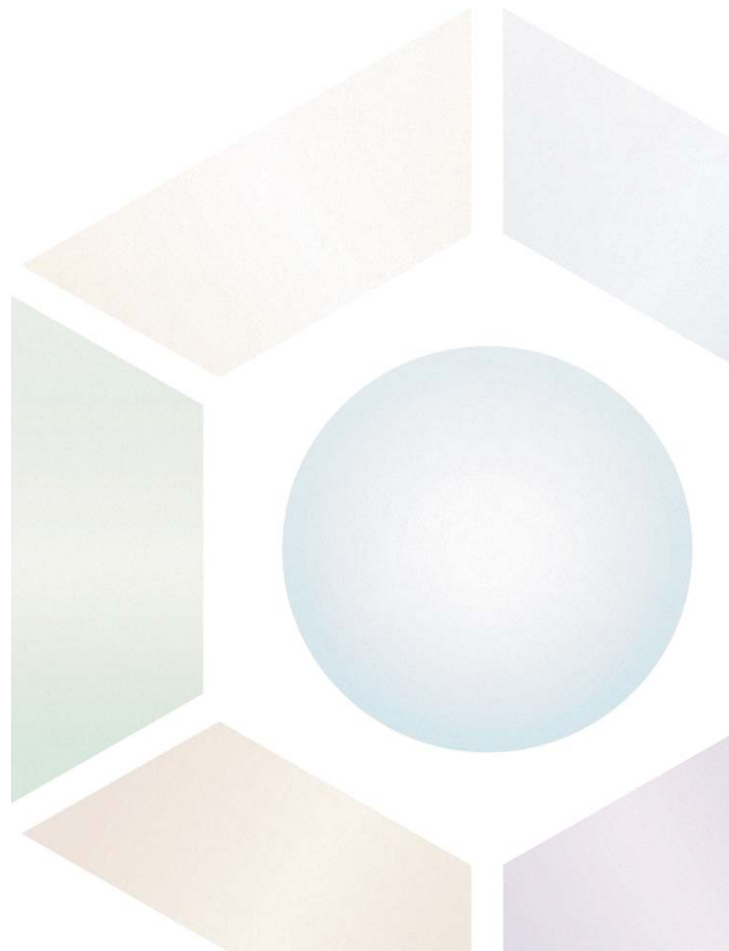
The CRP Gabriel - Lippmann will take part above all in the statistical studies and will publish a demographic and social atlas of the town of Esch-sur-Alzette, while the University of Trier will take part above all in the qualitative studies.

This is the first time the STADE unit has dealt with spatial analysis and used a GIS (Geographic Information System);

This project was taken over by the research structures of "Centre Universitaire" of Luxembourg on the 1st of May 2002.



Seminar on cryptology organised for information technology specialists





7. Cellule de Sciences Humaines et Sociales

SIDLUX

title:

“History of the Luxembourg metallurgical industry, 1840-1975”

field:

contemporary history

partners:

Centre d'études et de recherches
Robert Schuman, Luxembourg
Fondation Bassin Minier
Ministère de la Culture
Séminaire d'histoire contemporaine
du Centre Universitaire

project leader:

Monique Kieffer

period:

July 1998 - December 2002

objective:

The goal is to study the history of the metallurgical industry in the Grand

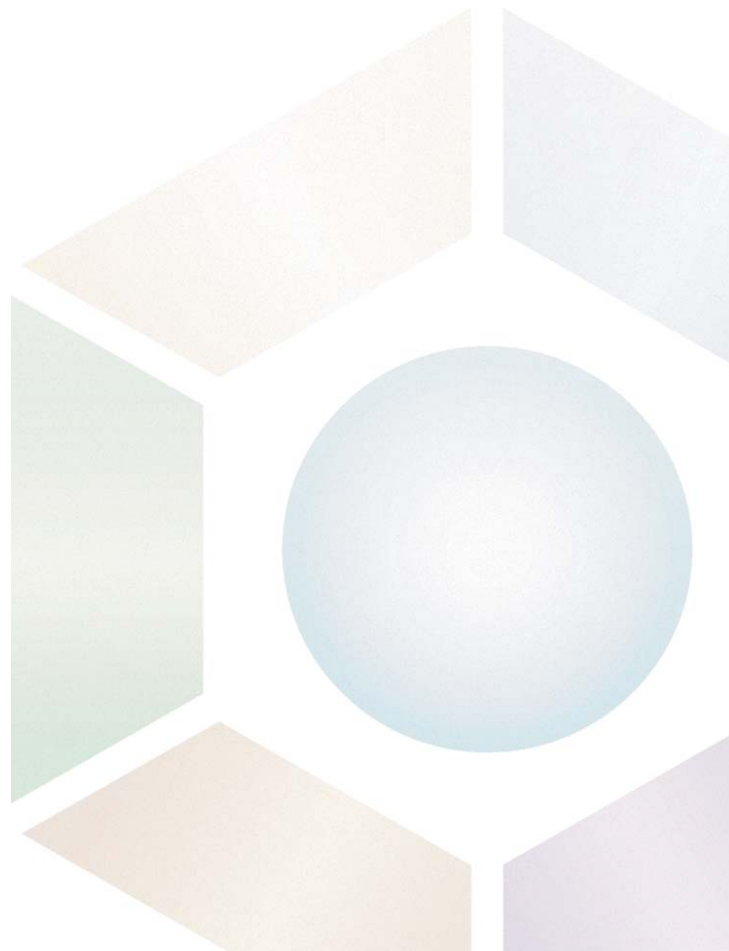
Duchy of Luxembourg while placing it in a European and international context and taking into account its economic, technical, social and political aspects. The research will focus on the 1840s to mid-1970s period, thus covering the discovery of minette in southern Luxembourg through the deep international steel crisis that had a profound negative impact upon Luxembourg.

The research will among other sources be based on the large archives of ARBED which to a large extent have been placed in the national archives and have been inventoried within the framework of previous projects carried out by CRP - Gabriel Lippmann.

The project gathers together Luxembourg professors and researchers and university personnel from the Greater Region.



Official unveiling of the brand new Nano-SIMS 50 on the 9th of July 2002





IV. Appendix

B. International Publications

The results of research carried out by the scientists of the CRP - Gabriel Lippmann have been published in more than a hundred internal reports. Most of these reports are available from the secretariat of the CRP - Gabriel Lippmann. The most important results have been submitted for validation to the international scientific community. Below, the interested reader will find the list of publications and reports submitted to international journals or scientific colloquiums and accepted by these. This list also includes scientific reports authored or co-authored by a CRP - Gabriel Lippmann researcher, as well as the reports on work carried out in a CRP - Gabriel Lippmann laboratory aiming at leading to a university degree (DESS, DEA, ...).

It should be noted that following their transfer to the "Centre Universitaire", the "Cellule de Recherche en Economie Appliquée" (CREA - Applied Economics Research Unit) and the "Statistique et Décisions" (STADE - Statistics and Decision-making) research unit are not included in the list below. Only publications by units and laboratories under the authority of the CRP - Gabriel Lippmann at the end of 2002 are listed.

1. CREBS

C. BOUTTE, R. WILLAME, P. BALTHASART, L. HOFFMANN, A. WILMOTTE: "Dynamics of cyanobacterial populations in a freshwater lake: a polyphasic approach", proceedings of the "European Science Foundation Cyanofix symposium «Cyanobacterial nitrogen fixation: from molecules to ecological systems»", Tomar, Portugal, 2002

V. BOYKO, N. SENCHUGOVA, V. POLISHJUK, T. SHEVCHENKO, P. BOLTOVETS, L. HOFFMANN, I. KOSTIKOV: "Artificial infection of the soil green alga *Bracteacoccus minor* by the Tobacco Mosaic virus", proceedings of the "Symposium Biology and Taxonomy of Green algae IV", Smolenice, Slovakia, 2002

- H. M. CAUCHIE:** "Chitin production by arthropods in the hydrosphere", published in "Hydrobiologia", volume 470, 2002
- H. M. CAUCHIE, M.F. JASPAR-VERSALI, L. HOFFMANN, J.P. THOMÉ:** "Potential of using *Daphnia magna* (Crustacea) developing in an aerated waste stabilisation pond as a commercial source of chitin", published in "Aquaculture", volume 205, 2002
- E. CORING, L. ECTOR, G. FRIEDRICH, P.R. PEREIRA DE ARAUJO:** "Uso de sustratos artificiales para el seguimiento biológico de la calidad del agua con diatomeas en los grandes ríos del estado de Rio de Janeiro (río Paraíba do Sul, Brasil)", proceedings of the "VI Congreso Latinoamericano de Ficología & IV Reunión Iberoamericana de Ficología", Ponce, Puerto Rico, 2002
- T. DARIENKO, L. HOFFMANN:** "Algal growth on cultural monuments in Ukraine", in "Biologia", in press
- E. DEMCHENKO, A. MASSALSKI, I. KOSTIKOV, L. HOFFMANN:** "*Chlamydomonas ucrainica* sp.nov., a new species from the section Agloe", in "Biologia", in press
- A. DOHET:** "Are caddisflies an ideal group for the biological assessment of water quality in streams?", published in "Nova Suppl. Ent., Keltern", volume 15, 2002
- A. DOHET, D. DOLISY, L. HOFFMANN, M. DUFRÈNE:** "Identification of bioindicator species among Ephemeroptera, Plecoptera and Trichoptera in a survey of streams belonging to the rhithral classification in the Grand-Duchy of Luxembourg", published in "Verh. Internat. Verein. Limnol.", volume 28, 2002
- D. DOLISY, A. DOHET:** "The use of Ephemeroptera to assess aquatic biodiversity in the rhithral part of the Luxembourgish rivers", in "Proc. X Int. Conf. on Ephemeroptera, XIV Int. Symp. on Plecoptera", Perugia, Italy, in press
- G. DROGUE, J. HUMBERT, J. DERAISME, N. MAHR, N. FRESLON:** "A statistical-topographic model using an omnidirectional parameterization of the relief for mapping orographic rainfall", published in "Int. J. Climatol.", volume 22, 2002
- G. DROGUE, A. EL IDRISSE, L. PFISTER, T. LEVIANDIER, J.F. IFFLY, L. HOFFMANN:** "Calibration of a parsimonious rainfall-runoff model: a sensitivity analysis from local to regional scale", in A.E. Rizzoli, A.J. Jakeman (editors), "Integrated assessment and decision support. Proceedings of the First biennial meeting of the International Environmental Modelling and Software Society", volume 1, Lugano, Switzerland, 2002
- G. DROGUE, L. PFISTER, T. LEVIANDIER, J. HUMBERT, A. EL IDRISSE, J.F. IFFLY, L. HOFFMANN:** "Using 3D dynamic cartography and hydrological modelling for linear streamflow mapping", published in "Computers & Geosciences", volume 28, 2002
- G. DROGUE, T. LEVIANDIER, L. PFISTER, A. EL IDRISSE, J.F. IFFLY, F. GUEX, B. HINGRAY, J. HUMBERT, L. HOFFMANN:** "The applicability of a parsimonious model for local and regional prediction of runoff in basins with various physiographic characteristics", published in "Hydrol. Sci. J.", volume 47, 2002
- C. DURÁN, L. ECTOR, J. GOMÀ, J. CAMBRA:** "Diseño de una red de vigilancia de la calidad biológica del agua con diatomeas bentónicas en la cuenca del Ebro



- (España)", proceedings of the "XI Congreso de la Asociación Española de Limnología y III Congreso Ibérico de Limnología", Madrid, Spain, 2002
- L. ECTOR:** "Revisión de los principales índices, normas y técnicas basados en diatomeas bentónicas para la evaluación de la calidad biológica de las aguas continentales en Europa", proceedings of the "VI Congreso Latinoamericano de Ficología & IV Reunión Iberoamericana de Ficología", Ponce, Puerto Rico, 2002
- L. ECTOR, M. POULIN:** "Simposio internacional sobre diatomeas en Ottawa (Canadá)", proceedings of the "VI Congreso Latinoamericano de Ficología & IV Reunión Iberoamericana de Ficología", Ponce, Puerto Rico, 2002
- L. ECTOR, F. RIMET:** "Calidad del agua y tipología de las comunidades de diatomeas en los ríos de Luxemburgo", proceedings of the "VI Congreso Latinoamericano de Ficología & IV Reunión Iberoamericana de Ficología", Ponce, Puerto Rico, 2002
- L. ECTOR, F. RIMET:** "Tipología de las comunidades en los ríos de Luxemburgo", proceedings of the "XI Congreso de la Asociación Española de Limnología y III Congreso Ibérico de Limnología", Madrid, Spain, 2002
- L. ECTOR, L.N. BUKHTIYAROVA, R. ISERENTANT:** "Taxonomy, morphology and biogeography of the group *Achnanthes subhudsonis* Hustedt sensu lato (Bacillariophyta)", proceedings of the "17th International Diatom Symposium", Ottawa, Canada, 2002
- L. ECTOR, L. TUDESQUE, M. COSTE:** "Calidad biológica y comunidades de diatomeas autóctonas o exóticas invasoras en los ríos de Francia", proceedings of the "VI Congreso Latinoamericano de Ficología & IV Reunión Iberoamericana de Ficología", Ponce, Puerto Rico, 2002
- L. ECTOR, F. RIMET, P. DI DATO, M. SCARDI:** "Neural network modelling of diatom community structure in the Loire river basin", proceedings of the "3rd Conference of International Society for Ecological Informatics", Grottaferrata, Italy, 2002
- L. ECTOR, L. TUDESQUE, D. GUILLARD, M. COSTE:** "Suivi annuel des communautés de diatomées benthiques et de la qualité biologique des cours d'eau du bassin Loire-Bretagne: invasion de diatomées exotiques dans les rivières de France", proceedings of the "21^e Colloque de l'Association des Diatomistes de Langue Française", Nantes, France, 2002
- A. EL IDRISSE, G. DROGUE, L. PFISTER, J.F. IFFLY, L. HOFFMANN, B. HINGRAY, F. GUEX:** "Estimation of high floods by three rainfall-runoff models with short rainfall-runoff series (Alzette river basin, Luxembourg", in A.E. Rizzoli, A.J. Jakeman (editors), "Integrated assessment and decision support. Proceedings of the First biennial meeting of the International Environmental Modelling and Software Society", volume 1, Lugano, Switzerland, 2002
- A. EULIN-GARRIGUE, L. TUDESQUE, L. ECTOR:** "Diatomées épilithiques des résurgences naturelles vendéennes (France)", proceedings of the "21^e Colloque de l'Association des Diatomistes de Langue Française", Nantes, France, 2002
- D. EVERS:** "Horizontal resistance to late blight in potato: characterization of *Solanum phureja x tuberosum* hybrids differing in their resistance to *Phytophthora infestans*", doctorate thesis, Université de Liège, 2002

- D. EVERS:** "Study of genes potentially involved in horizontal resistance of potato to late blight", published in la "Newsletter du GILB (Global Initiative on Late Blight)", 2002
- D. EVERS, J. DOMMES, J.F. HAUSMAN:** "Carbohydrates and resistance to *Phytophthora infestans* in potato plants", in "Acta Phys. Plant.", in press
- D. EVERS, M. GHISLAIN, J.F. HAUSMAN, J. DOMMES:** "Differential gene expression in two potato lines differing in their resistance to *Phytophthora infestans*", in "J. Plant Physiol.", in press
- D. EVERS, N. WELSCHBILLIG, J. DOMMES, J.F. HAUSMAN:** "Biochemical and morphological characterization of potato clones differing in their resistance to late blight", in "Potato Res.", in press
- T. GASPAR, O. FAIVRE-RAMPANT, C. KEVERS, J. DOMMES, J.F. HAUSMAN:** "Auxins in the biology of plants", in Y. Waisel, A. Eshel, U. Kafkafi (editors), "Plant roots: the hidden half", Marcel Dekker Inc., New York, pp. 383-403, 2002
- T. GASPAR, T. FRANCK, B. BISBIS, C. KEVERS, L. JOUVE, J.F. HAUSMAN, J. DOMMES:** "Concepts in plant stress physiology. Application to plant tissue cultures", published in "Plant Growth Regul.", volume 37, 2002
- S. GEBREMESKEL, Y.B. LIU, DE SMEDT, L. PFISTER:** "GIS based distributed modelling for flood estimation", in J. Ramirez (editor), "Proceedings of the 22nd Annual American Geophysical Union - Hydrology Days, Colorado State University Fort Collins", pp. 98-109, 2002
- M. GEVREY, F. RIMET, Y.S. PARK, J.L. GIRADEL, L. ECTOR, S. LEK:** "Use of artificial neural networks and diatom assemblages to predict rivers water quality" proceedings of the "3rd Conference of International Society for Ecological Informatics", Grottaferrata, Italy, 2002
- M. GEVREY, F. RIMET, Y.S. PARK, J.L. GIRADEL, L. ECTOR, S. LEK:** "Utilisation des réseaux de neurones artificiels pour prédire les communautés de diatomées des rivières du Luxembourg", proceedings of the Workshop "9^{es} Rencontres de la Société Francophone de Classification", Toulouse, France, 2002
- V. GLOAGUEN, N. GARBACKI, D. PETIT, H. MORVAN, L. HOFFMANN:** "Bioactive capsular polysaccharide from the thermophilic *Mastigocladus laminosus* (Cyanophyceae/Cyanobacteria): demonstration of anti-inflammatory properties", in "Algological Studies", in press
- J. GOMÀ, L. ECTOR:** "How the European water quality diatom indexes fit for Mediterranean rivers of Catalonia (Spain)", proceedings of the "17th International Diatom Symposium", Ottawa, Canada, 2002
- J. GOMÀ, L. ECTOR, J. CAMBRA:** "Aplicabilidad de los índices biológicos de calidad del agua basados en diatomeas IPS e IBID en ríos mediterráneos de la Península Ibérica", proceedings of the "VI Congreso Latinoamericano de Ficología & IV Reunión Iberoamericana de Ficología", Ponce, Puerto Rico, 2002
- J. GOMÀ, L. ECTOR, J. CAMBRA:** "Estudi de les diatomees epilítiques de les conques del Llobregat, el Besòs, la Tordera i el Foix. Aplicabilitat dels Índexs europeus de qualitat biològica del aigua als nostres rius", proceedings of the "Jornada sobre Biodiversitat i Aigües Continentals", Cerdanyola, Spain, 2002



- M. GUGGER:** "Taxinomie de deux genres de Cyanobactéries: *Anabaena* et *Aphanizomenon*", proceedings of the "Conférence dans le cadre des séminaires Cryptogames et perturbations environnementales: apport de la systématique et de l'étude des peuplements", Musée National d'Histoire Naturelle, Paris, France, 2002
- M. GUGGER, L. HOFFMANN:** "Phylogenetic comparison of stigonematalean cyanobacteria", proceedings of the "5th European Workshop on Molecular Biology of Cyanobacteria", Stockholm, Sweden, 2002
- M. GUGGER, C. LYRA, I. SUOMINEN, I. TSITKO, J.F. HUMBERT, M.S. SALKINOJA-SALONEN, K. SIVONEN:** "Cellular fatty acids as chemotaxonomic markers of the genera *Anabaena*, *Aphanizomenon*, *Microcystis*, *Nostoc* and *Planktothrix* (cyanobacteria)", published in "Int. J. Syst. Evol. Microbiol.", volume 52, 2002
- O. J. HARDY, N. CHARBONNEL, H. FREVILLE, M. HEURTZ:** "Microsatellite allele sizes: a simple test to assess their significance on genetic differentiation", in "Genetics", in press
- M. HEURTZ, J.F. HAUSMAN, X. VEKEMANS:** "Genetic structure of common ash in Europe analyzed with nuclear microsatellites", in S.M.G. De Vries, M. Heurtz, K. Russel, M. Bozzano (editors), "Report of the Sixth EUFORGEN Noble Hardwoods Network, Coudelaria de Alter, Alter do Chão, Portugal", International Plant Genetic Resources Institute, Roma, Italy, in press
- L. HOFFMANN:** "Photoautotrophic microorganisms in caves and other low light environments", in G. Collins (editor), "Encyclopedia of Environmental Microbiology", John Wiley & Sons, New-York, pp. 835-843, 2002
- L. HOFFMANN:** "Botanical nomenclature after the St Louis International Botanical Congress: modifications affecting the nomenclature of Cyanophyceae", in "Algological Studies", in press
- L. HOFFMANN:** "Waste stabilization ponds and production of valuable biomasses", proceedings of the "1st ASEM workshop on water management issues", Changsha, China, 2002
- L. HOFFMANN, L. PFISTER:** "The IRMA-SPONGE project FRHYMAP: Flood Risk and Hydrological Mapping", proceedings of the "European Geophysical Society - XXVII General Assembly", Nice, France, 2002
- L. HOFFMANN, L. PFISTER:** "FRHYMAP - Flood risk and hydrological mapping: from field data to spatio-temporal modelling", in A. Hooijer, A. Van Os (editors), "Towards sustainable flood risk management in the Rhine and Meuse river basins, Final report of the IRMA-SPONGE Umbrella Program", "NCR-publication", volume 18, 2002
- L. HOFFMANN, M. GUGGER, A.D. ASENCIO-MARTINEZ:** "Morphological and molecular characterisation of a stigonematalean cyanobacterium isolated from a Spanish cave", in "Algological Studies", in press
- L. HOFFMANN, M. GUGGER, I. KOSTIKOV:** "Towards a revision of the classification system of Radiococcaceae", proceedings of the "Symposium Biology and Taxonomy of Green algae IV", Smolenice, Slovakia, 2002
- L. HOLKO, S. UHLENBROOK, L. PFISTER, E.P. QUERNER:** "Groundwater runoff separation - Test of applicability of a simple separation method under varying natural conditions", proceedings of the "FRIEND

- 2002: Fourth International Conference on FRIEND: Bridging the gap between Research and Practice”, Cape Town, South Africa, 2002
- J. F. IFFLY, J.C. PIHAN, L. HOFFMANN:** “Nutrients fluxes dynamics in two rural watersheds in the Haute-Sûre river basin”, proceedings of the “ERB and Northern European FRIEND project 5 Conference”, Demänovská Dolina, Slovakia, 2002
- J. F. IFFLY, G. DROGUE, A. EL IDRISSE, L. PFISTER, M. SALVIA, L. HOFFMANN:** “The Attert river basin: a transnational experimental river basin in Luxembourg”, proceedings of the “ERB and Northern European FRIEND project 5 Conference”, Demänovská Dolina, Slovakia, 2002
- L. JOUVE, J.F. HAUSMAN:** “Physiological responses to salt stress of three poplar species (*Populus alba* L., *P. euphratica* Oliv., *P. tremula* L.)”, proceedings of the “Gordon Research Conferences. Salt and Water Stress”, Oxford, United Kingdom, 2002
- L. JOUVE, I. TSVETKOV, J.F. HAUSMAN:** “Could the encapsulation technique promote the multiplication rate in in vitro culture: *Populus euphratica* Oliv. as an example?”, proceedings of the “Belgian Plant Tissue Culture Group (BPTCG) annual meeting”, Louvain-la-Neuve, Belgium, 2002
- L. JOUVE, F. CRUMIÈRE, E. HENRY, J.F. HAUSMAN:** “Salt stress responses in aspen (*Populus tremula* L.)”, proceedings of the “13th FESPP Congress”, Hersonissos, Greece, 2002
- L. JOUVE, T. FRANCK, P. FAVRE, S. KAYALI, H. GREPPIN, R. DEGLI AGOSTI:** “IAA and regulation of *Arabidopsis* circadian rhythm”, published in “Endocytobiosis Cell Res.”, volume 14, 2001
- K. T. KISS, R. ISERENTANT, É. ÁCS, L. ECTOR:** “New occurrence of *Thalassiosira gessneri* Hustedt in Europe, in the rivers Moselle (Luxembourg), Rhône, Saône (France) and the channel Rhine-Main-Danube (Germany)”, published in “Algological Studies”, volume 107, 2002
- K. T. KISS, É. ÁCS, K. BARKÁCS, G. BORICS, B. BÖDDI, L. ECTOR, G.K. SOLYMOS, K. SZABÓ, A. VARGA, I. VARGA:** “Qualitative short-term effects of cyanide and heavy metal pollution on phytoplankton and periphyton in the rivers Tisza and Szamos (Hungary)”, published in “Large Rivers”, volume 13, 2002
- I. KOSTIKOV, L. HOFFMANN:** “What is *Nephrodiella brevis* Vischer?”, published in “Algological Studies”, volume 104, 2002
- I. KOSTIKOV, T. DARIENKO, A. LUKEŠOVÁ, L. HOFFMANN:** “Revision of the classification system of Radiococcaceae Fott ex Komárek (except the subfamily Dictyochlorelloideae) (Chlorophyta)”, published in “Algological Studies”, volume 104, 2002
- I. KOSTIKOV, T. DARIENKO, L. HOFFMANN:** “Taxonomic revision of the genus *Pseudococcomyxa*, with comments on the genus *Coccomyxa*”, proceedings of the “Symposium Biology and Taxonomy of Green algae IV”, Smolenice, Slovakia, 2002
- I. KOSTIKOV, T. DARIENKO, A. LUKEŠOVÁ, L. HOFFMANN:** “Taxonomy of the genus *Neocystis* Hindák (Radiococcaceae, Chlorophyta) with emphasis on species from terrestrial habitats”, in “Bibliotheca Phycologica”, in press



- B. KUEHN:** "Dynamique du métazooplankton dans deux réservoirs luxembourgeois: relations avec la dynamique de la biomasse de chitine", DES dissertation in Environmental Sciences, Fondation Universitaire Luxembourgeoise, Arlon, Belgium
- S. LEK, H.M. CAUCHIE, M. COSTE, J.P. DESCY, L. ECTOR, S. JORGENSEN, M. KNOFLACHER, F. RIMET, M. SCARDI, P. VERDONSCHOT:** "PAEQANN project: Predicting ecosystem quality using artificial neural networks. Impacts of environmental characteristics on the structure aquatic communities (Algae, benthic and fish fauna)", proceedings of the conference "Science in support of European water policies, Sustainability of aquatic ecosystems", Stresa, Italy, 2002
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- P. MATGEN:** "Modélisation des inondations en milieu urbain", dissertation, Ecole Polytechnique Fédérale de Lausanne, Switzerland, 2002
- M. A. MUGNAI, S. TURICCHIA, M.A. MARGHERI, C. SILI, M. GUGGER, G. TIEDOLI, J. KOMÁREK, S. VENTURA:** "Characterization of the cyanobacterial biocenosis of a freshwater reservoir in Italy", in "Algological Studies", in press
- L. PFISTER, L. HOFFMANN:** "Experimental hydro-climatological atlas of the Alzette river basin, Grand-Duchy of Luxembourg", published by the "Centre de Recherche Public - Gabriel Lippmann", Luxembourg
- L. PFISTER, G. DROGUE, L. HOFFMANN:** "Spatial variability of hydrological response to changes in rainfall structure in the Alzette river basin (Grand-Duchy of Luxembourg)", proceedings of the conference "European Geophysical Society - XXVII General Assembly", Nice, France, 2002
- L. PFISTER, J. HUMBERT, J.F. IFFLY, L. HOFFMANN:** "Use of regionalized stormflow coefficients in view of hydro-climatological hazard mapping", published in "Hydrol. Sci. J.", volume 47, 2002
- L. PFISTER, J.F. IFFLY, A. EL IDRISI, L. HOFFMANN:** "Spatial variability of low water discharge in the river network of the Grand-Duchy of Luxembourg", published in "Arch. Inst. Gr.-d. Lux., sect. sci. nat. phys. math.", volume 44, 2002
- L. PFISTER, J.F. IFFLY, A. EL IDRISI, L. HOFFMANN:** "The role of groundwater resurgence on runoff coefficients of the Alzette river (Grand-Duchy of Luxembourg)", in L. Holko, P. Miklanek, J. Parajka, Z. Kostka (editors), "Interdisciplinary approaches in small catchment hydrology: monitoring and research", Slovak Academy of Sciences, Bratislava, pp. 30-32, 2002
- L. PFISTER, J. KWADJIK, A. MUSY, A. BRONSTERT, L. HOFFMANN:** "Climate change, land use change and run-off prediction in the Rhine-Meuse basins", in "River Research and Applications", in press
- L. PFISTER, G. DROGUE, A. EL IDRISI, J. HUMBERT, J.F. IFFLY, P. MATGEN, L. HOFFMANN:** "Using groundwater level monitoring as a tool for estimating runoff coefficients in the Alzette river basin (Grand-Duchy of Luxembourg)", in "Proceedings of the ERB and Northern European FRIEND project 5 Conference", Demänovská Dolina, Slovakia, September 2002, in press

- A. PLIURA, M. HEUERTZ:** “Common ash (*Fraxinus excelsior* L.) technical guidelines of the EUFORGEN Noble Hardwoods Network”, in “International Plant Genetic Resources Institute”, Roma, Italy, in press
- J. PRYGIEL, P. CARPENTIER, S. ALMEIDA, M. COSTE, J.C. DRUART, L. ECTOR, D. GUILLARD, M.A. HONORÉ, R. ISERENTANT, P. LEDEGANCK, C. LALANNE-CASSOU, C. LESNIAK, I. MERCIER, P. MONCAUT, M. NAZART, N. NOUCHET, F. PERES, V. PEETERS, F. RIMET, A. RUMEAU, S. SABATER, F. STRAUB, M. TORRISI, L. TUDESQUE, B. VAN DE VIJVER, H. VIDAL, J. VIZINET, N. ZYDEK:** “Determination of the Biological Diatom Index (IBD NF T 90 - 354): results of an intercomparison exercise”, published in “J. Appl. Phycol.”, volume 14, 2002
- F. RIMET, L. ECTOR:** “Reference diatom communities in Rhone basin and Mediterranean region (France) defined with artificial intelligence”, proceedings of the “17th International Diatom Symposium”, Ottawa, Canada, 2002
- F. RIMET, V. PEETERS, H. VIDAL, L. ECTOR:** “Use of artificial intelligence techniques (Mirmax) for reference diatom communities definition in the Rhone basin and Mediterranean region”, proceedings of the “3rd Conference of International Society for Ecological Informatics”, Grottaferrata, Italy, 2002
- F. RIMET, V. PEETERS, H. VIDAL, L. TUDESQUE, L. ECTOR:** “Assemblages de diatomées épilithiques de référence des rivières du bassin Rhône-Méditerranée-Corse (France)”, proceedings of the “21^e Colloque de l’Association des Diatomistes de Langue Française”, Nantes, France, 2002
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- A. TATON, L. HOFFMANN:** “Marine Cyanophyceae of Papua New Guinea. VII. Endoliths”, in “Algological Studies”, in press



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- L. TUDESQUE, L. ECTOR, C. BOUILLON, A. GEORGES, M. HORN:** "Communautés de diatomées benthiques et qualité biologique des eaux de la Sienne en amont et en aval du Barrage du Gast (Basse-Normandie, France)", proceedings of the "21^e Colloque de l'Association des Diatomistes de Langue Française", Nantes, France, 2002
- H. VIDAL, L. ECTOR, C. BOUILLON, L. TUDESQUE:** "Flore diatomique d'une source chlorurée sodique des Alpes Maritimes (France)", proceedings of the "21^e Colloque de l'Association des Diatomistes de Langue Française", Nantes, France, 2002
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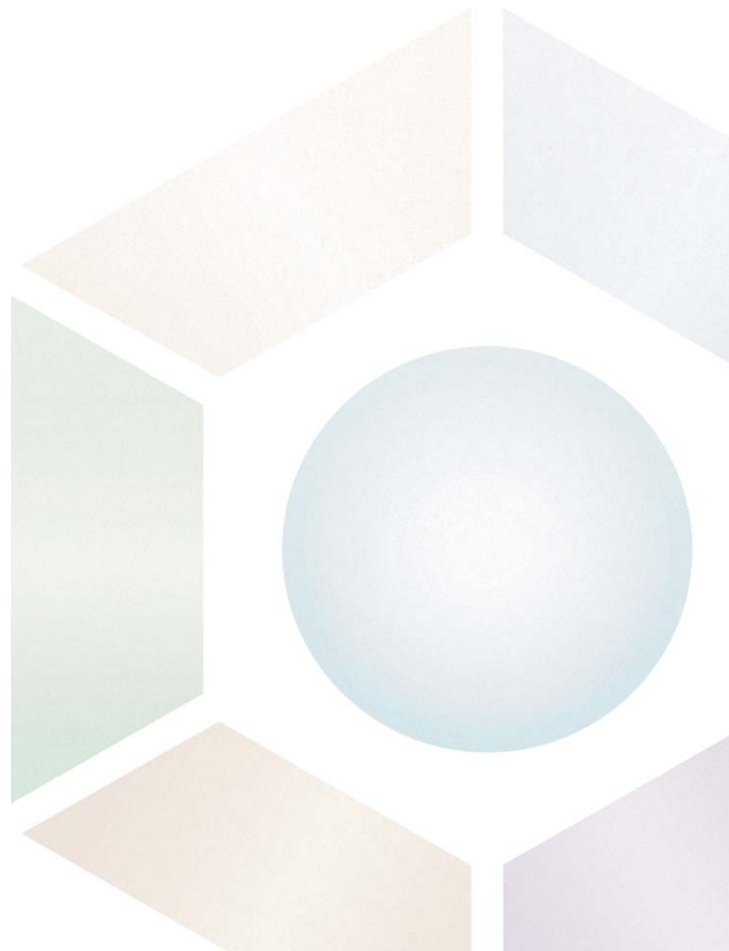
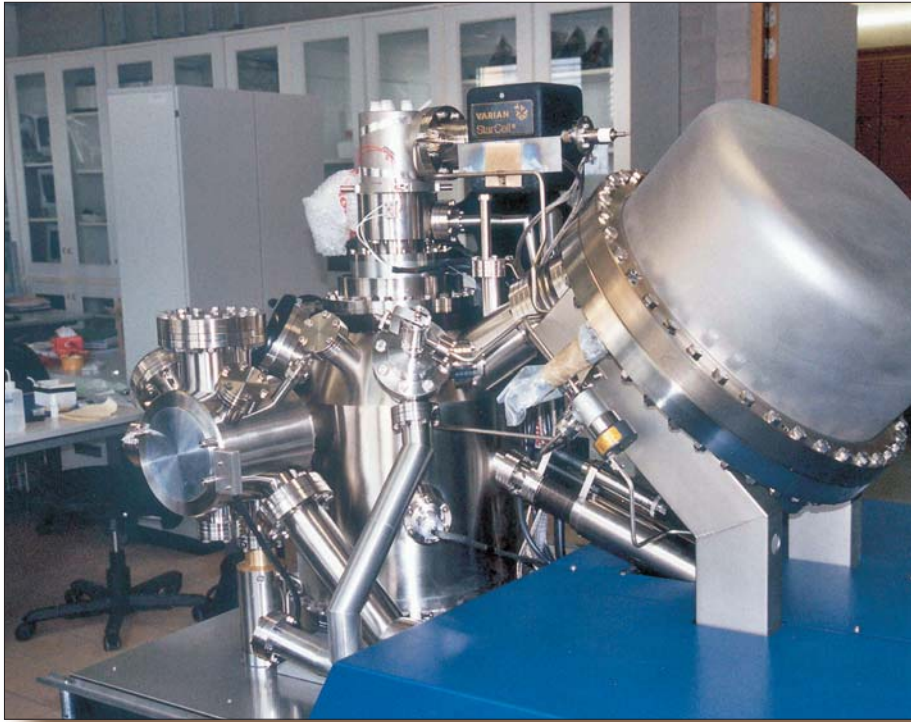
3. LAM

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- H. N. MIGEON, J.N. AUDINOT:** "Recent developments in Secondary Ion Mass Spectrometry: a technique to investigate the distribution of trace and major elements as well as isotopically labeled molecules in tissues with a lateral resolution of 100 nm", published in "Bull Soc Med Lux", 2002
- D. RUCH:** "Étude comparée des matériaux polymériques et/ou polysulfurés par ablation/ionisation laser et bombardement ionique couplés à la spectrométrie de masse. Application à la caractérisation d'élastomères vulcanisés", doctorate thesis, Université de Metz, France, 2002
- D. RUCH, C. BOES, R. ZIMMER, J.F. MULLER, H.N. MIGEON:** "Quantitative analysis of styrene butadiene copolymers using S-SIMS and LA-FTICRMS", published in "Applied Surface Science", volume 203-204, pp. 566-570, 2003
- T. WIRTZ:** "Optimisation de l'analyse quantitative des matériaux en utilisant des agrégats MCs_x^+ : application au développement de la technique Cation Mass Spectrometry (CMS)", doctorate thesis, INPL, Nancy, France, 2002
- T. WIRTZ, H.N. MIGEON, H. SCHERRER:** "Cation Mass Spectrometer: Towards an optimisation of MCs_x^+ cluster analysis", published in "Applied Surface Science", volume 203-204, pp. 189-193, 2003
- T. WIRTZ, H.N. MIGEON, H. SCHERRER:** "Useful yields of MCs_x^+ clusters: a Cesium concentration dependent study on the Cation Mass Spectrometer (CMS)", published in "International Journal of Mass Spectrometry", volume 225, pp. 135-153, 2003



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- A. PRÜM:** "Luxembourg Takeover law in Takeover Laws in Europe", in Theodor Baums and Georg F. Thoma (editors), "RWS Verlag Kommunikationsforum GmbH", Köln, mars 2002
- A. PRÜM:** "La future directive sur les services financiers à distance", published in "Revue de Droit Bancaire et Financier", N° 3, p. 111, 2002
- A. PRÜM:** "Impartialité et Justice économique, rapport sur le droit luxembourgeois", proceedings of the "Colloque organisé par l'Université Robert Schuman de Strasbourg, le 14 juin 2002", in press
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IV. Appendix

C. Report of the independent auditor

To the Board of Directors of the
Centre de Recherche Public
Gabriel Lippmann
Etablissement public
Luxembourg

In accordance with the mandate entrusted to us, we have audited the accompanying annual accounts of the Centre de Recherche Public - Gabriel Lippmann for the financial year ended December 31, 2002. Those annual accounts are the responsibility of the Board of Directors. Our responsibility is to express an opinion on these annual accounts, based on our audit.

We conducted our audit in accordance with International Standards on Auditing. Those Standards require that we plan and perform the audit to obtain reasonable assurance about whether the annual accounts are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the annual accounts. An audit also includes assessing the accounting principles used and significant estimates made by the Board of Directors, as well as evaluating the overall annual accounts presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the attached annual accounts give, in conformity with the significant accounting principles described in note 2 of the accompanying annual accounts, a true and fair view of the assets, liabilities and financial position of the Centre de Recherche Public - Gabriel Lippmann as of December 31, 2002 as well as of the results of its operations for the financial year then ended.

COMPAGNIE DE REVISION
Société Anonyme
Réviseur d'entreprises

Jean-Marie GISCHER

Luxembourg, April 1st, 2003

BALANCE SHEET
December 31, 2002 (in euros)

| ASSETS | 2002 | 2001 |
|--|---------------|---------------|
| Fixed assets | | |
| Intangible assets (Note 3) | | |
| Patents, licences, software | 51.087,20 | 39.159,02 |
| Tangible assets (Note 3) | | |
| Other fixtures and fittings, tools and equipment | 3.514.463,60 | 2.030.705,03 |
| Payments on account and tangible assets in course of construction | 882.278,19 | 842.271,08 |
| | 4.396.741,79 | 2.872.976,11 |
| Financial assets | 4.462,00 | 4.462,08 |
| | 4.452.290,99 | 2.916.597,21 |
| Current assets | | |
| Debtors (amounts falling due within one year) | | |
| Trade debtors | 484.181,75 | 489.101,66 |
| Other debtors | 1.929.797,80 | 1.619.357,81 |
| Cash at bank and in hand | 6.390.010,57 | 7.233.377,20 |
| | 8.803.990,12 | 9.341.836,67 |
| Prepayments | 64.817,47 | 92.299,29 |
| | 13.321.098,58 | 12.350.733,17 |

The accompanying notes form an integral part of the annual accounts



BALANCE SHEET
December 31, 2002 (in euros)

| LIABILITIES | 2002 | 2001 |
|---|---------------|---------------|
| Capital and reserves | | |
| Contribution in capital (Note 4) | 6.966.413,93 | 4.977.810,53 |
| Reserve fund (Note 5) | 1.265.842,97 | 1.265.842,97 |
| Investment reserve (Note 6) | 8.824,19 | 195.492,43 |
| Compensation reserve (Note 2) | ..... | ..... |
| Results carried forward | (174.889,22) | (100.071,71) |
| | 8.066.191,87 | 6.339.074,22 |
| Investment subsidies (Note 3) | 1.089.462,58 | 1.239.738,55 |
| Provisions for liabilities and charges | | |
| Other provisions (Note 7) | 794.995,82 | 765.267,54 |
| Creditors | | |
| Amounts falling due within one year | | |
| Payments received on account | ..... | 49,58 |
| Trade creditors | 484.603,78 | 268.923,57 |
| Other creditors | | |
| Tax payable | 56.991,10 | 49.837,75 |
| Social security | 87.696,20 | 72.649,15 |
| Other | 715.947,95 | 327.330,07 |
| | 1.345.239,03 | 718.790,12 |
| Deferred income | | |
| Deferred contributions and funds (Note 2) | 1.825.764,93 | 3.139.615,17 |
| Advance payments | 199.444,35 | 148.247,57 |
| | 2.025.209,28 | 3.287.862,74 |
| | 13.321.098,58 | 12.350.733,17 |

CRP - GABRIEL LIPPMANN
Etablissement public

PROFIT AND LOSS ACCOUNT
For the year ended December 31, 2002
(in euros)

| | 2002 | 2001 |
|--|----------------|----------------|
| Net turnover | 586.121,09 | 802.884,27 |
| Contributions and funds (Note 2) | 4.437.298,13 | 3.804.525,29 |
| Other operating income including use of the compensation reserve (2001: EUR 0) | 69.866,69 | 160.442,49 |
| Other external charges | (999.617,48) | (930.582,62) |
| Staff costs | | |
| - wages and salaries | (2.906.896,54) | (2.641.465,72) |
| - social security costs | (341.395,97) | (305.687,72) |
| Value adjustments in respect of tangible and intangible assets (Note 3) | (585.219,21) | (550.220,40) |
| Other operating charges | (331.218,60) | (568.004,83) |
| Operating result (Note 2) | (71.061,89) | (228.109,24) |
| Interest receivable and similar income | 237.595,58 | 249.931,41 |
| Interest payable and similar charges | (8.500,44) | (7.174,66) |
| Financial result | 229.095,14 | 242.756,75 |
| Extraordinary charges (Note 8) | (232.850,76) | (31.865,30) |
| Result available for appropriation | (74.817,51) | (17.217,79) |
| APPROPRIATION ACCOUNT | | |
| Result available for appropriation | (74.817,51) | (17.217,79) |
| Compensation reserve - release (Note 2) | ..... | ..... |
| Results carried forward | 74.817,51 | 17.217,79 |
| Balance of the result | ..... | ..... |

The accompanying notes form an integral part of the annual accounts



Notes on the accounts – December 31, 2002

NOTE 1 – GENERAL

In pursuance of the Grand Ducal regulation of May 31, 1999 on the change of the nomination of the Centre de Recherche Public du Centre Universitaire de Luxembourg, the latter is hence called Centre de Recherche Public - Gabriel Lippmann.

The Centre de Recherche Public - Gabriel Lippmann ('CRP - Gabriel Lippmann') was incorporated by the Grand Ducal regulation of July 31, 1987, on the establishment of a public research centre associated to the Centre Universitaire de Luxembourg. The financial year begins on January 1 and ends on December 31 in each year.

The CRP - Gabriel Lippmann is responsible for research activities as well as technological transfer and development activities for the promotion of scientific progress or technological innovation.

According to its statutes, the CRP - Gabriel Lippmann's main resources for the carrying out of its activities can be the following:

- an annual financial contribution from the Government budget for revenue and expenditure allocated in accordance with the priorities for research and development decided upon by the Government and the activity programme proposed by the CRP - Gabriel Lippmann;
- annual financial contributions from the Government budget for revenue and expenditure reserved to the execution of specific tasks;
- financial contributions paid for research and development projects carried out on the basis of an agreement;
- donations and legacies in cash or in kind, revenues from the management of its property as well as revenues from an assignment of licence.

Moreover, premises, fittings and equipment have been placed free of charge at the CRP - Gabriel Lippmann's disposal.

NOTE 2 – SIGNIFICANT ACCOUNTING POLICIES

General principles

The annual accounts are prepared in all material respect in accordance with generally accepted accounting principles and regulations of the law of August 10, 1915, as amended for commercial companies.

Financial contributions

Financial contributions are accounted for as income in the profit and loss account when they are received or receivable except in the following cases:

1. Financial contributions used to finance future operating charges are deferred and accounted for as income in the period during which they will be used.
2. Financial contributions recorded as "Investment subsidies" and used to finance the purchase of fixed assets which, a priori, should not to be renewed or the renewal of which would be financed again by means of a financial contribution, are differed

Notes on the accounts – December 31, 2002

NOTE 2 – SIGNIFICANT ACCOUNTING POLICIES (continued)

and amortized in the profit and loss account over the useful life of the assets to which they relate.

3. Financial contributions used to finance the purchase of fixed assets which will be renewed on the CRP - Gabriel Lippmann's own resources, are considered as "contribution in capital".

Tangible and intangible assets

Tangible and intangible assets are accounted for at their acquisition cost.

Tangible and intangible assets are written off on a straight-line basis over their estimated useful lives at the rate of:

| | |
|----------------------------------|--|
| Licences - patents | 33,33 % - 20 % |
| Constructions | 10 % |
| Technical equipment and machines | 33,33 % - 25 % - 20 % - 16,67 % - 12,5 % |
| Office furniture | 10 % |
| Office equipment | 20 % |

Tangible and intangible assets are financed, when not by financial contributions, either by other resources of the CRP - Gabriel Lippmann or by the investment reserve, which is constituted by the invested part of the provision for other liabilities and charges.

With regard to the tangible and intangible assets, which are financed by financial contributions, these contributions are recorded:

- either as "contribution in capital" when the renewal of the assets is supported by the CRP - Gabriel Lippmann;
- or as "investment subsidies" when the assets will not be renewed, or will be renewed by means of new financial contributions.

Debtors

These items are accounted for at their nominal value. Specific value adjustments are made if necessary in order to reduce the amounts recorded to their net realizable value.

Compensation reserve - extraordinary income

Any surplus of annual financial contribution assigned to the working budget of the CRP - Gabriel Lippmann compared to actual annual charges are posted to extraordinary income. The extraordinary result is appropriated to the settlement of a compensation reserve which serves to balance the operating result in case of an insufficient annual financial contribution.

Reserve fund - financial result

Based on the accounting rules which determine the operating result (see below) there remains a financial result which is the product of the management of cash received. This result is either appropriated to the reserve funds under "capital and reserves", or is used to cover the loss for the financial year.

Provisions for liabilities and charges

Provisions for liabilities and charges are intended to cover losses or debts, the nature of which is clearly defined and which at the date of the balance sheet are either likely to be incurred, or certain to be incurred but uncertain as to amount or date on which they will arise.

Liabilities

Liabilities are accounted for at their nominal value.



Notes on the accounts – December 31, 2002

NOTE 2 – SIGNIFICANT ACCOUNTING POLICIES (continued)

Deferred income - deferred contributions and funds

This item includes annual financial contributions from the Government budget and funds from the partners of the research and development projects received or receivable in the course of a fiscal year and relating to charges of coming fiscal years.

Net turnover

Net turnover includes the cost of services charged to the beneficiaries of these services.

Operating result

The total expenditure for the financial year is covered partly by the sum of net turnover and other operating income (including possible withdrawals from the compensation reserve), and partly by the appropriate portion of the annual financial contributions attributed by the State. The result of this method is that the operating result should be balanced so long as the financial contributions attributed by the State are sufficient.

Research and development expenses

Research and development expenses are recorded directly into the profit and loss account when they occur. Research and development expenses are made for research work which is mainly scientific or activities in the context of which practical applications for the above-mentioned research work are developed.

Management activities

The CRP - Gabriel Lippmann manages "bourses de formation recherche" as well as donations in relation with its research and development activities on behalf of public and private entities. The mandate

of the CRP - Gabriel Lippmann is to act as an intermediary from the financial point of view only.

These management activities are accounted for as off-balance sheet items.

The commissions which remunerate the management activity, and, when possible, interests on assets involved, are booked in the profit and loss account of the CRP - Gabriel Lippmann.

Foreign currency translation

Until December 31 2002, the accounts of the company were in Luxembourg francs (LUF) and annual accounts were drawn up in the same currency.

Since 2002, the accounts of the company have been kept in Euro (EUR) and the annual accounts have been drawn up in the same currency. All the assets and liabilities have been converted at the official exchange rate of 1 EUR = LUF 40,3399. In order not to distort the comparison, the former figures included in this report have been converted using the same rate.

During the year, transactions, income and charges in another currency than the Euro are converted into Euro at the rate of exchange applicable on the dates of the transactions.

At the date of the balance sheet, current assets and liabilities in OUT currencies are translated into Euro at the exchange rate of the balance sheet date. Exchange gains and losses are taken into the profit and loss account.

Notes on the accounts – December 31, 2002

NOTE 3 – TANGIBLE AND INTANGIBLE ASSETS AND INVESTMENT SUBSIDIES – 2002 (EUR)

| | Intangible assets | | Tangible assets | | | |
|---|-----------------------------|----------------------|--|---|--------------------------|-----------------------|
| | Patents, licences, software | Investment subsidies | Other fixtures and fittings, tools and equipment | Payments on account and tangible assets in course of construction | Total of tangible assets | Investment subsidies |
| Net book value at 01/01/2002 | 39.159,02 | (1.978,49) | 2.030.705,03 | 842.271,08 | 2.872.976,11 | (1.237.760,06) |
| – acquisition cost | 148.282,02 | (14.917,71) | 5.875.742,25 | 842.271,08 | 6.718.103,33 | (2.198.061,13) |
| – cumulative depreciation | (109.123,00) | 12.939,22 | (3.845.037,22) | --- | (3.845.037,22) | 960.301,07 |
| Movements on the year | | | | | | |
| – additions / investment subsidies received | 43.804,54 | (3.270,09) | 1.206.347,48 | 882.278,19 | 2.088.625,67 | (32.967,11) |
| – transfers | ..... | ..... | 842.271,08 | (842.271,08) | ..... | ..... |
| – disposals | (5.297,64) | 5.297,64 | (200.515,27) | ..... | ((200.515,27) | 2.424,42 |
| – amounts written off | (30.493,50) | 1.378,22 | (554.725,71) | ..... | (554.725,71) | 178.372,80 |
| – amounts cancelled on disposals | 3.914,78 | (3.914,78) | 190.380,99 | ..... | 190.380,99 | (2.222,39) |
| – transfer to the account “contribution in capital” | ..... | ..... | ..... | ..... | ..... | 5.177,26 |
| Net book value at 31/12/2002 | 51.087,20 | 2.487,50 | 3.514.463,60 | 882.278,19 | 4.396.741,79 | (1.086.975,08) |
| – acquisition cost | 186.788,92 | (12.890,16) | 7.723.845,54 | 882.278,19 | 8.606.123,73 | (2.223.426,56) |
| – cumulative depreciation | (135.701,72) | 10.402,66 | (4.209.381,94) | --- | (4.209.381,94) | 1.136.451,48 |



Notes on the accounts – December 31, 2002

**NOTE 3 – TANGIBLE AND INTANGIBLE ASSETS AND INVESTMENT SUBSIDIES
– 2001 (EUR)**

| | Intangible assets | | Tangible assets | | | |
|--|-----------------------------------|-------------------------|---|---|--------------------------------|-------------------------|
| | Patents, licences, software | Investment subsidies | Other fixtures and fittings, tools and equipment | Payments on account and tangible assets in course of construction | Total of tangible assets | Investment subsidies |
| Net book value at 01/01/2001 | 19.279,32 | (19.279,32) | 2.052.464,93 | 215.040,69 | 2.267.505,62 | (1.334.797,78) |
| – acquisition cost | 235.863,00 | (235.863,00) | 5.477.476,89 | 215.040,69 | 5.692.517,58 | (2.094.116,64) |
| – cumulative depreciation | (216.583,68) | 216.583,68 | (3.425.011,96) | ..... | (3.425.011,96) | 759.318,86 |
| Movements on the year | | | | | | |
| – additions / investment subsidies received | 40.976,16 | (2.507,64) | 292.642,86 | 842.271,08 | 1.134.913,94 | (103.944,49) |
| – transfers | ..... | ..... | 215.040,69 | (215.040,69) | ..... | ..... |
| – disposals | (128.557,14) | 128.557,14 | (109.418,19) | ..... | (109.418,19) | ..... |
| – amounts written off | (21.096,46) | 1.013,63 | (529.123,94) | ..... | (529.123,94) | 200.982,21 |
| – amounts cancelled on disposals | 128.557,14 | (128.557,14) | 109.098,68 | ..... | 109.098,68 | ..... |
| – transfer to the account “contribution in capital” | ..... | 18.794,84 | ..... | ..... | ..... | ..... |
| Net book value at 31/12/2001 | 39.159,02 | (1.978,49) | 2.030.705,03 | 842.271,08 | 2.872.976,11 | (1.237.760,06) |
| – acquisition cost | 148.282,02 | (14.917,71) | 5.875.742,25 | 842.271,08 | 6.718.013,33 | (2.198.061,13) |
| – cumulative depreciation | 109.123,00 | 12.939,22 | (3.845.037,22) | --- | (3.845.037,22) | 960.301,07 |

Notes on the accounts – December 31, 2002

NOTE 4 – CONTRIBUTION IN CAPITAL

| | 2002 |
|--|------------------|
| Contribution in capital at the beginning of the financial year | 4.977.810,53 |
| Additions | 1.793.110,97 |
| Amounts reclassified | 195.492,43 |
| | <hr/> |
| Contribution in capital at the end of the financial year | EUR 6.966.413,93 |

NOTE 5 – RESERVE FUND

| | 2002 |
|--|------------------|
| Reserve fund at the beginning and at the end of the financial year | EUR 1.265.842,97 |

NOTE 6 – INVESTMENT RESERVE

| | 2002 |
|---|--------------|
| Investment reserve at the beginning of the financial year | 195.492,43 |
| Invested part of the provision | 9.586,96 |
| Portion of amortization | (762,77) |
| Amounts reclassified | (195.492,43) |
| | <hr/> |
| | EUR 8.824,19 |



Notes on the accounts – December 31, 2002

NOTE 7 – OTHER PROVISIONS

| | 2002 | 2001 |
|--|------------|------------|
| Provisions for other liabilities and charges | 794.995,82 | 765.267,54 |
| | <hr/> | <hr/> |
| EUR | 794.995,82 | 765.267,54 |

The provisions for other liabilities and charges include EUR 197.447,33 (2001: 401.409,80) for purchasing equipment the acquisition of which is supported by the CRP - Gabriel Lippmann or equipment hitherto made available by a third party. This sum also includes EUR 547.548,20 (2001: EUR 317.997,44) to cover the balance of statements still uncertain as to amount and date on which they will be finalized.

NOTE 8 – EXTRAORDINARY CHARGES

The extraordinary charges amounting to EUR 232.850,76 consist of a provision intended to cover the balance of statements of which the amount has become uncertain during the financial year (Note 7).

NOTE 9 – TAXATION

In accordance with article 19 of the law of March 9, 1987, concerning the organization of technological research and development in the public sector as well as technology transfer and scientific and technical co-operation between companies and the public sector, the CRP - Gabriel Lippmann has been granted an exemption from taxation by state and local governments except for value added tax and salary taxes.

Notes on the accounts – December 31, 2002

NOTE 10 – PERSONNEL

The average number of persons employed during the financial year 2002 was 69 (2001: 64).

NOTE 11 – COMMITMENTS

- Management activities

The commitments relating to management activities are the following:

| | 2002 EUR | 2001 EUR |
|---------------------|-------------|-------------|
| Payments to be made | 18.996,71 | 6.569,18 |

As of December 31, 2002 and 2001, cash available for these management activities amounted to EUR 263.860,08 and EUR 275.646,12, respectively.

The procedure for application of the Grand Ducal regulation of 17 April, 1998 relating to the assignment of civil servant and employees of the State to the public research centres could involve financial effects for the CRP - Gabriel Lippmann (expenditure and receipts) which cannot be currently estimated. No entry was made as of 31 December, 2001 and 2002.



IV. Appendix

D. Organization

1. Board of Directors

2. Direction

3. Administrative and Technical Service

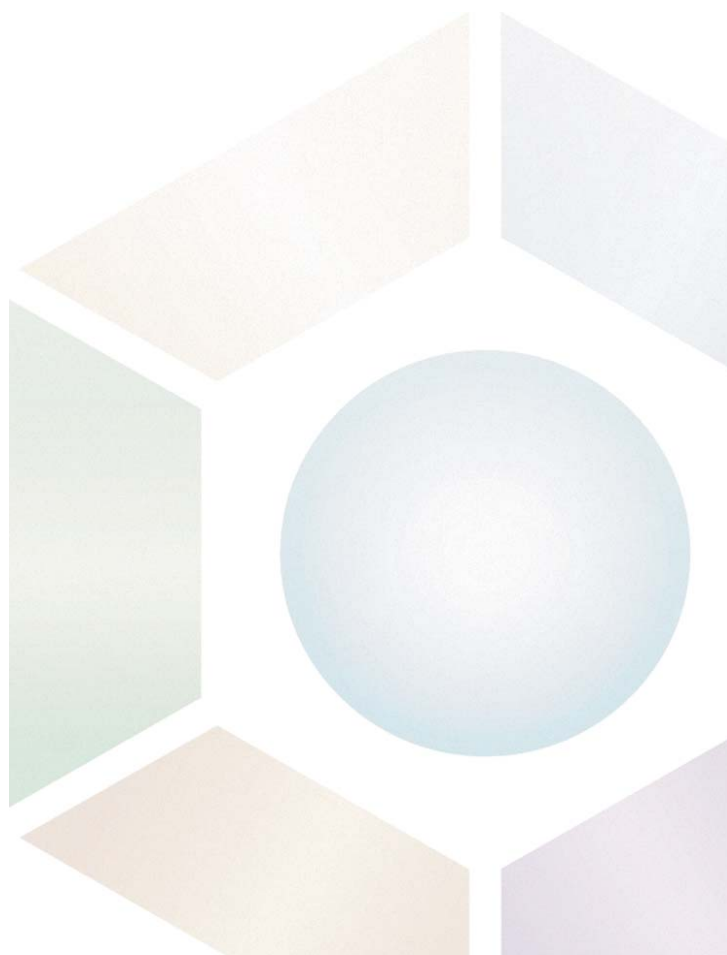
4. Training Centre

5. Research Units



Meeting of the new board of the CRP - Gabriel Lippmann

From left to right: Mr René Elvinger, deputy chairman, Mr Fernand Reinig, secretary, Mr Charles-Louis Ackermann, chairman, Mr Pierre Seck, treasurer and Mr Henri Metz, member of the board of directors





1. BOARD OF DIRECTORS

| | |
|--------------------------|--|
| Charles-Louis ACKERMANN, | chairman |
| Marc FABER, | deputy chairman until 5 October 2002 |
| René ELVINGER, | deputy chairman since 6 October 2002 |
| Pierre SECK, | treasurer |
| Fernand REINIG, | secretary |
| Germain DONDELINGER, | member |
| Romain FOUARGE, | member since 6 October 2002 |
| Monique KIEFFER, | member until 5 October 2002 |
| Robert KIEFFER, | member |
| Dr Henri METZ, | member |
| Gaston REINESCH, | member |
| Eric TSCHIRHART, | member since 6 October 2002 |
| Marco VALENTINY, | member until 5 October 2002 |
| Pierre DECKER, | Government commissioner |
| Norbert VON KUNITZKI, | chairman of the Centre Universitaire, observer |
| Jean-Paul MOSSONG, | administrative director of the Centre Universitaire, observer |
| Romain SCHINTGEN, | chairman of the IUIL, observer |

2. DIRECTION

managing director, **Fernand REINIG**

3. ADMINISTRATIVE AND TECHNICAL SERVICE

head of administrative and technical service, **Michèle ROULET**

accounting: **Alain DEPAIRON**, Sylvianne BRÜLS, Corinne LATTANZIO

project management: **Mireille THIL**, Michèle BARTUCCI

secretariat: Aline ERB, Chantal GRETHEN, Valérie MARCHAL, Chantal MIGEON

HR management and communication: **Stéphane KUCHARCZYK**, Monique LEICK, Marie-Emilie MENGAL

management and coordination of computer resources: **Alexandre DEMANGE**, Bernard PERBAL, Michel POLEUR, Michel WEINACHTER

management of technical resources and security: **Dominique ROBINET**, François BARNICH, Nicolas BONJEAN, Christophe BOUILLON, Bénédicte DE VOS, Estelle HENRY, Jean-François IFFLY, Arnaud MOSCHETTA, Francis RODICQ, Laurent SOLINHAC



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CRP - Gabriel Lippmann
162a, avenue de la Faïencerie
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tel. (352) 47 02 61 - 1
fax (352) 47 02 64
e-mail: info@crp.gl.lu

4. TRAINING CENTRE

Centre de Formation
du CRP - Gabriel Lippmann
162a, avenue de la Faïencerie
L-1511 LUXEMBOURG

project leader:

Francis BARBA

tel. (352) 47 02 61 - 648
fax (352) 47 02 64
e-mail: formations@crp.gl.lu
<http://www.crp.gl.lu/formations>

5. RESEARCH UNITS

a. Cellule de Recherche en Environnement et Biotechnologies (CREBS)



CRP - Gabriel Lippmann
 CREBS
 162a, avenue de la Faïencerie
 L-1511 LUXEMBOURG

head of research unit: **Lucien HOFFMANN**
 tel. (352) 47 02 61 - 428
 fax (352) 47 02 61 - 389
 e-mail: hoffmann@crp.gl.lu

heads of subunits: **Henry-Michel CAUCHIE,**
Jean-François HAUSMAN,
Laurent PFISTER

project leaders: Alain DOHET, Luc ECTOR,
 Danièle EVERS-SIEBENALER,
 Isabelle LEONARD-THYS

researchers: Nathalie BABIC, Fabienne CRUMIERE,
 Sébastien DELGOULET, Danielle DIERICKX-
 DOLISY, Gilles DROGUE, Sandrine DUGIED,
 Abdelkhalak EL IDRISSE, Sandra GIGLIOTTI,
 Muriel GUGGER, Cédric GUIGNARD,
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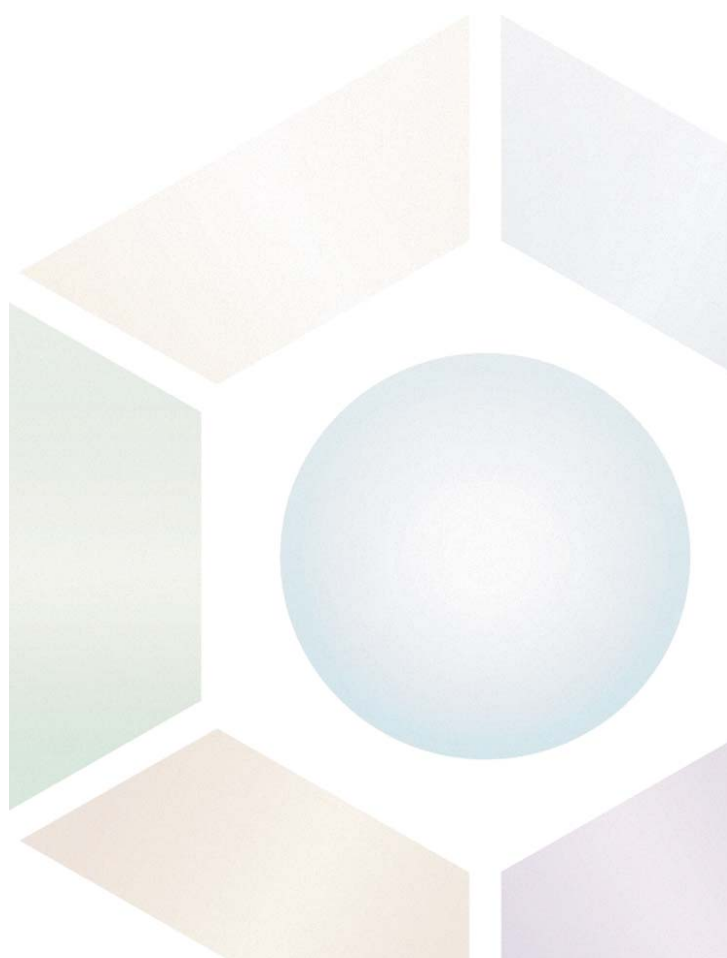
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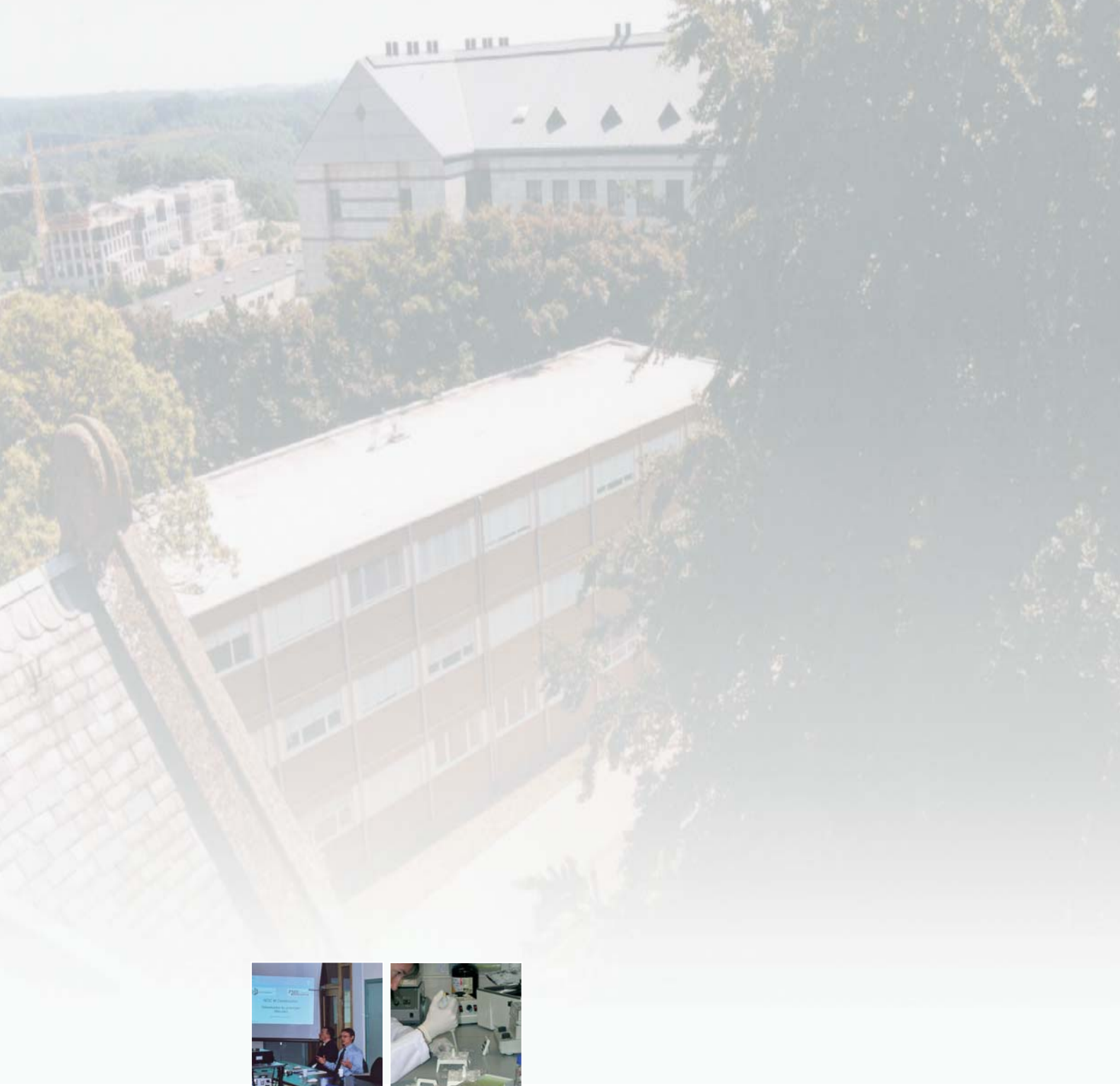
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