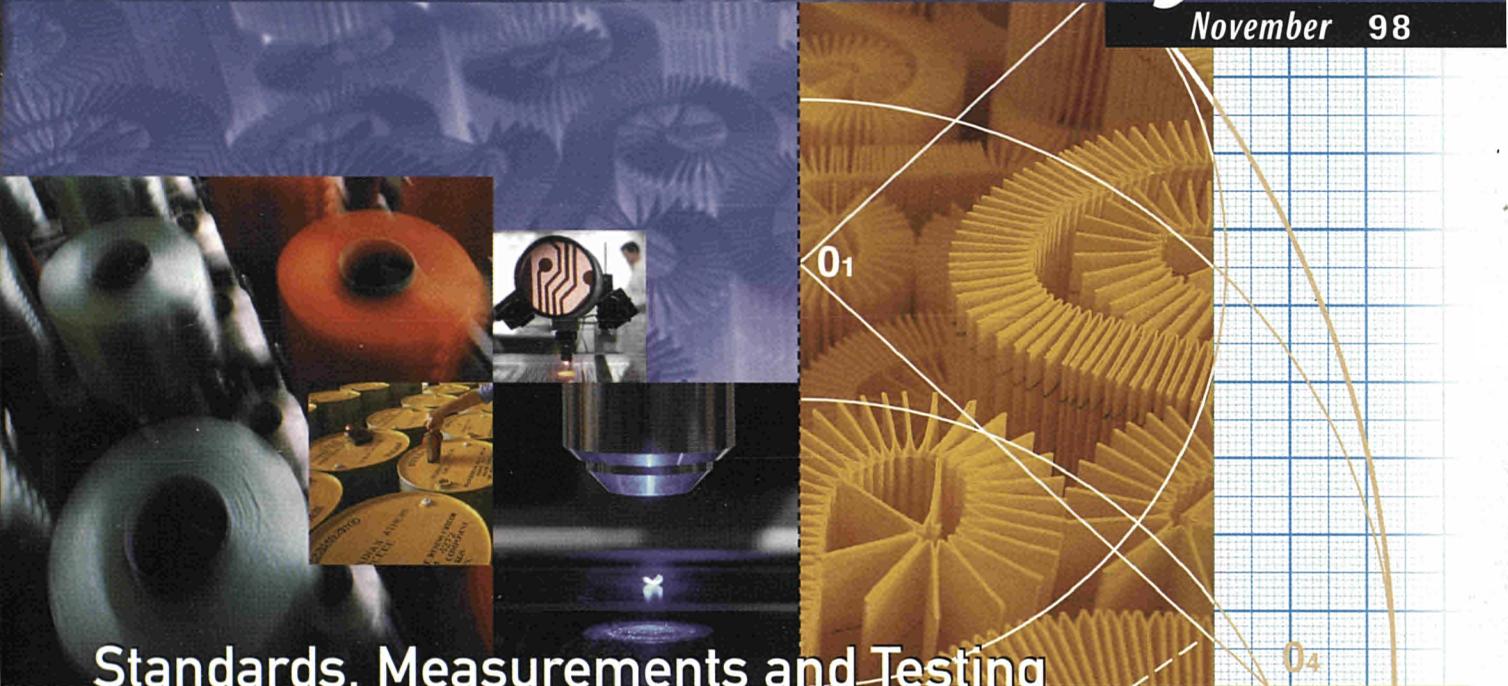




SCIENCE RESEARCH DEVELOPMENT

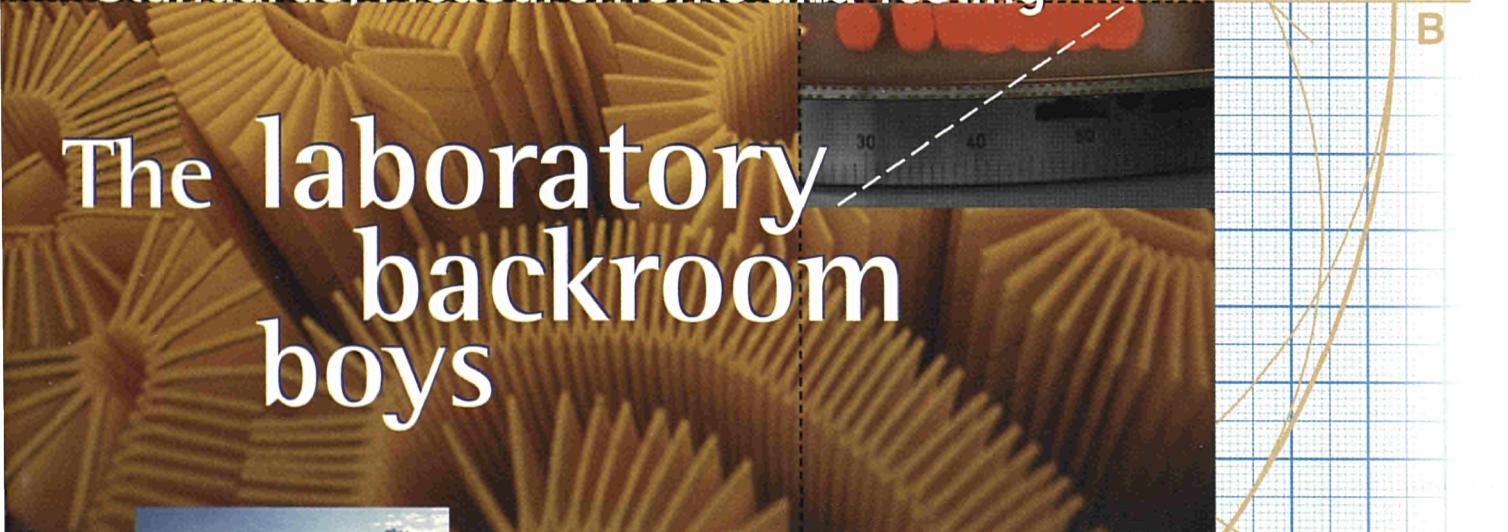
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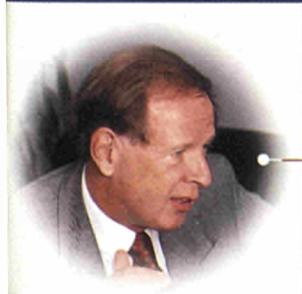


Standards, Measurements and Testing

The laboratory backroom boys



Climate After Kyoto



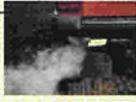
Fifth Framework Programme for RTD

A new deal for European research

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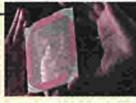
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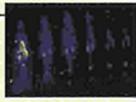
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RTD Info is a magazine on research and technological development supported by the European Union. It covers general aspects of Community research such as project results and research policy, as well as practical information including dates of calls for proposals, events, conferences, publications, and so on. RTD Info is aimed not only at current and potential participants in Community research programmes, but also at a wider public of industrialists, decision-makers, students, and others who are interested in developments in European research. Published quarterly, RTD Info is available in English, French and German. Subscription is free. To subscribe, fill in the form below.

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Research in society

The Commission is about to announce the members of the advisory groups that will assist in the start-up of the Fifth Framework Programme. These high-level experts, drawn from scientific and industrial backgrounds as well from society in its widest possible sense, will advise on the contents and the directions to be taken by research within the remit of the key actions of the Fifth Framework Programme. The objective of these actions is to establish multi-disciplinary research teams to tackle specific socio-economic problems, such as employment, health, and the environment.

Following a communications campaign organised by the Commission, several thousand candidates were proposed by Member States, by interested organisations and associations, and by the individuals themselves. However, I note that much remains to be done to ensure a significant participation by women.

The first selection will enlist the services of several hundred highly qualified and independent people to follow the key actions closely and ensure that their objectives are met.

This new approach, reflecting modernised and more transparent management, was proposed by the Commission itself. Its aim is to bring research closer to society and to allow society to make use of technical progress more rapidly for the greater benefit of European citizens.



Edith Cresson
Member of the Commission,
responsible for research,
innovation, education, training
and youth

The laboratory backroom boys

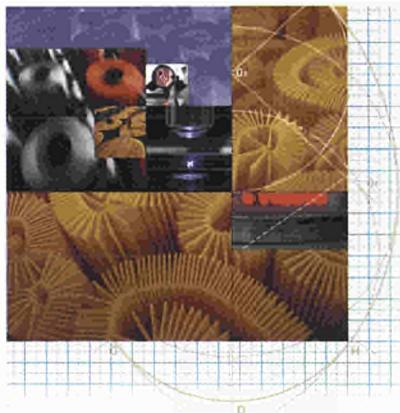
Since the Community Bureau of Reference (BCR) was founded a quarter of a century ago, European research in the field of standards, measurements and testing has experienced constant growth. RTD Info takes a look at an increasingly broad and diverse area of activity.

Science and technology attract attention when they discover and innovate. But a very important part of research activity, one which does not make the headlines, is based on two essential activities: identifying and measuring. Many scientists and engineers are hard at work behind the scenes in their laboratories identifying and comparing products, defining new measurements and procedures, creating instruments, inventing new tests for verification purposes, producing reference substances and setting new standards.

Without them, the biblical story of the Tower of Babel - whose construction was abandoned because the builders lost the ability to speak a common language - would be constantly repeated. Based as it is on communication, human society is incapable of functioning in the absence of agreed rules on the way of describing and measuring time, space, and objects - whether living or inanimate. "The growing participation of science and technology in society - bringing in particular the accelerated globalisation of trade - has made it imperative to adopt not simply a European but also an intercontinental approach to standards, measurements and testing," stresses Wiktor Raldow, RTD manager in this field at the European Commission.

A look back

There have been four main stages in the European Commission's involvement in this area of research.



- In the 1960s, the Joint Research Centre (at the time the only mechanism for European scientific cooperation, and mainly involved in R&D in the field of civilian nuclear energy under the EURATOM Treaty), set up the Central Bureau for Nuclear Measurements.

- In 1973, still on a modest scale - and still in the framework of the

JRC's activities - a major step was taken with the birth of the Community Bureau of Reference Materials (BCR), which celebrates its 25th anniversary this year. The BCR meets an increasing demand for European harmonisation of the measurements and tests carried out by metrology laboratories in the Member States by providing them with certified reference materials (see page 7).

- In the 1980s, the European Single Act marked a turning point in the development of European research policy. Widening the field of scientific and technological cooperation between Member States - previously limited to the four principal areas of common policy (steel, coal, nuclear energy, and agriculture) - the Community now acquired extensive research capabilities. This was reflected in the launch of framework programmes covering many scientific and technological fields - from information and communication technologies to life sciences, the environment, and energy - and within which, from 1990, a considerable budget was allocated specifically to research in the field of Standards, Measurements and Testing (SMT).

Involving the protagonists

With a budget of more than ECU 180 million under the Fourth Framework Programme (1994-1998), the SMT programme has diversified considerably and increased its European research in this key sector by involving all the protagonists: industrialists, specialised laboratories and users.

The first strategic axis was to strengthen R&D in the field of standards preparation, the demand for which is growing in line with the present explosion in technology. In all areas of society - consumer goods and equipment, food, mobility, health, environmental protection, and leisure activities - new materials, products, processes and services are competing to win increasingly global markets. For European industry, and for SMEs in par-

ticular, it is crucially important to set new standards which make it possible to penetrate these markets, and possibly to influence these standards by being involved in their preparation.

Meeting precise needs

It is this which led the SMT programme to launch its targeted calls⁽¹⁾ in order to set up co-normative⁽²⁾ research projects which meet the demands of industry as expressed through European standardisation bodies (see in particular the active role played by the CEN/STAR, p. 8).

"The targeted calls are also designed to satisfy the standardisation needs created by the widening of European policy. A growing number of European directives are being enacted covering an increasingly wide range of compe-

Measurements, the keys to competitiveness

This is the theme of the conference organised in Brussels on 3 and 4 November 1998 to mark the 25th anniversary of the Community Bureau of Reference. There will be debates on the international situation of standards, measurements and testing, especially in the United States and Central and Eastern Europe; the needs of trade (health, consumer protection, fraud prevention) and society (health, legal medicine, the environment, training); and the challenges of industry (process control, micro-measurements). An exhibition will also present the many results of SMT research programmes.

tences," continues Wiktor Raldow. In 1985, the EU decided to adopt a new approach in setting standards linked to European jurisdiction. "Since then, directives defining new regulatory requirements for

products or services have simply fixed or described the required level of performance, without setting technical standards or measurement and testing procedures. This flexible approach makes it possible to

"The growing participation of science and technology in society - bringing in particular the accelerated globalisation of trade - has made it imperative to adopt not simply a European but also an intercontinental approach to standards, measurements and testing."



allow for the constant technological evolution which would quickly render obsolete any too-precise stipulations." The technical details of standards and measurements are thus left to the standardisation bodies and accredited laboratories.

Downstream of Community jurisdiction, scientists, metrology institutions and standardisation bodies need the logistic support of R&D in order to act on the legal provisions.

Certifying quality

Another essential field - that of quality certification - has also entered the arena of SMT. Professional users and consumers expect those who supply them with goods and services to guarantee a certain standard of reliability and safety. This is why quality and quality control have become such essential considerations over recent years. This is aimed not just at the physical or chemical performances of products, but also at the whole chain of conditions under which they are produced, handled and stored. A European standardisation programme specifically aimed at quality certification has therefore been implemented in line with the quality standards enacted by the International Standards Organisation (standards ISO 9000, ISO 14000, ISO25).

At the same time, laboratories accredited by the public authorities have been charged with developing and carrying out all the measurements and verifications required to certify

that companies respect these quality standards. National bodies have structured their cooperation within the EA network (European Cooperation of Accrediting Laboratories) in order to launch the necessary research, and develop standards for the measurements and tests required for quality certification.

The final component of SMT research actions is that of advanced instrumentation technologies, a constantly developing field. Progress in fundamental research, for example, has opened up new avenues for the creation of biosensors (able to instantly measure air and water quality, signal odours, check tactile properties, etc.), the development of online physico-chemical systems of analysis in production chains, and the manufacture of innovative measuring and testing equipment in the field of medical analyses, etc. ■



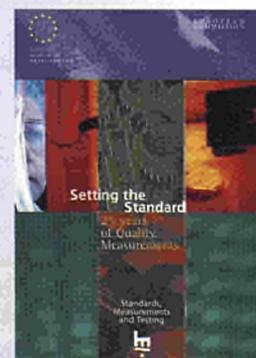
Quality and its control concern the performances of products, their conditions of manufacture, handling and storage.

(1) Unlike traditional calls for tender - for which the Commission asks European research bodies to submit ideas for projects in a given field, targeted calls are designed to elicit applications from research consortia able to meet precise SMT needs.

(2) In contrast to pre-normative research (designed to lay the scientific and technical bases for preparing new standards and which is present in all actions within the EU framework programme), co-normative research refers to completed studies on the basis of which standards already being proposed can be finalised.

Recommended reading

- *Setting the standard - 25 years of quality measurement* - Brochure summarising the European approach developed by the SMT programme.
- *Research and Standardization* - This Commission Communication, adopted in early 1998, has just been published by the EUR-OP under reference EUR 18194 - ISBN 92-828-2979-0.
- *Standards, Measurements and Testing*, examples of successful projects - a selection of projects on individual A4 sheets.

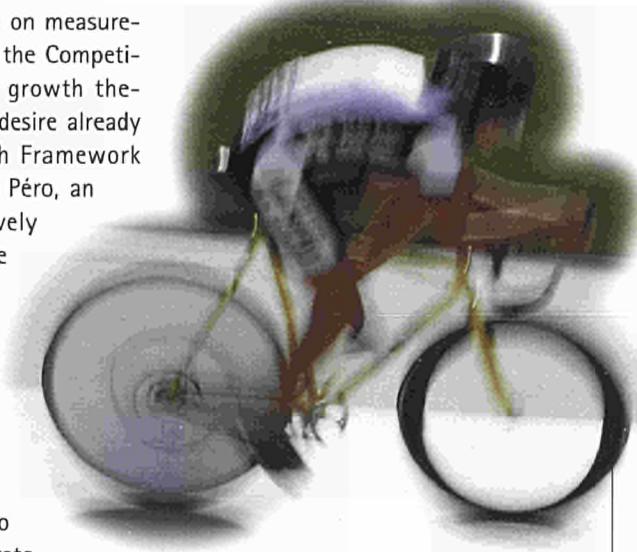


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Repositioning for growth

Seen as a "generic" field of research, the results of which are vital in all sectors of science and technology, RTD on measurements and testing will be repositioned for 1999-2002 within the "Competitive and sustainable growth" thematic programme.

The linking of research on measurements and testing to the Competitive and sustainable growth thematic programme reflects a desire already expressed under the Fourth Framework Programme," explains Hervé Péro, an adviser in DG XII and actively involved in drawing up the content of the new programme. "Needs in this field concern all scientific and technological activities - whether in medicine, biology or the environmental sciences. But this research cannot be limited to the needs of specialised laboratories, essential as they are. Progress in measurements and testing must also increasingly affect European industry as a whole, and SMEs in particular - in the form of new standards, quality performance, and guarantees of reliability and safety. This is of crucial importance in the context of global competitiveness."



After having thwarted the counterfeiters of medicines, toys, software, etc., researchers are now tackling doping in sport.

services and consumers of goods demand quality performance covering an increasingly broad and diverse field, this sector, which is a determining factor in European

competitiveness, will constitute a major priority for generic M&T research. .

Fraud prevention. The new stress placed on this line of research is a response to a growing concern in the context of the globalisation of trade. Fraud prevention will not be limited to industrial counterfeiting, but will also include types of fraud that are becoming increasingly pressing problems for society, such as illegal drug use in sport (see box).

Research projects launched in these three fields should make it possible to draw up new measurement tools and methodologies and to develop certified reference materials.

The programme will also help develop the infrastructure of European laboratories specialised in measurements and testing. ■

Standards, quality and fraud prevention

Three lines of approach have been defined for generic M&T research.

Support for standardisation. Since 1994, the system of targeted calls, which are open to requests from standardisation bodies and the needs for new standards following EU directives in all areas, has developed considerably, and this will be continued (see *The laboratory backroom boys*, p.3). But as in the past, support will also be given to pre-normative research in addition to clearly identified needs. This is a constant concern, which is reflected in all the key actions under the Fifth Framework Programme.

Improving quality policy. The need for measurements and testing is constantly growing in this essential field. As users of

Tackling the fraudsters

ECU 30-40 billion. That is what counterfeiting is estimated to cost European industry every year. The Maastricht Treaty clearly empowered the EU to combat the devastating effects of this fraud on goods and services, the impact of which goes far beyond a weakening of Europe's international competitiveness. In addition to luxury industries - a particular victim - counterfeiting and pirating is spreading to sectors such as medicines, food, automobile and aviation components, toys, and software, which affect a growing number of people and have the potential to seriously compromise their safety.

Researchers have come up with a number of sophisticated devices with which to tackle

the fraudsters, such as concealed and coded tracers which guarantee a non-falsifiable identification of the authentic origin of certain kinds of product (textiles, mechanical parts, biological substances, etc.).

A specific project will be devoted to combating another form of cheating that is very much in the news at present: illegal drug use in sport. An express request for S&T cooperation - viewed positively by the European Commission - has been formulated by the International Olympic Committee's Medical Committee, chaired by Prince Alexandre de Mérode, a loyal defender of the sporting ideal.

European standards of diversity

What are, and what purpose is served by, the Certified Reference Materials (CRMs) produced and distributed throughout Europe over the past two decades? We find out, at the Joint Research Centre in Geel (Belgium) - the world's best-equipped producer of CRMs.

By road or by air, sometimes refrigerated to extremely low temperatures, thousands of bottles containing liquids, gases or solids, leave the Institute of Reference Materials and Measurements (IRMM) in Geel (Belgium) for hundreds of destinations in Europe and beyond.

"Without these samples, if you had your blood tested at 10 different laboratories, you would obtain such different results that your doctor would be unable to diagnose what you are suffering from," explains Dr Jean Pauwels⁽¹⁾, manager of the Certified Reference Materials (CRM) unit. "The validity of the results of any kind of product analysis depends on the type of equipment used, its calibration, the methodology followed, and even the techniques employed by a particular technician."

Validating the analysis results

CRMs are therefore essential to a reliable comparison between the results of different laboratories. They are the subjects of very strict measurements formulated by a specialised ISO (International Organization for Standardization) committee, which guarantees their precise composition and stability. "Before carrying out his own measurements on the products to be analysed - such as the copper content in various alloy samples - the laboratory technician in a metallurgical company first checks his measurement procedure on the CRM itself. He is then sure that, if he obtains the expected result, corresponding to a clearly specified and certified copper content, his measurements are reliable and the value obtained can serve as a comparison for all the measurements he carries out on the samples to be analysed."

The production and distribution of certified reference materials was one of the

original scientific responsibilities entrusted to the European Commission when the BCR was first founded in 1973. Over the years, a set of European CRMs has thus been built up covering an extremely wide range, consisting of reference materials for industry (metallurgy, micro-electronics, glass, ceramics, plastics, etc.), clinical chemistry (proteins, enzymes, hormones,



"Without these samples, if you had your blood tested at 10 different laboratories you would obtain totally different results in each case."

plasma and blood serums, diagnosis kits, etc.), the environmental field and health (microbiology of water and foodstuffs, fertilisers and pesticides, etc.), and the physical characteristics of materials (colour measurements, film and surface properties).

Stability is crucially important

"Today, the IRMM has two missions: it is able to produce, on a large scale, any type of CRM requested but it has also become the central warehouse which stores, manages, distributes and sells all European certified materials. A crucially important task is to keep a constant check on the

stability of the products we distribute and to replenish the stocks." The storerooms are packed with row upon row of bottles containing all kinds of substances. Other materials are waiting at a temperature as low as -70°C in the cold-store rooms. The IRMM catalogue contains more than 400 CRMs, representing almost 500,000 samples in stock⁽²⁾.

The Geel laboratories boast an impressive array of sophisticated technical equipment. "The Institute has accumulated four decades of expertise in this very specialised field. We have designed and built several of our machines and systems ourselves, including those for producing homogenised and very finely granulated freeze-dried powder, for preparing materials in sterile conditions or at the temperature of liquid nitrogen, and for the safe packaging of samples of microbes such as salmonella. Today, the IRMM is the best-equipped site in the world for CRMs. Even the impressive National Institute of Standards and Technology (NIST) in the United States does not have resources to match this." ■

(1) All quotes are from Dr Pauwels.

(2) Most of these CRMs are produced under the responsibility of the SMT programme, which works closely together with the IMMR on decisions concerning the storage of materials.

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The increased search for standards

The STAR (Standardisation And Research) unit of the European Committee for Standardization is the vital link between the standardisation needs of industry and European research programmes.

In 1996, the European Committee for Standardization (CEN) defined 800 new standards in an increasingly wide range of industrial, environmental and social sectors. Up to 1990, it had produced fewer than 100 per year. CENELEC (the European Committee for Electro-technical Standardization) is also stepping up its activities, from around 150 standards a year in the early 1990s to 500 in 1995. More than 350 ETSI standards (information and telecommunications technologies) were also registered in

1995, 10 years after the organisation was set up. European standardisation is certainly a booming activity.

Faced with this increased demand linked to the growth of technology, CEN noted that many standards being prepared by its scientific committees - at present numbering around 270 - came up against the problem of a lack of specific measurement and testing systems. Scientific and technological research and development were therefore needed. This is why, in 1992, Jacques Repusart, the Secretary-General of

CEN, together with the French standards organisation, AFNOR (l'Association française de normalisation), and Daniel Vinard, European R&D manager of French Saint-Gobain Recherche, set up the CEN/STAR unit.

European R&D funding has the advantage of greater transparency and total impartiality."

Disseminating the results

Under the Fourth Framework Programme, about 50 normative research contracts, worth approximately ECU 35 million, were steered by CEN/STAR towards targeted calls.

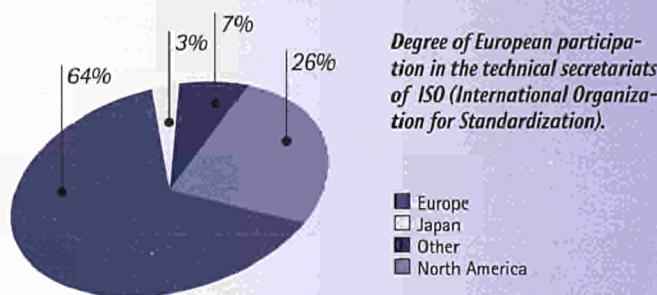
"We are expecting a great deal from this combination of R&D and standardisation. The recent position adopted by the Commission signals that this priority will remain under the Fifth Framework Programme, which starts up next January," stresses André Pirlet. "We have also been approached by the Joint Research Centre which has valuable expertise in the field of Measurements and Testing. Given its operating flexibility - which allows it to solve normative needs quickly - this cooperation could prove very valuable to CEN's work." ■

Targeted calls

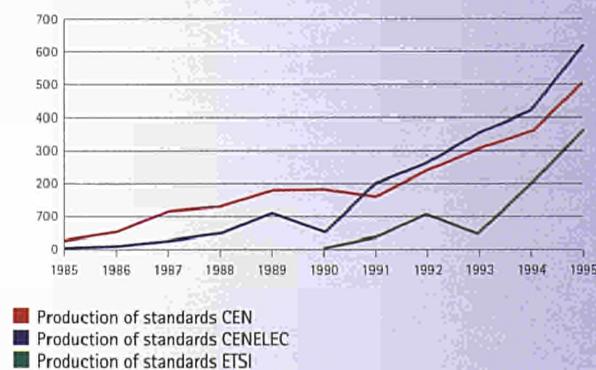
"The raison d'être of this unit is to function as the link between industry's needs for standards and the Union's pre-normative research activities, or indeed other pan-European R&D initiatives, such as COST and Eureka," explains André Pirlet, STAR coordination manager. "At the time of preparing the Fourth Framework Programme, in 1993/94, the close contacts we had with the Commission resulted in the new principle of targeted calls⁽¹⁾. These allow consortia of industrial and scientific laboratories to carry out the necessary research to define certain standards identified as a priority."

The CEN/STAR group is responsible for channelling the needs of the technical committees. "We currently have a list of approximately 200 research topics which we have listed in order of priority on the basis of a set of clear and precise criteria. The SMT programme's independent evaluation committee then selects which of these short-listed topics are to be the subject of targeted calls and decides which consortia are going to be charged with carrying out the research. Standardization can also have a major economic impact.

Secretariat of the international technical groups, per region (end of 1994)



Annual production of European standards



(1) See *The laboratory backroom boys*, p.3.

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Children on board, safety first

How to improve the safety of seats and restraining systems designed for young road-users? And how to increase the reliability of tests - and especially of the dummies used? That is the challenge facing researchers on the European CREST project.

A head-on collision on a country road. Two cars travelling at speeds of between 60 and 75 km/h. In the first car, a seven-year-old on the back seat without any restraining system is unharmed. In the second, a five-year-old girl and an eight-month-old baby, both secured in children's seats, are injured. This is just one of the hundreds of accidents investigated by European researchers working on the CREST project. Launched in 1996 for a four-year period, with the support of the Standards, Measurements and Testing programme, this wide-ranging partnership brings together motor manufacturers, university laboratories and public research centres from six Member States (France, Italy, Germany, the Netherlands, the United Kingdom, Sweden). The aim: to improve road safety for children travelling in cars, because restraining systems designed for young passengers, on which tests indicate effectiveness in between 70 and 80% of accidents, in reality only prove effective in between 30 and 50% of cases.

The need for urgent action

CREST is continuing the work of the International Task Force on Child Restraining Systems which, in 1990, brought together the best international experts in the study of accidents from Europe, the United States and Canada. "Work was progressing very slowly, in a field where it was vital to make rapid progress," explains Xavier Trosseille, an engineer at the Bio-mechanical Laboratory of the French car manufacturer PSA Peugeot-Citroën/ Renault, the project coordinator. "That is why we suggested that the Commission should set up a specifically European pro-



ject based on close cooperation between industrialists, universities and research centres."

It is a huge task, involving the analysis of many types of injuries occurring in very different accidents and involving children of different ages - from 0-12 years. By the end of 1997, six European teams had collected 188 cases. But the goal is to collect data on almost 400. In order to reconstruct the accident in a laboratory, the accidents selected must include data on speed, type of impact, condition of the vehicle after impact, nature of the injuries, exact position of the children, etc. About 20 cases have already been reconstructed: the impact was reproduced, using identical vehicles and dummies, while additional tests permitted a more detailed analysis of certain parameters, such as the effects of the exact seat position or the way in

which it is fitted in the vehicle. "That is how we identified the phenomenon known as submarining," explains the project coordinator. "Young children placed on raised seats and restrained by normal seat belts can slide beneath them in the event of a violent impact and suffer abdominal injuries. In traditional tests this does not happen with the dummies."

"Biofaithful" dummies

These meticulous reconstructions make it possible to study the reliability of dummies. They have been carried out over the past 30 years by the Crash-Safety Research Centre (CSRC) of the TNO Road-Vehicles Research Institute, in the Netherlands, one of the CREST partners. "It is in order to be able to reproduce the phenomenon of submarining that changes were made to the dummies of 3-, 6- and 10-year-olds," explains Michiel van Ratingen, research manager at the CSRC. Improvements to the structures of the thorax and pelvis, improved thoracic suppleness to allow increased sensitivity to shocks and the use of more biofaithful materials are the principal changes which will give much more precise indications to the manufacturers of restraining systems and airbags. The safety of young passengers should be quickly increased as a result. ■

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After Kyoto

After Kyoto, it is Buenos-Aires which - from 2 to 13 November, 1998 - is to host the fourth international conference on the implementation of the UN Convention on Climate Change, designed to implement a policy to limit greenhouse gas emissions. The regulations laid down in the Kyoto Protocol present many challenges, both for scientists and society as a whole. In three key areas - the analysis of the socio-economic effects of the policies which apply this new international environmental law, the development of sustainable energy systems, and our understanding of the carbon cycle - Europe is busy mobilising a major research effort.

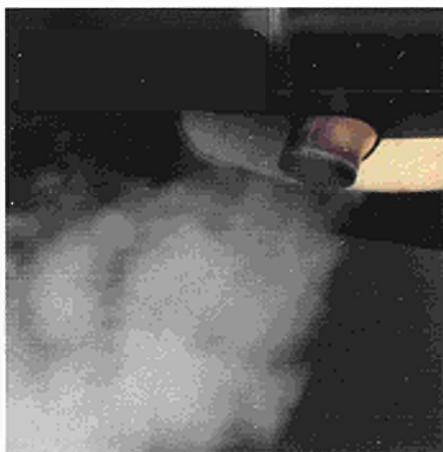
It's a race against time. The Kyoto Protocol, adopted by 174 countries in December 1997, has set the first precise targets in terms of levels and dates. Between 2008 and 2012, Europe is to cut greenhouse gas emissions by 8%, the United States by 7% and Japan by 6%.

Despite this progress, the Kyoto results fall well short of what was proposed by the Europeans who were prepared - provided the other industrialised nations followed suit - to cut emissions by 15%. The arduous negotiations leading to this Protocol also resulted in a legal framework which will not only be complicated to apply in practice but also leaves many uncertainties.

A historic first

"It is the first time there has been a unanimous international agreement on climate change and that this problem has been recognised as a vital environmental issue on a global scale," points out Sylvie Faucheux, of the Centre d'Economie et d'Ethique pour l'Environnement et le Développement⁽¹⁾. "It is also no doubt the first time that the international community has set itself goals which imply a radical change in the way we organise our industrial activities and our services, our means of transport and our energy consumption."

That is the challenge facing the post-Kyoto European strategy. The undertaking given by the EU countries to reduce emissions within just over a decade is now legally and jointly binding. Observance of the obligations of the individual Member States (Article 4 of the Protocol) will be



Under the Kyoto Protocol, Europe must reduce its greenhouse gas emissions by 8% by the years 2008-2012.

recorded at the European level, it being possible to offset the results achieved by one country against those of another. This means that the whole question of the reduction of emissions and the related socio-economic and political constraints must be approached in the framework of wide-ranging Community consultation. For this, the parties involved - governments, regional and local authorities, companies, consumers, citizens - must remain committed to their choices and their decisions.

Challenges for individuals and society

Over recent years, European research has become increasingly interested in the human dimensions of environmental change. The social, socio-economic and political problems posed by reducing

greenhouse gas emissions now occupy an important place in this research policy. In 1997, several research/policy interface workshops were set up by the EU's Environment & Climate programme in order to assess the scale of the challenge, explore the various political responses to the problems posed, assess their impact and contribute to the formulation of the EU's stance at Kyoto. These brought together experts on climate, technological change, economics and the human sciences in a debate with political and industrial decision-makers, the social partners and non-governmental organisations.

In 1998, new workshops of this kind were also set up to analyse European policy options in implementing Kyoto. An initial research group looked at the concerns of those involved from various sectors and social groups. "It is essential for the interested parties to be involved in realistically assessing and analysing the socio-economic effects, the risks run by the various groups, and their motivations," explains Sylvie Faucheux.

Two other workshops looked at criteria and methods for judging the degree of fairness and effectiveness of alternative climate policies, together with the implementation of the "emission trading" regimes introduced by the flexibility instruments created at Kyoto.

(1) The C3ED (Université de Versailles St-Quentin-en-Yvelines, France) was charged by DG XII with coordinating a series of research/policy interface seminars analysing the tasks for research and the implications of climate change for the socio-economic players.

70% of the EU's energy consumption is linked to the needs of the urban world.



Energy research is at the heart of the problem

"The Union is at present responsible for approximately 16% of global CO₂ emissions linked to energy, while representing just 6% of the world's population," points out the European Commission⁽²⁾. Energy policy and the underlying research are central to the debate on climate change. "New undertakings to reduce emissions must lead to a serious discussion to find out how to go beyond what has been achieved in energy savings over recent years."

Two sectors are in the firing line: if no effort is made to cut emissions, CO₂ emissions resulting from the growth of transport in the EU will increase by almost 40% by the year 2010, and the increase in emissions due to electricity and heat production will reach 12%. So it is on these two fronts that a post-Kyoto strategy must concentrate its efforts.

The technological stakes

Technology is crucially important in these fields. Over recent years, a great deal of European research, actively supported by the JOULE-THERMIE programme, has been devoted to the clean car of the future, (see box), as well as to the development of intermodal transport systems.

In the field of electricity and heat production, considerable progress has been made in advanced technologies which use clean and efficient fossil fuels - natural gas, coal or brown coal. The dissemination of these innovations, in particular the parallel development of combined heat and electricity production, is a key

area of activity for achieving the Kyoto objectives - not only in Europe, but also worldwide.

The JOULE-THERMIE programme also attaches great importance to highlighting technologies arising out of European research and demonstration projects for the harnessing of renewable energies - such as biomass, wind power, photovoltaic energy. Biomass, in particular, has the additional advantage of capturing the CO₂ present in the air, and is a priority source of energy as part of a policy to strengthen the "carbon pools".

In terms of CO₂ emissions, the scenarios drawn up at the European level have an ambitious but realistic objective: to increase the share of renewable energies from 6% to 12% by the year 2010. Such progress can only be achieved by means of a committed policy which makes it possible to include these non-polluting energy sources in the major electricity distribution networks.

"Technologies to reduce greenhouse gases will only have an effect if they are backed up by policies designed to support innovation and to open up markets by incentives in the areas of investment financing, taxation and emission trading," stresses Pierre Valette, manager of support for RTD-Energy strategy at DG XII⁽³⁾. "A pragmatic response to the Kyoto objectives must also include increased coordination between Community policies on research, energy, transport and the environment."

(2) Commission Communication: *The energy dimension of climate change* - COM/97/0196 (Final).

(3) In this capacity also responsible for E3 (Energy, Economy, Environment) technology forecasting and modelling at DG XII.

The 100% clean, 120 km/h car

A revolutionary prototype of an electric car powered by a polymer electrolyte fuel cell was unveiled on 29 September in Brussels, at an international symposium on electric vehicles. This car of the future was designed under the European FEVER project (JOULE-THERMIE programme) in which car manufacturers Renault and Volvo worked together with other industrial partners. The car runs on a mix of hydrogen and air and its only emission is

clean water. Thanks to this propulsion system, which is still very much at the experimental stage, it achieves the best performance ever for an electric car: a top speed of 120 km/h and a range of 500 km. When it goes into industrial production, this fuel cell system could be a major option in absorbing the growing impact of the transport sector on climate warming.



Europe's goal is to increase the share of renewable energies from 6% to 12% by 2010.



Double-pronged approach to combat greenhouse effect

The compromise negotiated at the Kyoto Conference caused pandemonium among climatologists and Earth science experts. Starting from the principle that the objective is to arrive at a fixed and quantified global reduction, two complex mechanisms are provided in order to reduce greenhouse emissions.

■ On the one hand, the calculation of emission volumes can take into account the role played by the natural carbon pools of the world's forests. Countries which apply policies of afforestation (the creation of forests in previously unforested areas) or reforestation (the replanting of forests which once existed) will have the option of deducting from their CO₂ emissions the carbon quantities thereby stocked by the plant world rather

than being emitted into the atmosphere. On the other hand, every time a country's forestry policy results in net deforestation, this will bring an additional emission reduction requirement.

■ On the other hand, in order to achieve an effective reduction in global terms, the protocol has introduced a complex system of flexible instruments allowing industrialised partners bound to achieve certain reduction quotas to exchange or postpone a part of these quotas. On the basis of a cost/effectiveness analysis of their reduction policy, they can buy and sell emission rights (on condition that the aggregate of their joint obligations is respected) or "earn" an emission right by investing in projects leading to a lasting reduction for the future⁽⁴⁾.

New method of calculation

In order to implement such a system it is necessary to set up a new method of calculating CO₂ emissions which is both rigorous and fair. Yet considerable uncertainty continues to surround any such system. "The majority view among the scientific community was that the threat of global warming had to be attacked at source, by means of a clear and transparent policy to reduce emissions," comments Anver Ghazi, manager of research on global change with the EU's Environment & Climate programme. "Natural carbon pools are going to be taken into account, but the lack of figures in this area poses an enormous scientific challenge."

The land ecosystem alone is estimated to have the potential to absorb almost 25% of the CO₂ emissions caused by human activity. Yet this evaluation only takes into account a tiny fraction (about one thirtieth) of the vast and continuous carbon fluxes between the ecosystem and the atmosphere, essentially by means of the alternating photosynthesis and respiration of the plant world – and of the forests in particular. The margin of error regarding the real capacity of forests to absorb greenhouse gases is therefore very high.

"The main problem is that the land biosphere's ability to capture carbon is limited and there is no permanent absorption," writes Claus Brüning, scientific officer with the Environment & Climate programme. "Sooner or later, the

(4) The launch of such a project can also be taken into account if carried out in a developing country not subject to emission reductions ("clean development mechanism").

The EUROFLUX model

Launched four years ago, with the support of the Environment & Climate programme, the EUROFLUX network is at present one of the most constructive research projects on the role of forests in the carbon cycle. It is based on a new measurement of carbon fluxes, carried out on 17 very different European forest ecosystems in a wide range of latitudes. A world first, the integration and modelling of the data gathered by a team at the Joint Research Centre in Ispra has made it possible to draw up a regional report at European level. This shows that between 10% and 40% of human CO₂ emissions in the EU were absorbed by the forests in 1997. The EUROFLUX researchers have highlighted the complexity of the factors which must be taken into account and

established the bases for a new assessment method for carbon pools. "This project has initiated intense cooperation between European and US scientists, who are setting up a joint network known as AMERIFLUX, together with a future global network, FLUXNET," stresses Panagiotis Balabanis, scientific officer with DG XII. European research is also involved in creating two other measurement networks of interest to Europe – Eurosiberian Carbonflux, on which Russian teams are working, and MEDELU, which covers the countries of the Mediterranean Basin.

EUROFLUX
<http://www.unitus.it/eflux/euro.html>

rate of absorption will reach saturation level and, within a matter of decades, the carbon will be once again released into the atmosphere. The strategy of increasing the land pools is therefore no more than a stop-gap political solution which threatens to burden future generations with an even more critical problem."

What about the primeval forests?

Mechanisms based exclusively on the three criteria of afforestation / reforestation / deforestation also ignore the very major carbon pools constituted by primeval forests, the stocks of which, having been built up over the course of centuries, would take a very long time to be replenished. The felling of long-lived forests - such as for high-quality construction woods - could be compensated for by reforestation/afforestation with fast-growing species, for paper pulp production for example. But the ultimate result would be a net destocking of carbon.

Furthermore, not all forests play the same role. "The bio-geochemical processes involved in carbon exchanges between the atmosphere and the land biosphere are complex, extremely variable in space and time, and are not yet fully understood," continues Claus Brüning. This applies in particular to interactions between plants and the soil in which they are rooted, because it is in fact below soil level that plants store carbon in the most stable and long-lasting manner. Reforestation/afforestation can result in a negative CO₂ result when young plantations draw their carbon requirements from the soil, becoming a source of carbon emissions rather than carbon pools.

The parameters defined in Kyoto to include the pool concept therefore need to be revised and supplemented. In February 1998, the European Commission set up a scientific study group to assess the current state of knowledge in the field of land carbon pools. Presented under the International Geosphere-Biosphere Programme (IGBP), the group's conclusions are generally shared by the international scientific community. ■

Representing important natural carbon pools, forests play a major role in reducing climate change.

Climate and the Fifth Framework Programme

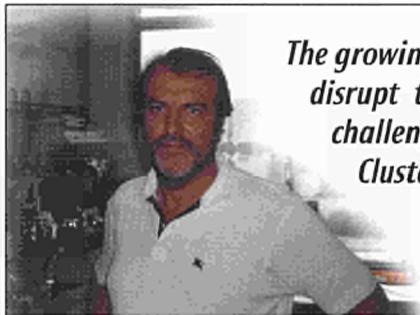
Many fields of research and technological development have to take account of climate change for which an interdisciplinary approach is becoming increasingly necessary. Structured around a number of key actions, the Fifth Framework Programme (1999-2002) adopts precisely this multidimensional approach.

The thematic programme, *Preserving the ecosystem* will be at the forefront. The key action Global change, climate and biodiversity, with a proposed budget of ECU 400 million, will conduct climate research, identify the effective and fair policy options, and assess their socio-economic impact.

The key actions *Cleaner energy systems, including renewables* and *Economic and efficient energy for European competitiveness*, will receive financing of almost a billion ecu.

Climate is also present in the key action *The city of the future*, in which the energy problem - 70% of the EU's energy consumption is linked to the needs of the urban world - will play a major role. Reductions in greenhouse emissions will also be one of the systematic criteria for new technologies of interest to industry and transport in all the key actions of the *Competitive and sustainable growth* thematic programme. Finally, climatic concerns will also be very much in evidence in the key action, *Sustainable agriculture, fisheries and forestry, including integrated development of rural areas*.

When life's waste changes life itself



The growing mass of organic compounds discharged into the water cycle can disrupt the sexual systems of living organisms. This unique environmental challenge is at present being studied by the scientists of the Waste Water Cluster projects. RTD info talked to project coordinator, Damià Barceló

[Damià Barceló, coordinator of the Waste Water Cluster projects]

The more you look at the problem of water quality, the more you realise that treatment and purification policies - which for a long time have focused on contamination by metals - have to date tackled no more than the tip of an iceberg, the real magnitude and long-term effects of which we simply do not know. We are only now beginning to discover how to measure and evaluate the potential toxicity of the organic pollutants which our industrial and domestic consumption are introducing to aquatic ecosystems."

Director of the laboratories of the environmental chemistry department at the CID-CSIC National Research Centre, located at the heart of the Barcelona University campus, Dr Damià Barceló, 44, is one of Europe's leading experts in the field of monitoring and evaluating the quality of underground, river and maritime waters.

Sexual disruptions

"The warnings of the previously unsuspected dangers caused by organic contamination are quite recent," he stresses. "It was not until the first half of this decade that the experts started to express their concerns about the effects of substances collectively known as endocrine disruptors"⁽¹⁾. This concern is caused by the worrying signs of sexual dysfunction in living organisms and their link with the increasing appearance of new industrial, chemical and pharmaceutical products, certain organic com-

pounds of which are entering the water cycle and upsetting hormonal systems. "The only species for which we have already built up well-founded proof is fish. A number of independent scientific studies carried out in different European rivers and on fish farms have shown with absolute certainty that the high concentration of certain products which behave like oestrogens leads to an abnormal feminization of the species present in these waters. There has been a clear fall in the number of male fish being born."

In addition to the serious risk this poses to biodiversity, the risk of similar hormonal imbalances appearing in man is taken very seriously by the scientific community. "We do not yet have significant data, but there are certain indicators. We can no longer pollute water with such toxic substances. In addition to studying the effects of these pollutants, we must also trace the sources and set up a monitoring network so that they can be rapidly detected."

A European vocation

A number of specialised laboratories throughout the EU are currently investigating this new threat. The Community's Environment & Climate programme has lent its support to a number of targeted research programmes on protecting the quality of water resources. "I was a chemist originally, and first became interested in water quality in the 1980s," continues Damià Barceló. "I had the opportunity of spending two years at the

Free University of Amsterdam and this experience rapidly convinced me of the work to be done at the European level. I have subsequently been involved in a number of EU-backed research programmes, and, as the Commission wanted the maximum possible synergy between these various parallel initiatives, it asked me to organise a federation and coordinate this 'cluster' of projects. Hence the Waste Water Cluster (WWC)."

The WWC brings together five specific projects (see box) and network participants from Austria, Germany, Greece, the Netherlands, the United Kingdom and Sweden. In addition to the many university laboratories and research centres, two industries in the chemicals sector and two manufacturers of water quality measurement and pollution warning systems are also actively involved in the projects.

A broad cluster

The projects are principally concerned with three families of organic substances - phenols, amino acid compounds, and surfactants - the origin of which may be agricultural or industrial (chemicals, petrochemicals, textiles and tanning in particular), or the discharges of factories processing urban waste water. Among these families, the group of surfactants represents an increasingly vast range of organic compounds with marked oestrogenic effects which are widely used in detergents (particularly those used in industrial cleaning) and which are found in large quantities in the water cycle.



"A series of measurements recently made in Spain, in the Bay of Cadiz, showed that contamination is not limited to fresh water but also affects the water in coastal areas."

The WWC is tackling the full range of problems. An initial priority is to understand how organic waste evolves chemically once it is diluted in water, to analyse its toxic effects, and to evaluate and draw up a model of the seriousness of the risks run. This requires detection using a system of biosensors and an advanced automatic sampling and measuring device which operates on line. Finally - and perhaps most importantly - scientists want to put an end to this contamination, with its unexpected effects, either by developing new methods of treating waste water or by eliminating the waste at its point of origin: industrial processes.

Eco-industrialists

"I believe it is very significant that in Spain we have managed to involve a very large detergent production group in the WWC's activities. Industrial companies are increasingly concerned by their possible impact on the environment and their responsibilities. New chemical products are being developed all the time, yet we also realise - and this is the worrying thing - that we do not really know a great deal about the medium- to long-term risks they could pose. This is why there is a growing demand for environmental research and technologies."

The WWC is a pilot project and an example of the increased interdisciplinary approach of the key actions under the Fifth Framework Programme (1998-2002).

"One of the key actions of the thematic programme *Preserving the ecosystem* will be concerned with water quality and its sustainable management. This is confirmation that this field of research is a priority environmental concern requiring the coordination of research at a European level." ■

Fewer and fewer males... Fish are the first living species in which serious sexual disruptions have been observed as a result of oestrogenic pollution.

(1) All quotations are from Damià Barceló

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The federation of five projects within the WWC

Project	Objective
INEXSPORT Coordination: University of Lund (S)	Development of portable autonomous units for the sampling and detection of phenols, surfactants and endocrine disrupters by biosensors.
OWWA Coordination: Free University of Amsterdam (NL)	Development of on-line technical systems for the measurement and quality control of waste water.
PRISTINE Coordination: Institute of water research and technology, Wiesbaden (D)	Improvement of our knowledge of the processes of contamination and the toxicity of surfactants discharged by the use of new detergents.
PREDISENSOR Coordination: New University of Lisbon (P)	Evaluation and forecasting of the effects of endocrine disrupters present in sewage sludge spread on farmland.
SANDRINE Coordination: Technical University of Berlin (D)	In-depth study of the chemistry and detection of endocrine disrupters.

A new deal for European research



The Fifth Framework Programme comes into force at the beginning of 1999. It has a new, streamlined look. Out goes the previously sectorial approach and in come multi-disciplinary "key actions" within a few large thematic programmes. To discover the reasoning behind this radical reform, RTD Info talked to Professor Jorma Routti, Director General of the Commission's research department, DG XII.

“We need to think about the not-yet-born industries as well as the existing ones.”

[Jorma Routti during the interview]

Why has the EU's R&D policy been reoriented around key actions? Is this a response to some political imperative, or is it to do with a change in the nature of science and technology and their relation to society's problems?

Professor Jorma Routti: There are two main reasons. First, the increased relevance of science to society. Earlier this year the European Commission published *Society, the Endless Frontier*, in an attempt to analyse the impact of science and technology on our economy, industry, society and policy-making in general. Science has always been, and continues to be, a curiosity-driven exploration of the unknown and an effort to understand ourselves and the world around us. It has produced many surprises that have given rise also to major technological and economic possibilities. Today, science and technology are amongst the main driving forces in society for industrial, economic and social development. Information technology, biotechnology and nanotechnology are fundamental changes, which we must couple with industrial development and with competitiveness.

Secondly, the increased complexity of science. Throughout its history, science has been a search for simplicity in explaining the world, as exemplified by

Einstein's profound equation $E=mc^2$. But today its nature has changed. Science has turned towards mastering complex phenomena, characterised by chaotic and non-linear behaviour, such as climatic change, the genetic modification of crops, and the use of modern biotechnologies in medicine. And complicated issues require integrated approaches. If you look at life sciences today, whether you study medicine, biotechnology, or even agriculture, you have to do it on a molecular biology, genetic information level. Telecommunications and computing have similarly integrated into information technologies. In transportation issues you have to look simultaneously at questions of energy, environment, telematics, city planning, economics and behavioural science.

We therefore have to change our methods, because these issues require a multi-disciplinary, multi-dimensional approach, which can only be tackled by bringing in key actions which are more problem-driven than science-driven. Instead of as many as 15 specific programmes, divided along classical science and technology lines, the new programme has only four broad themes, and about 20 key actions. These key actions are the principal element of the Framework Programme, and around three-quarters of the funding is allocated

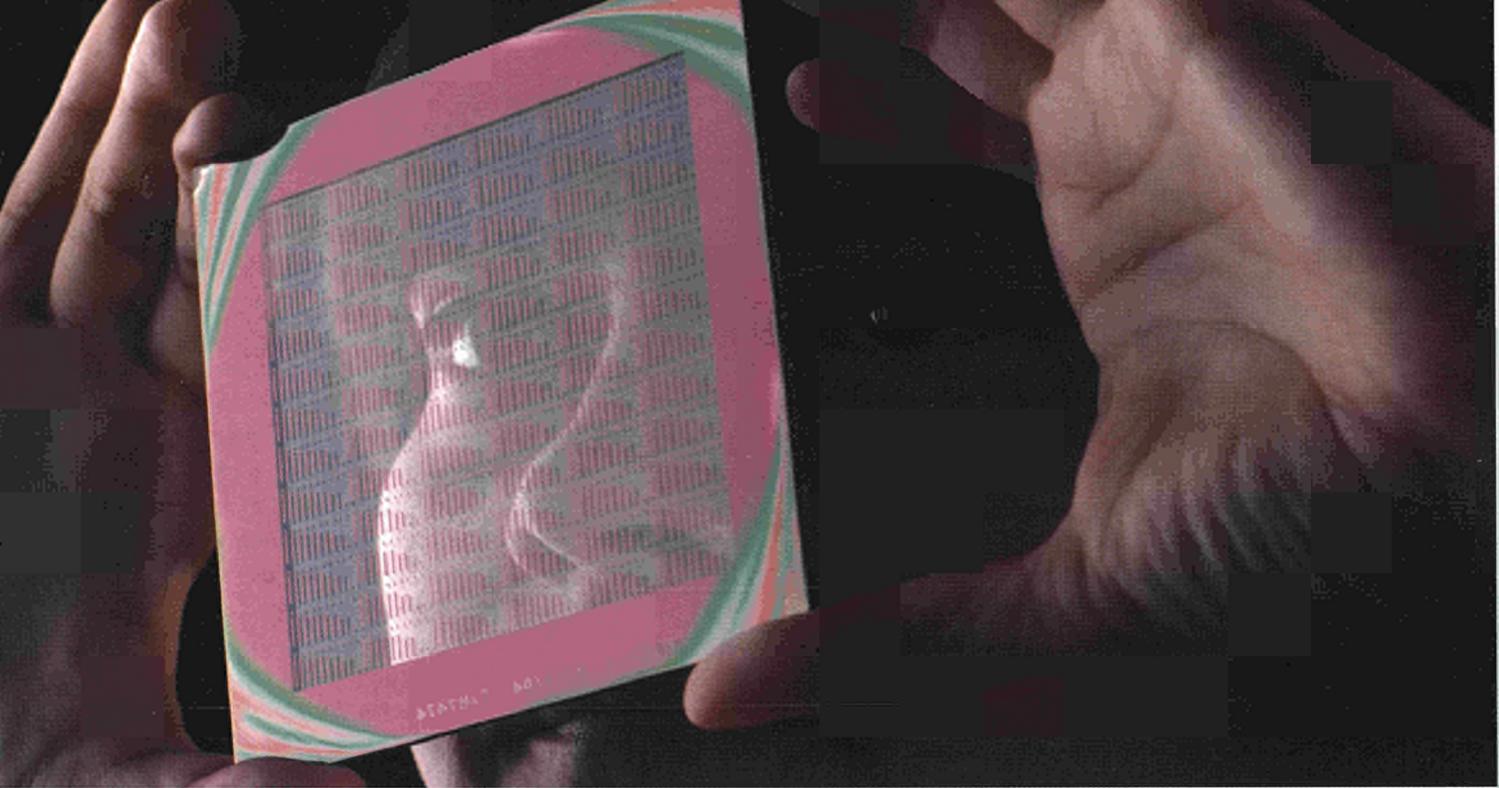
through them. Each will have its own advisory group, consisting of experts not only from the research world but from industry and policy-making, so that we can bring together the knowledge producers and the knowledge users.

Studying the whole problem

Is basic research being neglected in the Framework Programme's striving for tangible economic and commercial results? Is there some sort of tacit agreement that most basic research should be done at national level?

Not at all! Many of the key actions are in areas where there are still large gaps in our knowledge. In life sciences for example there is a key action on nutrition, the environment and health, which will require a lot of basic research in biology. Even though the bulk of basic research is done at the national level, our task is to focus it on the areas which are the bottlenecks to the solutions. If we are to answer society's concerns about the quality of life, safety, health or the environment, we have to strengthen the knowledge base upon which policy decisions must be made.

The point is to generate European added value by considering the whole of a problem, and this includes basic



"These issues require a multi-disciplinary, multi-dimensional approach, which can only be tackled by bringing in key actions which are more problem-driven than science-driven."

research as well as standards, applications, markets, social and environmental effects, and even ethics. Work on standards, for example, can have an immense economic impact. European pre-normative research in the telecommunications area is a typical example where government, science and industry got together and defined what became a world-wide standard. European GSM technologies now account for about two-thirds of the world market for digital mobile telephone systems, and are being adopted the world over. Without a common platform there never was any chance for the relatively small European companies to acquire such a dominant global position.

And there are similar challenges in many other fields. In multi-media for example, we need to define the common platform that European inventiveness and creativity can plug into and play with. In a sense we have to reinvent Gutenberg for the information era - otherwise this will be done by global corporations very much based on a single culture and a single language. If you place a high value on linguistic and cultural wealth as we do, it's important to do things like this.

Integrating behavioural science and economics inside the key actions is

equally important, because the usefulness of much research is more a social and political question than a technological one, for instance in energy or transport - indeed sometimes I feel that we don't need a new car, we need a new driver! Finally ethical issues surface in many areas: in biotechnology of course, and in information technology there are concerns over privacy and the security of electronic trade.

The subsidiarity principle

And does the programme's design also satisfy demands that the "subsidiarity principle" be respected?

Remember that we have a limited share of European research funding, about 4%. But we make this go a long way. First it is matched by national and industrial funding, so in cost terms it is in fact maybe 10-15%. And secondly it is all project funding, allocated to the best projects, so I would think that the impact it has is 20-30% of Europe's total. It also provides guidance to many national programmes. But still, it's not 50%, it's not 70%, so we have to look carefully at what things need to be done together.

There are a great many questions which can only be addressed on a regional or global level. For instance cli-

matic change, air quality, water and transport systems - we have in Europe eleven signalling systems for trains. Enlargement towards the East requires the common study and design of the most appropriate transport and telecommunications systems. Mapping the human genome calls for co-ordinated work by tens of thousands of scientists. We need common standards for the acceptance of biologically modified crops, genetically engineered foods and therapeutic products. It's very difficult to imagine the common market could work well if we have different standards in different countries.

Is there a need for a closer link between science and policy-making?

Very much so. I have been chairing committees on climate change, and very often what we serve up to the policy-makers is climatological models, sediment studies, ice core drillings, fragmented macro-economic impact analysis and data of this type. It's very difficult for the ministers to make a choice as to what to do. The scientific world could and should go further to integrate these scientific findings into policy alternatives, calculating their cost, benefit, impact and risk. It is of course up to the policy-maker to make the choice, depending



on his or her ideology, value systems and constituency, but it's not fair to criticise policy-makers for failing to make decisions, if they are not offered reasoned alternatives.

A home for the new knowledge-based industries

The Commission has identified something called the 'European paradox', our seeming inability to turn excellent research results into globally competitive products. What are the causes of this paradox? How can we overcome it?

Of course economists are still debating the existence of the European paradox, but nevertheless it does seem that Europe's advanced science is too often taken elsewhere to be exploited commercially - usually to the United States. The underlying causes of this are many and various, and there are questions related to our risk-and-reward equation, and our cultural attitudes to entrepreneurship, risk-taking and success.

But there are also causes that are gradually being remedied by Europe's economic and political development: it is now recognised, for example, that technology transfer needs to be done at international not local level, so that the best partners anywhere in the world come together to turn knowledge into products.

But the key thing we need to do is to build a home for the new knowledge-based industries, which are the only ones providing new industrial jobs. To do this, we need to appreciate that the economics of these industries is very different from that of traditional industries. They grow very fast, and they have very short product development cycles - unless you launch your new digital phone at the right moment, you can forget about it. They also face immediate global competition. Consequently they have massive R&D costs. For example developing one new drug costs hundreds of millions of ecus. And launching it is a risky game, like

Russian roulette - you only have one shot. So you have to have ten or twenty drugs in the pipeline, and you need a capitalisation in the billions. This is what is fuelling the current spate of pharmaceutical mergers.

Capitalism today is not a form of ownership, it is an allocation system for capital, which must take resources from profitable areas but non-growth areas and put them into new areas. In Europe,



"The coming of the euro will create new investment opportunities which provide real growth, not just inflated values."

this has traditionally not been very attractive tax-wise, and we have over-invested in non-growth areas, and under-invested in the new growth areas. So we need to develop common European risk capital markets.

What we can see coming, and should promote, is a kind of network economy, where small development studios, very often based on university research work, can be partners to the largest marketing and production organisations in the world, which are outsourcing their technologies from these small companies.

Research and the euro

Is the coming of the single currency going to make it easier for Europe to develop high-tech products?

Yes. The euro is changing the financial environment. The convergence criteria for the common currency call for balanced budgets and a ceiling on national debt. This means that the great liquidity sink which has been the financing of public deficit by government bonds is now over; no longer can you get a 10% risk-free return by lending to the state. As a result, interest rates have fallen to a few per cent, and the spread of interest rates, which reflects exchange rate uncertainty, has narrowed to less than one per cent. So there's a great incentive to invest in equities.

In parallel, another cause of this accelerating interest in equities is that Europe's pension funds still mostly take a cash-flow approach, where those now in work pay the pensions of those who have retired. As the support ratio of society - that is the number of workers per pensioner - decreases, we have to save much more through pension funds and also as individuals.

These two factors have created a stock-market boom: European stock indices have doubled in the last couple of years. And indeed they have inflated because there has been a scarcity of investment opportunities. That's why we need to create new investment opportunities which provide real growth, not just inflated values.

And this means creating an interface between science and the financial world, to work in parallel with the existing interface between science and industry. We need to think about the not-yet-born industries as well as the existing ones. ■

News in brief

European RTD Policy

Conference to launch the Fifth Framework Programme - 25-26/2/99 - Essen (D) - "In order to meet the challenges of the transition to a "knowledge-based society", the Fifth Framework Programme will be quite different from its predecessors in terms of both content and operation," explains Edith Cresson, Member of the Commission for research, innovation, education, training and youth. "The intention is to move away from research for its own sake and towards research focusing on current socioeconomic problems, i.e. research with the potential to accomplish the changes expected by the general public."

The Fifth Framework Programme (1999-2002) will be launched officially at the Essen Conference in Germany, on 25 and 26 February. Events fall into six main categories:

- a presentation of new Community research programmes which form the various chapters of the Fifth Framework Programme
 - a presentation of the services and expertise offered by the Joint Research Centre
 - a series of practical workshops allowing potential coordinators to obtain information on the conditions for participation
 - a presentation of particularly successful research projects by the relevant project managers
 - an exhibition of RTD projects supported by the EU together with stands for the various programmes
 - a cyber café and electronic messaging system to permit various kinds of exchange (partner search, announcements, etc.) and an Internet site to transmit the debates.
- The Conference not only seeks to provide information, but also to serve as a forum for contacts between potential partners, in particular with a view to forthcoming calls for proposals.

Programme addresses on EUROPA and CORDIS:

The "EUROPA-12" and "CORDIS" Internet addresses given for the various programmes referred to in the following pages should all be prefixed as follows:

For EUROPA-12: <http://europa.eu.int/comm/dg12/>

For CORDIS: <http://www.cordis.lu/>

Reference to DG XII press releases

Information bearing the reference PR +DATE is also available as a press release on EUROPA-12: [press.html](http://europa.eu.int/comm/dg12/press.html)
Fax: +32-2-295.82.20.

Publications

Publications listed where the EUR number is followed by an (*) are subject to charges and can be ordered from the OOPCE (Office for Official Publications of the European Communities) - Fax: +352-48.85.73. Other publications can be obtained from the programmes concerned.

Information:

Communication Unit, DG XII - Fax: +32-2-29 58220 - E-mail: michel.claessens@dg12.cec.be

European research: 1997 results - Now available⁽¹⁾, the 1998 annual report on the research and technological development activities of the European Union confirms that 1997 was an excellent year.

■ **The figures** speak for themselves: 24 000 replies to calls for proposals; more than 7 000 contracts signed; 24 000 participations; EU financing of ECU 3 000 million. By 31 December 1997, the Fourth Framework Programme (1994-1998) had enabled 15 000 projects, with a total value of ECU 8 200 million, to get under way. Since 1994, 160 000 cooperative links between European partners have been created - including almost 60 000 in 1997 alone. This vast network helps researchers and companies to confront complex problems, often international in scope, and to work together on new technologies, the development of which is becoming more expensive all the time. The increasingly active participation of SMEs in European programmes (see below) also emerges clearly from this report.

■ **Many scientific and technical results** have been achieved in the various fields which contribute, directly or indirectly, to improving the quality of life in Europe. There has also been progress in translating research results into innovations, thanks to a series of coordinated initiatives (satisfying the objectives of the First Action Plan for Innovation), involving the Commission's various directorate generals. These have been mainly in the fields of the protection of intellectual property, the financing of innovation, simplifying the legal and regulatory framework, and education and training.

■ 1997 was also marked by the **preparation of the Fifth Framework Programme** (1998-2002), which benefited from the active participation of many of those involved in European research. More than 300 contributions were collected: almost 150 from European associations and more than 170 from private bodies, including about 50 from industrial and professional federations. An initial conference on the scientific and technological content of the Fifth Framework Programme for RTD was held in February 1997, followed by further consultations in July,

which made it possible to prepare the field for negotiations with the Parliament and Council of Ministers (PR 9/9/98). This report can be consulted on the Internet (EUROPA: [report98.html](http://europa.eu.int/comm/dg12/report98.html)) or obtained from the DG XII Communication Unit - Fax: +32-2-29 58220.

SME participation in European research

32% of companies participating in European RTD projects ("shared cost actions") are SMEs. More than 12 000 of them had been involved in various research projects financed by the EU under the Fourth Framework Programme (1994-1998), compared with 5 400 under the previous framework programme. This interest is the result of new specific actions, such as the Technology Stimulation Measures for SMEs. Thus, between 1995 and 1997, 2 700 SMEs received an exploratory-phase grant and another 4 300 participated in one of the 767 CRAFT projects. In addition, some 5 000 SMEs participated in joint research projects.

A recent survey⁽¹⁾ gives a more precise idea of the involvement of SMEs in European research. 64% of those which had participated in projects under the Fourth Framework Programme for RTD had never before participated in a European research programme, and 63% had no previous experience whatsoever - whether at regional, national or international level - of cooperation in the field of RTD. Furthermore, SMEs are more active in European programmes than in any other national or international research programmes. Two thirds of the participating SMEs employ fewer than 50 staff. They report that the main

(1) SME Participation in the Fourth Framework Programme for Research and Technological Development - VERTICA Oy, in consortium with Yellow Window NV and Zenit GmbH, 23.6.98

benefits they have drawn from participation in the Fourth Framework Programme for RTD are the creation of international partnerships, the development of a new product or process, access to a new technology, and exploitation of their own know-how. That is why the Fifth Framework Programme plans to continue with these special measures aimed at SMEs. A special information service is to be set up, which SMEs can contact with their questions, proposals and expectations regarding future actions.

Increased patent applications

34 608 EU researchers submitted patent applications in 1996. This encouraging figure, published by EUROSTAT, shows annual growth of 2.14% compared to the 1989 results. Germany is the clear leader, with 41.4% of total applications, followed by France (16.3%), and the United Kingdom (11.9%). Although this trio regularly lead the field, it is nevertheless in certain small countries - those where the public authorities give most active support to their R&D expenditure, and Denmark in particular - that we see the most dramatic increases.

Also, if we compare the number of patent applications to the active population, we then find that Sweden, Germany and Finland lead the field. A regional breakdown also reveals the scientific and technological differences within the same country (733 applications in Stockholm compared to 44 Mellerstta Norrland) and which regions or Member States are the strongest innovators in which fields. North-east Italy and the western Netherlands specialise in products which are in immediate demand among the citizens, for example, whereas the Rhineland and Westphalia, where the focus is more on industry, are particularly strong on chemicals and metallurgy. For further details: *Statistics in*

Focus-Research and Development, 1998, issue 2 - *Patent activities in the EU* - Published by EUROSTAT - Available from the EUROSTAT Data Shop
Fax: +352-433522221
E-mail: agnesn@eurostat.datashop.lu

Correction

We wrongly attributed US nationality to the physicist John Bell in the article *Teleporting Talent around Europe* (RTD Info 19). "This is an injustice to European science," writes Pier Giorgio Innocenti, of CERN. "Bell was born and brought up in Belfast, obtained his doctorate in Birmingham, and remained a British subject all his life. From 1960 to 1990 - when he died - it was as a physicist at CERN, in Geneva, that he carried out his remarkable work on quantum mechanics."

Publications

■ *Fresh Water: a challenge for research and innovation* - 40 pages defining Europe's research and innovation priorities in the field of drinking water management and conservation.

Information -

Fax: +32-2-296.3193 - E-mail: Bruno.Schmitz@dg12.cec.be

■ *Examples of demonstration projects in the life sciences programmes - Biotechnology, Agriculture and Fisheries, Biomedicine and Health** - EUR 17784 EN - ISBN 92-828-3411-5

Industrial Materials and Technologies (Brite EuRam)

Fax: +32-2-295.80.46 / 296.70.23

E-mail: imt-helpdesk@dg12.cec.be
EUROPA: br-eur1.html
CORDIS: brite-euram/home.html

Publication

*Silos - Fundamentals of Theory, Behaviour and Design** - E&F.N. SPON -

This book presents the results of the CA-Silo concerted action, conducted between

1992 and 1996 with the participation of Europe's best specialists, on eliminating technical incidents and the risk of accident in silo operation.

Environment & Climate

Fax: +32-2-299.57.55

E-mail: environ-infodesk@dg12.cec.be

EUROPA-12: env1r1.html

CORDIS: env/home.html

Diary

■ *4th United Nations Conference on Climate Change* - 9-16 November 1998 - Buenos-Aires (Argentina) - See article p. 10.

■ *Beyond growth: Institutions and Policies for Sustainability* - This 5th Biennial Meeting of the International Society for Ecological Economics will include a session on related European RTD; 15-19 November 1998; Santiago, Chile

■ *European symposium on sustainable regional development* - 28-30/10/98 - Graz (A).

Marine Science and Technologies (MAST)

Fax: +32-2-296.30.24

E-mail: mast-info@dg12.cec.be

EUROPA-12: marine1.html

CORDIS: mast/home.html

Diary

■ *International Workshop: The deep ocean - a model for processes functioning under extreme environmental conditions*; 19-22 November 1998; Kiel, Germany

Biomedicine and Health (BIOMED)

Fax: +32-2-295.53.65

E-mail: biomedicine@dg12.cec.be

Diary

Chronic pain as a Major Health Issue in Europe - 4/11/98 - Brussels - Presentation to the European Parliament of the "Consensus statement on the neuromodulation of pain." E-mail: JG@intermar.be

Biotechnology (BIOTECH)

Fax: +32-2-299.18.60

E-mail: life-biotech@dg12.cec.be

EUROPA-12: biot1.html

CORDIS: biotech/home.html

New European network of vegetal biotechnology (ENVB)

- The aim is to promote the networking, exploitation and dissemination of the results of European research projects in the field of plant biotechnology (improved nutritional quality, disease-resistant cultures, control of biodiversity, etc.). This initiative will help maintain and strengthen Europe's leading position in this sector (PR 25/6/98).

Biotechnology and management

- How can you exploit your research results when you are working in a high-tech sector in which SMEs could occupy niche markets? By setting up your own company, for example. To help scientists move from discovery to innovation, the Biotechnology programme is offering accelerated and personalised training: Biobiz®. This intensive 3-day workshop (case studies, use of specialised software, etc.) is designed to equip researchers to draw up a business plan and win the confidence of venture capital managers.

A subsidy of ECU 1000 is offered to scientists in the Member States who would like to attend the Biobiz® course (cost: ECU 2,200). After the United Kingdom, Germany, France and Sweden, the next training sessions will be held in Roosendaal (NL) from 3 to 5 November, in Milan (I) from 10 to 13 November and in Barcelona (E) from 17 to 19 November (PR 22/7/98)

Information: Michel Lepers, Amersham Pharmacia biotech
Fax: +49-7614 519 349

E-mail: Michel_lepers@compuserve.com

Diary

■ *Allied Genome Research Symposium* - 26-27/11/98 - Brussels (B)

■ *Yeast as a cell factory - Symposium* - 30/11-2/12/98 - Vlaardingen (NL)

Publication

Biotechnology and Finance Forum - Report - The activities of the May 1998 forum.

Agriculture and fishing (FAIR)

Fax: +32-2-296.43.22 - EUROPA-12: agro1.html
E-mail: life-fair@dg12.cec.be
CORDIS: fair/home.html

Publications

■ *Integrated Biomass System - Use of biomass for the production of electricity and biofuels* - EUR 17541

■ *Success stories for the agro-industrial research programmes* - Selection of 67 projects carried out under the FLAIR, ECLAIR, FOREST, AIR and FAIR programmes - EUR 18227

■ *Fair Food Projects Synopses* - Review of 118 projects selected by FAIR - EUR 18306

Non-Nuclear Energy (JOULE)

Fax: +32-2-296.68.82
E-mail: helpline-energy@dg12.cec.be
EUROPA-12: joule1.html
CORDIS: joule/home.html

Publications

■ *Final report of SENSER (Synergies between European and Member States Energy RTD)* - EUR 18527 - ISBN 92-828-4387-4

■ *Summary report of SENSER (together with the report of the "Co-ordination-activity with the Member States")* - EUR 18526 - ISBN 92-828-4386-6
SENSER's objective was to analyse and compare the RTD energy strategies pursued in the Member States. A data and information base now provides key indicators for political decision-makers in four fields: evaluation of RTD, technology characterisation and forecasting, analysis of market forces, opportunities and synergies for the EU.

■ *Non-Nuclear Energy Programme, 1990-94, JOULE II - Individual assessment report - Volume I** - EUR 17981/1 - ISBN 92-828-2122-6 - Results of the first assessment exercise involving 100 completed projects.

Nuclear Fission Safety

Fax: +32-2-295.49.91
EUROPA: fission1.html

Publications

Nuclear fission safety progress report 1997

■ *Volume 1: Reactor safety and innovative approaches* - EUR 18322/1 EN

■ *Volume 2: Radioactive waste management and disposal and decommissioning* - EUR 18322/2 EN

■ *In situ testing in underground research laboratories for radioactive waste disposal* - Proceedings of a cluster seminar in Alden Biesen, 10-11 December 1997 - EUR 18323 EN

International Cooperation (INCO)

Fax: +32-2-296.59.36
E-mail: inco-desk@dg12.cec.be
EUROPA-12: inco1.html
CORDIS: inco/home.html

Enlargement: candidate countries and the Fifth Framework Programme - The Commission has officially started negotiations for the participation in the Fifth Framework Programme of Cyprus and the Central and Eastern European Countries - CEECs - which are candidates for EU membership. On payment by their governments of an appropriate contribution, their research institutes, universities and companies can participate in the programme on the same basis as organisations in the Member States (in particular in terms of financing). The inclusion of these countries will broaden the range of partners and cooperation opportunities throughout Europe.

Diary

New partners, new opportunities - 14-15/12/98- Brussels (B) - Conference on the participation in the Fifth Framework Programme of the 11 EU candidate countries.

Targeted Socio-Economic Research (TSER)

Fax: +32-2-296.21.37
E-mail: tser-secr@dg12.cec.be
EUROPA-12: tser1.html
CORDIS: tser/home.html

Diary

European conference on socio-economic research - 18-20/11/98 - Brussels (B) - An analysis of the results of TSER projects and prospects for the Fifth Framework Programme.

Training and Mobility of Researchers (TMR)

Fax: +32-2-296.32.70
E-mail: tmr-info@dg12.cec.be
EUROPA 12: tmr1.html
CORDIS: tmr/home.html

10th EU Young Scientists Contest - At the finals, held in Porto, Portugal, from 21-17/9/98, the three first prizes of ECU 5 000 were awarded to:

- Gabor Bernath, 15, from Hungary (development of a scanner reproducing 3D images);
- Paul Pak, 19, and Peter Weilenman, 20, Austria (development of an ultrasonic sensor allowing visually impaired people to have a virtual vision of their surroundings);
- Robert Craney, 18, and Matthew Thomas, 18, United Kingdom (analysis of the yellowing of alkyd-based paints).

13 other competitors shared the 2nd and 3rd prizes.

Innovation Programme

Fax: +352 4301 32084
E-Mail: rtd-helpdesk@lux.dg13.cec.be
CORDIS: innovation/home.html

Publication

■ *Innovation in the service of growth and employment - Implementation of the First Action Plan for Innovation in Europe* - This important communication by the Commission is available on the Cordis server (www.cordis.lu/innovation/src/iap-fr1.htm) or in printed form (ISBN 92-828-2865-4)

■ *Cordis Focus: RTD Results Supplement*

Joint Research Centre

Fax: +32-2-296.23.11
E-mail: gisele.vanwert@jrc.cec.be
<http://www.jrc.org/jrc/>

New institute for the health and protection of consumers

In the framework of the recent repositioning of the JCR's activities on research linked to EU policies⁽¹⁾, the creation of this institute, on the Ispra site, meets needs relating to protecting citizens' interests, strengthening sustainable development, and the competitiveness of European industry. Its objective will be to provide the necessary scientific and technological tools for the application of the many European directives on product safety. The Institute of the Environment, formerly responsible for this field of research, will in future concentrate its activities on specifically environmental problems, such as the greenhouse effect and climate change, waste and water management, renewable energy, etc. ■

(1) See the interview with Herbert Allgeier, the JCR's new director, in RTD Info n° 19

Strengths and weaknesses of European S&T

*Europe has very strong scientific bases. But compared to the United States and Japan, it produces far fewer results in terms of technological and economic performances. What are the reasons for this relative weakness? Is it the cause of Europe's unemployment problem? And what can be done to correct it?**

European science is in anything but bad shape. An international comparison of the number of scientific results produced⁽¹⁾ in relation to R&D expenditure shows that the productivity of European researchers is every bit as good as that of their American or Japanese counterparts. On the other hand, when you look at the ability of European researchers to produce patents, you find they are very largely concentrated in certain traditional sectors - chemicals, motor vehicles, aerospace - and lag far behind in the major strategic fields of the new technologies.

"The US has the dominant share of patents at the European Patent Office (EPO) in virtually all key technology fields, and in particular enjoys a substantial lead in key technologies relating to pharmaceuticals and drugs (with 60% of EPO patents versus the EU's 27%) and biotechnology (56% EPO share against 31% for the EU)," underline the authors of the ERSTI report. "Japan remains very focused on electronics, audiovisuals and telecommunications, and performs very well in patenting individual key technologies in these fields, not least in electric vehicles (where it has 40% of EPO patents versus the EU's 20%) and flat screens (51% against Europe's 22%)."

But within this global picture, Europe's scientific and technological landscape is far from uniform. "The paradox is most clearly confirmed for Belgium, Greece, Spain, Sweden and the UK, countries with a high scientific output but below average technological returns on R&D investment. The best performers are Denmark, Finland and the Netherlands, which boast high levels of both patent and publication output."

Negative effect on employment

The most negative point is in the field of employment. "During the first half of the 1990s, in every sector except pharmaceuticals, total sector employment fell by at least 2-4% a year," notes the ERSTI report.

"At this level, we begin to grasp one of the key issues of innovation and its relationship to employment. Multinationals based in the EU tend to be the largest losers of employment in their sectors, in

contrast to those based in the US which create more jobs than the industry average. The story for European new technology-based firms is similar, with no clear successes so far in terms of job creation, although such firms do have a significant impact on knowledge creation while providing high quality careers for many PhD's. Meanwhile, the evidence available for innovative SMEs suggests that they may not create more employment on average than non-innovative SMEs, but

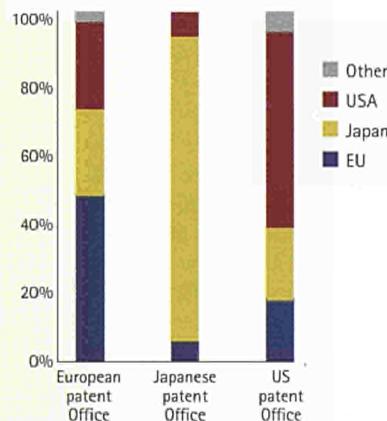
Comparison of the origins of patents registered in Europe (EPO), Japan (JPO) and the United States (USPTO - 1995)

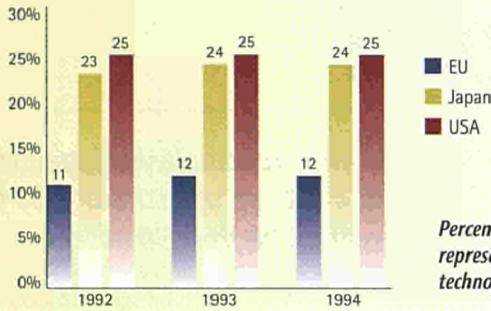
Almost absent from the Japanese market, and only very moderately represented on the US market, patents of European origin also represent no more than half of the total patents registered in Europe itself. Apart from this overall picture of the situation in 1995, a more detailed study of performances, carried out during two successive periods from 1986-90 and 1991-1994, reveals a worrying trend for Europe.

■ On the US market, taking as an indicator the number of patents registered compared to the R&D expenditure of companies - and this in eight key sectors of high scientific and technological density: pharmaceuticals, electronics, computers and office equipment, aerospace, chemicals, motor vehicles, electrical machinery and instruments - we find that European companies have an average coefficient of 206 patents registered between 1986 and 1990 and 201 patents between 1991 and 1994. The same measurement carried out for US companies on their own market showed an increase

from 305 to 437 patents and for Japanese companies an increase from 460 to 532.

■ On the European market, during the same periods, the EU continued to remain in the lead, with 285 and 333 patents respectively. But over the same period US firms doubled the number of patents they registered in Europe, from 115 to 203, while Japanese industry also recorded an increase, from 247 to 295 patents.





Percentage of export market represented by high technology products

do tend to be the most dynamic, having the highest and lowest employment growth rates."

Two strategic axes

What new ways forward can be identified by analysing the present situation? The authors of the Indicators Report point to two strategic axes that could stimulate the European Union's S&T performance. One distinguishing feature of European research is that "its strength lies more in its universities and public research institutes than in its enterprises and, consequently, the university-industry interface needs to be better cultivated." They recommend in particular that "policies to develop the bridge between firms and academia need to be adapted to the culture of university research, avoiding an overly commercial approach, and instead integrating the objectives of the company with the long term research theme of the university laboratory."

A second axis is based on the fact that "strategic bridges are increasingly being built between firms in the form of technology-based alliances. Links between large firms and small and medium-sized enterprises are also observed to be significant and complementary, with innovative SMEs frequently transferring and commercialising technologies developed by larger companies, while the latter sometimes bring to market products by new technology-based firms." This dynamic relationship is being stimulated by several measures at EU level but "an important challenge for future policy might be the encouragement of innovation in SMEs through regional support

mechanisms and agencies which some argue are often better placed to tailor measures to the specific needs of their local clients." ■

* This article is the second in a series which RTD Info is devoting to the "1997 European Report on S&T Indicators" (ERSTI).

(1) These are traditionally measured by the number of publications which result in the relevant journals.

Next article
European research: diversity,
convergence and cohesion

ERSTI Contents

The Second European Report on S&T Indicators (ERSTI), published by the Commission in December 1997, is a unique and massive collection of data and analyses on every imaginable aspect of science and technology in Europe as it compares to the rest of the world.

Part I - European Science and Technology in the World

firms in Europe and the US - Innovative activities of European enterprises

Part II - From R&D to innovation and competitiveness

An industrial look at R&D: the eight most R&D intensive sectors - Comparative performances of European, American and Japanese Industries - Technological performance by industry - An analysis of the scientific base of industries

Part III - European diversity, convergence and cohesion

Part IV - R&D co-operation in Europe

Part V - The European Union as world partner

Beyond the European paradox - From Science to Technology: interactions and return on investment - From Technology to international trade in high-tech products
Dossier: Innovation and technological competitiveness of European enterprises - The technological activities of the leading Multinationals - New technology-based

Second European Report on Science and Technology Indicators 1997. Published by the European Commission, December 1997. EUR 17639 ISBN 92-828-0271-X ECU 60 (2 volumes + CD ROM) 729 pp; Appendices 198 pp
Contact:
Office of the Official Publications of European Communities - Fax: +352-48.85.73.

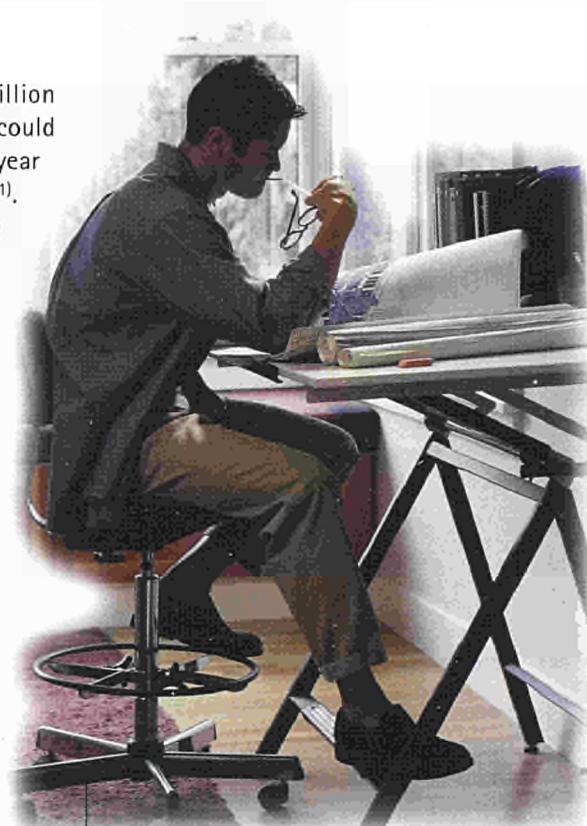
Who's afraid of telework?

New technologies are allowing a growing number of people to do their jobs without actually having to travel in to work each day. But this "telework" requires a new approach and a change of attitude - by both management and their staff - a subject that will be debated hotly in Vienna at IST 98 from 30 November.

There are more than four million teleworkers in Europe. This could increase to 15 million by the year 2002 and over 40 million in 2007⁽¹⁾. But teleworkers are a very diverse group. Those who work from home (telecommunications or computer experts, freelance journalists and translators, etc.) remain rare. More numerous are the *nomads* - engineers, salesmen, service technicians - who exercise a large part of their activity in close contact with the customer and use portable computers, *groupware*⁽²⁾, mobile phones, etc., in order to keep in contact with their company and provide a real-time response to any problems encountered in the field. A third type of professional meets at *telecentres* - centres which are independent of companies - and *telecottages* - "stop-off offices" - which are well equipped for the needs of a wide variety of teleworkers.

Encouraging change

"The common - but simplified - image of working at home does not appeal to many Europeans," believes Horace Mitchell, director of European Telework Development⁽³⁾, who will be presenting the European situation at the IST 98 conference. "Many people need the social contact which comes with working in close proximity to colleagues and the discipline of a more formal working environment. Most homes are also too cramped for two teleworkers and people tend to live close to their place of work anyway so the savings on travelling are not a major factor." The loss of contact



By eliminating distance, telework offers new employment possibilities for those who live far from companies.

with the company can also bring about marginalisation and thus harm career development.

Many bosses are also reluctant to encourage telework because they see it as reducing their control over their workers and posing additional organisational problems. Yet Horace Mitchell believes that "the right combination of different methods of telework can generate substantial benefits both for employers and employees and bring savings. Companies which use telework report savings as high as 50% - notably through reduced outlay on premises and equipment - and productivity gains of almost 40%." Also, eliminating distance considerably widens the labour market and brings new

employment opportunities to those who do not live near industrial or technology parks.

European research

But telework requires planning. A number of different technologies and organisational models have been the subject of research under the Community's ACTS (Advanced Communications Technologies and Services) programme. The TECODIS project, for example, provides a practical demonstration of the possibilities of telework for the joint development of software systems between engineers of the Swedish firm Ericsson, employed at its Aachen (D), Stockholm (S) and Madrid (E) sites and linked by advanced communication systems (ATM, ISDN, GSM) and telematics tools.

Important progress has also been achieved in implementing multimedia videoconferencing systems able to function on both the local networks of companies and public networks, thereby immediately making this technology available to the millions of European SMEs. The DIVINE project - set up by Alcatel (F), Nice University, IPK Berlin and Ford Cologne and involving many European partners - made it possible to demonstrate the viability of an interpersonal videoconference system based on relatively unsophisticated and inexpensive multimedia PCs.

Flexible, stress-free personnel

Interface initiatives

The ACTS Telework Concertation Chain (GAT: Generic Access - Telework) effectively coordinates all these efforts. This forum, which functions as an interface between the various research projects, has made it possible to draw up a series of guidelines intended for the public authorities, companies and developers on various aspects of telework: the interoperability of services, multisite work, the use of maritime transport, etc. Last May, it identified about 30 ACTS projects which help reduce the costs of telecommunications, increase the capacity and interoperability of networks, simplify their use and introduce work in multisite teams⁽⁴⁾.

Researchers are also looking at the social and industrial aspects of telework. The DIPLOMAT project is trying to achieve a consensus on "new socially attractive and economically efficient ways of working" and to prepare the ground for future European directives in this field. With this in view, DIPLOMAT has drawn up a European telework charter which industrialists, employers' associations, trade unions, experts and politicians have all been invited to sign. ■

(1) According to the figures published by the European Information Technologies Observatory - EITO 1998 Report. This document is available from the EITO: <http://www.eto.org.uk/eito>.

(2) Software suites (sets of compatible and integrated software application programmes) permit a networked exchange of information and cooperation within a working group, generally comprising electronic messaging, a document manager system and a programming unit.

(3) ETD is a European initiative to increase awareness of telework, supported by the European Commission under the ACTS programme.

(4) GAT Survey of ACTS Projects (1998) (<http://www.eto.org.uk/gat/actsurv.htm>)

The European Telework Development (ETD) initiative, which seeks to promote telework via the European Telework Online⁽¹⁾ Internet site, holds an annual Telework Week, complete with prizes. The 1998 event will run from 2 to 9 November.

In 1997, an award went to IBM-Belgium (IBM Belgium Shared Offices) for a telework programme, which was described as the "best contribution to European competitiveness". "About 1 100 employees were given a portable computer, mobile phone and second telephone line at home so that they could connect to our IBMNet network from their own home, their client or any of the IBM offices," explains Marianne Schouten, spokesperson for the company. The productivity gains are, however, diffi-

cult to quantify, as although gains were made in terms of expenditure on premises, telecommunication costs naturally increased. "The essential contribution was in terms of the new work flexibility and the satisfaction of the personnel who were able to get rid of much of the stress of their job which is linked to the travelling," concludes Marianne Schouten.

(1) <http://www.eto.org.uk>

IST 98 Vienna

Living and working in the Information Society

New job creation, mobility of human resources, telework, electronic commerce, leisure activities, culture, network security and control, protection of private life and intellectual property... will all be debated at IST⁽¹⁾ (Information Society Technologies) 98. This annual conference-exhibition will be held in Vienna from 30 November to 2 December. It is organised jointly by the EU's ACTS, Esprit and Telematics Applications programmes.

The new *User-friendly Information Society* programme will be presented at the conference. This is an important element of the Fifth Framework Programme for RTD which reflects the convergence of information technologies, communications and the media, bringing together within a single integrated programme the research activities conducted to date by the ACTS, ESPRIT and Telematics Applications programmes.

The advanced technologies and products developed under these Community programmes, as well as a series of projects conducted under the auspices of the Info

2000/MLIS programmes, will be the subject of presentations, demonstrations and technology transfer actions. An Investors Forum will allow venture capital providers to get into contact with representatives of high-tech SMEs.

IST 98 is also the time for European awards. As a prelude, the EuroPrix Multi-MediaArt 98 awards ceremony will be held on 29 November, in Vienna. The conference will close with the presentation of the European Information Technology Awards by Austrian Chancellor Viktor Klima.

(1) One of the debates on the subject of the networked society will be chaired by Nobel Prize-winner, Ilya Prigogine. IST 98 will also be coupled with the European Netd@ys.

Contact IST 98

Steve Rogers

E-mail: steve.rogers@cec.be

Internet: www.cordis.lu/ist98/

The virtual world of electronic commerce

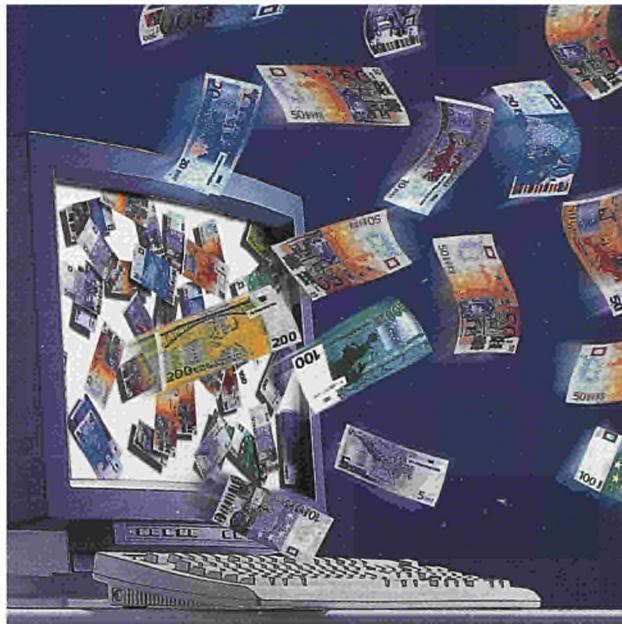
Revolutionising purchasing habits and bringing new opportunities to companies, the inexorable rise of the Internet is opening up major growth prospects for electronic commerce. Already the world's biggest bookshop and travel agency, the Web is all set soon to become the world's biggest supermarket.

By 2001, according to estimates from a recent survey carried out by Forrester Research⁽¹⁾, electronic commerce in Europe should represent a market worth some \$64 billion, compared with a little over \$206 billion in the United States. This is just 0.9% of Europe's gross domestic product but 2.7% of that of the United States.

Also in 2001, 53.2 million people in Europe should be connected to the Internet, compared with 98 million in the USA, despite its smaller population. By then, annual purchases made via the Internet should average around \$1 217 per person in Europe, compared with \$2 101 across the Atlantic. According to the Forrester survey, the turnover for advertising on the Web is set to increase from \$105 million in 1998 to \$2.8 billion in 2003.

More than just window shopping

More cautious in its forecasts, the European Commission believes that worldwide electronic commerce should generate a turnover of around ECU 200 billion by the year 2000. To date, it has been principally large companies which have engaged in electronic commerce, in the framework of business-to-business relations and in particular via EDI (Electronic Data Interchange). In 1997, this segment represented an estimated \$8



Confidentiality and security of transactions, protection of consumers and private life, intellectual property... Essential conditions for the success of electronic commerce.

billion out of the total \$9.2 billion turnover generated on the Internet.

But the Web also offers considerable opportunities for SMEs. Many of them have already taken the first step by creating their own Website. But apart from this promotional aspect, they are also wondering how to go about deriving a profit from investments in this new "shop window". The fact is that doing business on the Internet remains rather a risky affair, and this for a number of reasons linked to the confidentiality and security of transactions, the protection of consumers and private life, and intellectual property.

As to the relatively small volume of private transactions, these are mainly concentrated in the areas of computer

products, tourism and leisure activities, and the purchasing of books and CDs.

For European growth

In the interests of the security - and thereby growth - of electronic commerce, the European Commission has supported a number of research projects studying solutions designed to meet the needs of specific sectors (retail, textiles, tourism) or developing platforms for electronic transactions and secure payment methods, intelligent agents and the management of intellectual property. These various projects are dealt with in some depth in two works published by DG

III's Esprit programme in June, drawing particular attention to the synergy that results from the way one project complements the other⁽²⁾.

In the retail sector - which has already seen many electronic supermarkets where consumers are invited to fill their virtual trolleys - Philips, CD-Italy, Freemans, LaSer and Parisa Group have launched the Homestead 2000 system throughout Europe. By combining two technologies, consumers can select their purchases on the basis of multimedia catalogues (the CD-Rom is pleasant to consult and provides high-quality video images) and place an immediate order, via the Internet, at a secure site.



Security...

The experts agree that increased security and improved interoperability of services are essential conditions for the success of electronic commerce. This is the goal of the SEMPER (Secure Electronic Marketplace for Europe) project which, following several months of tests, is now offering "the first comprehensive and secure architecture designed for commerce on the Internet".

Under this system, service providers draw up catalogues in the form of databases accessible to customers via the Web. Customers place their orders using the forms available at the site. Digital certificates delivered by a certification authority⁽³⁾, which customers access by means of a password included in the SEMPER software, guarantee confidence between the partners. A system of electronic signatures ensures that the recipient of data transmitted by an electronic network is able to determine where the data came from and check whether or not they have been changed. This powerful secure payment procedure is contained in a tripartite software protocol, which manages the interfacing of the consumer, supplier, and financial institution in a single message. Payment for the order is by credit card using the SET (Secure Electronic Transaction) protocol supported by Visa and Mastercard, or alternatively by an ecash smart card.

This model, developed by IBM, has been tested on a number of occasions, in particular in connection with the Otto-Ver-sand (Hamburg) mail order catalogue system, the Fogra (Munich) specialised consultancy for the printing sector, and the

Eurocom (Athens) home study technical education service. CWI and Digicash managed the banking logistics from Amsterdam, while GMD, the German national data processing research centre in Darmstadt, acted as the registration and certification authority. Last March a further trial involved the Dutch company OPL (specialising in publications on the oil and gas sector) and the French companies Acric (management of satellite and aerial photograph databases) and Actimédia (sale of CD-ROMs). The results of this experience will be assessed at the end of this year.

...and interoperability

The need now is to set up mutually compatible electronic commerce systems based on common protocols and equipped with interfaces for two-way communication. This is the view expressed by about a hundred companies in the banking, tele-

com, retail and data-processing sectors, together with SMEs specialising in various fields. Last February, these companies signed a draft agreement in order to guarantee the coherence and openness of electronic commerce systems developed in Europe. There is also a desire for compatible standards for databases, search engines and online certification and payment systems. ■

(1) These figures were presented at the Forrester Forum Europe in London last June. For more details contact: www.forrester.com

(2) *Business Transformation through Technology, 21 Striking Cases from Technologies for Business Processes* (ISBN 92-828-3426-3) and *Accelerating Electronic Commerce in Europe* (ISBN 92-828-0376-7).

(3) These data are accompanied by a certificate, delivered by a certification services provider, which allows a message recipient to check the sender's identity. The European Commission has just proposed a directive laying down minimum regulations for their use.

Does information sell?

Will Internet users who have grown accustomed to the Web's free services switch off when they find they have to pay for them? This question applies primarily to information, a product which seems to be difficult to sell via the Web as the consumer wants to assess its value before purchasing it and then no longer wants to pay the price once he has seen it. An IST workshop is to be held on the subject (Vienna, 30.11.98). New ideas for electronic commerce will be tested at the workshop and participants invited to "invest" electronic tokens in solutions judged to be the most commercially viable.



From advanced physics to heavy industry

The world's shortest steel rolling mill is to be found in Cremona (Italy). Energy efficient and environmentally friendly, it was built on the basis of models developed to study the effects of intense magnetic fields on the materials of a nuclear fusion reactor.

In an attempt to control the enormous energy produced naturally in the stars when atomic nuclei fuse, scientists with the European Thermonuclear Fusion research programme are working on highly complex installations, in which an ionised gas - or plasma - heated to a temperature of 100 million degrees is confined within an intense magnetic field. Following the successes of the JET (Joint European Torus) experiments, they are now working on a major international project, involving Euratom, Russia, USA and Japan, to build the ITER experimental reactor. Its objective is to maintain the combustion of a deuterium-tritium (hydrogen isotopes) mix long enough to demonstrate the feasibility of using fusion as an energy source.

A steel rolling revolution

A partner in the European programme, the ENEA (Ente per le Nuove tecnologie l'Energia e l'Ambiente) research centre in Frascati (Italy) developed sophisticated mathematical and computing models to study the extreme electromagnetic and thermal phenomena experienced by the components of a fusion reactor. "It is on the basis of this expertise, which is far removed from traditional metallurgy, that we came to cooperate with the engineers from the Arvedi steelworks in Cremona, Italy, who were looking for ways of improving rolling techniques at their plant," explains Pietro Costa, researcher

at the ENEA's fusion division. Thanks to this unexpected spin-off, the Italian metallurgical company now has the world's shortest steel rolling mill, which is low on both energy consumption and pollution.

In the traditional steel production process, the thick slab of red-hot steel is cooled to room temperature after it leaves the furnace. The surface is checked and any defects removed. In order to produce thin strip steel using the hot rolling method, the slab must then be reheated to 1000°C and processed for several hours in a roll train more than 1400 metres in length - an operation which consumes huge amounts of energy and is as expensive as it is polluting. Thanks to the new ISP (Inline Strip Production) process developed by Arvedi, the production of a 25-metre roll of strip steel 1.5 millimetres thick takes just 15 minutes in a system measuring only 175 metres in length. The energy saving is 13% and the polluting smoke emitted when reheating the slab is eliminated.

A sensitive technology

The principal innovation of this system lies in the magnetic induction furnace, which homogeneously restores to the steel the heat lost when it leaves the continuous caster. On its way through some 10 heating zones the steel recovers between 250°C and 350°C. The increase and uniformity of temperature are obtained by virtue of the particular con-

figuration of the inductors which concentrate the magnetic flow according to the product's geometry. The induction furnace, 13 metres in length and with a power of 20 megawatts, can receive steel slabs 15-25 millimetres thick and 65-133 centimetres wide.

"We conducted the study on the prototype induction furnace using the same computer programmes as for the analysis of the behaviour of the fusion reactor elements," explains Pietro Costa. "When calculating the heat diffusion inside the steel, account was taken of the system's real environment, electromagnetic parameters, and the geometry and speed of the slab. In this way, it was also a sensitivity analysis. Finally, the experimental measures taken on the prototype - which corresponded closely to the model's predictions - proved its quantitative and qualitative validity." ■

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Functional foods fight fat

A COST Action on nutrition sciences and technology aims to develop functional foods that help us stay thin and healthy by wasting food energy as heat rather than storing it as fat.

More than a quarter of the US population is clinically obese and the number has grown by about 30% during the last decades. Though one in every two Europeans has a body mass index (BMI)⁽¹⁾ over 25, we cannot be complacent. Nor is fatness only a rich country's problem; even in developing countries it appears to be growing just as fast. Obesity has become a major public health issue.

Carrying too much weight not only causes physical and psychological discomfort, but also greatly increases the risk of heart disease, late onset diabetes, hypertension, gallstones, arthritis and other problems. Yet medical research has shown that obesity is not due simply to eating too much. Its causes are surprisingly complex: genetics play a major role, but the expression and function of the different genes involved is strongly influenced by diet and environment. In recent years, European obesity specialists have been leading the world in research on thermogenesis, i.e. the energy transformation process which, by producing heat, allows one to maintain the body temperature and to control body weight.

Heat versus fat

Each cell in the body contains mitochondria, tiny 'generators' that turn the chemical energy in food into readily-available "ATP" body energy that can power motion, growth and cell repair, be stored in fat tissues, or generate heat (thermogenesis). Basic studies through different European networks⁽²⁾ have demonstrated that mitochondria contained in some tissues house specialised uncoupling proteins. These proteins switch the mitochondria away from the metabolic cycles that break down food molecules to release ATP energy, to a short-cut pathway that



A European approach enables to study obesity and its complications in relation to a wide variety of diets and genetic backgrounds.

'wastes' the chemical energy by converting it to heat. Energy lost in this way cannot be used by the body. Most significantly, it cannot be stored as fat.

Against this background, a very challenging issue has arisen since researchers have also shown that some substances occurring naturally in food can enhance the expression of the genes that produce the uncoupling proteins in body tissues. "This is the stake behind the creation of the COST action - Body weight and energy expenditure: functional food and nutrition technology - set up under the coordination of Andreu Palou of the Spanish University of the Balearic Islands," says Francisca Serra, expert at the COST secretariat within the European Commission, responsible for coordination actions in nutrition science and technology. "If such sub-

stances could be added to food products to create healthier functional foods, then these could help the body to produce heat rather than weight."

The need for bridges

"Quite a number of COST actions in the food SET area are designed to build bridges between research and applications, because this field has strong links with the market and the consumer," Ms Serra explains. "But scientists do not always know how to ensure that results are exploited and to promote the creation of innovative companies."

In February this year, Andreu Palou together with the Commission's COST Secretariat and with the support of the Eureka initiative jointly organised the Inno Food Linkage Event in Palma de Mallorca. The meeting brought together experts from 83 universities and research centres, industrial companies and decision-making bodies. "The event opened up communication channels," Ms Serra reports, "and we are now working with the Eureka Euroagri umbrella to promote market-oriented RTD partnership projects and to develop spin-offs." ■

(1) Body Mass Index (BMI) is body weight (in kg) divided by the square of height (in m²). A healthy human adult has a BMI between 20 and 25. A BMI between 25 and 30 is classed as overweight; over 30 as obesity; over 40 as severe obesity.

(2) In particular the Metabolic and Integration Energy Control (MIEC) Network supported by DG XII

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European safeguards for bioethics



After a long and complex debate, the European Parliament, Commission and Council of Ministers have reached agreement on setting clear, effective and ethical regulations on the controversial subject of the "patentability" of life. RTD Info discussed the subject with Alain Pompidou, Member of the European Parliament and a man who is very closely involved in a subject of vital importance to the growth of biotechnologies.*

The Commission submitted an initial proposal for a directive on the protection of biotechnological inventions to the European Parliament in 1995. It was rejected by a majority of MEPs. For what reasons?

Alain Pompidou: To my mind, the initial proposal was based on two considerations only: harmonisation of the single market and the protection of intellectual property. The text failed to take sufficient account of the ethical dimension. Yet this is an essential element when it comes to patenting and marketing processes and products obtained from human beings. The Directive's rejection was therefore the point of departure for a genuine and essential debate. Parliament has done a considerable job in shedding light on the questions raised in this field. The some 66 amendments finally tabled have radically changed the original text.

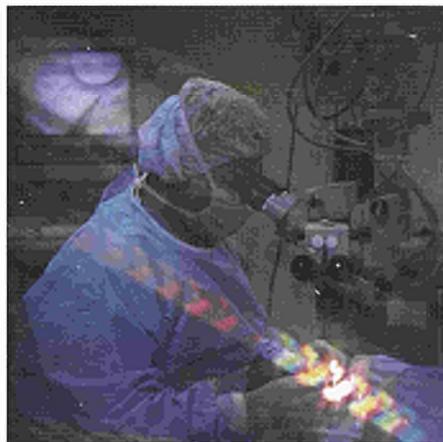
What is the overall effect of the proposed amendments?

The Directive first stipulates a fundamental point, namely the field of what is or is not patentable in the area of living organisms, together with the precise significance of the intellectual property rights conferred by a patent. You cannot patent a scientific discovery which, by definition, is universal and must remain accessible to everyone. A researcher, laboratory or company cannot acquire ownership of a living organism and in particular all or part of a human being at any stage of its development. The protection can only relate to an invention, that is a

value added linked to intelligence and know-how which is likely to lead to a new application, product or process.

We must also remember that registering a patent does not mean automatic authorisation to market it. Protection of the inventor does not give him automatic marketing rights.

What are the ethical safeguards introduced by the new text?



"This Directive will make it possible to mobilise research bodies and stimulate the registering of patents."

Without going into the details, as the Directive covers many different ethical considerations, I would cite three major cases in which patenting is out of the question. The first concerns all processes resulting from research on embryos that are not for their direct benefit. Then there are inventions based on modifications to the genetic identity of human germ-line cells as well as any cloning process for the purposes of human reproduction.

How are these major principles going to be translated in legal terms?

The EU Member States will have two years in which to transpose them into national legislation. The Directive fixes the terms of reference, but it clearly does not close the debate on bioethics. Its application will require further discussion as the sociocultural contexts and approaches can vary significantly from one country to another. Whereas France and Germany already have a strict policy banning any experimentation on the embryo, the United Kingdom allows this type of research until the 14th day of embryo formation, arguing that during this period the nervous system is not yet formed.

Another example is human cloning. As the position recently adopted by the United States shows, there is a consensus on the principle of banning it, but that does not rule out the possibility of certain exceptions, which are at present being debated by the experts. Examples of these include multiplying embryos in order to produce a sufficient stock to attempt an implant in cases of sterility where oestrogenic hyperstimulation is dangerous, or obtaining embryos which are not going to be developed but used to take samples of stem cell lines to be used for skin grafts, or nerve, endocrine or blood cells for the treatment of Parkinson's disease, diabetes or leukaemia. This is cellular cloning for therapeutic purposes. It has nothing to do with manufacturing a new child.

80% of Europeans approve of biotechnological developments in the field of health. They have many more reservations about their use for agri-foodstuffs purposes.

Could processes of this kind be patented?

The process which results in reproducing stem cell lines is already patented, not on cloned embryos but from blood taken from the umbilical cord for the treatment of leukaemia.

Similarly, although the Directive clearly establishes that the identification or decoding of the partial or total sequence of a human gene cannot be a patentable invention, this would not apply if this sequence were to be used to produce a protein with a known function for an industrial application. For example, there is already a patent on the use of the human gene which codes relaxin, a hormone produced by the uterus and placenta during pregnancy. The gene protein and sequence exist naturally but are not accessible. The expertise which permits their extraction is indeed linked to an invention.

But are these not subtleties which are difficult for the non-specialist to appreciate, but which it must nevertheless be possible to explain when life sciences become part of the democratic debate?

The perception of what a gene can represent is not always very clear to the public. For many people it is something which passes on hereditary characteristics and the basis of identity. For scientists, the gene is primarily a key element in the cell system, and genetic engineering consists of drawing benefit from a fundamental natural mechanism which is able to lead to previously unimagined progress. If clearly understood, this perception can make it possible to dispel ideas of the gene as an instrument with which to exercise fiendish control over human beings.

How are the attitudes of Europeans to biotechnologies changing?

Associations of parents of myopathic or diabetic children and of families with serious genetic predispositions are mobilising in favour of research in this field. This movement is highlighting the social implications which underlie biotechnological advances. A recent EU-wide survey shows that 80% of people approve of scientific developments where health is concerned. On the other hand, the use of biotechnologies for agri-foodstuffs purposes meets with quite strong distrust. But it is not unthinkable that one day in the not too distant future tomatoes labelled "guaranteed transgenic" will be all the rage.

One of the implications of this Directive – and not the least important – is economic: 65% of patents originating in biotechnological research in the pharmaceutical sector are registered in the United States, compared with 15% in Europe. Will this new legal framework help to correct this imbalance?

I have personally made strenuous efforts to move forward this ethical

debate and to arrive at the compromise which we now have, as the previous legal vacuum certainly resulted in a lot of European capital ready to be invested in this sector going to the United States. But we are very strong in biotechnology and this Directive will now make it possible to mobilise research bodies and stimulate the registering of patents. I believe not only that this draining of European venture capital can be halted, but also that our scientists can attract funds from countries outside the EU. The creation of the euro zone also raises hopes of increased investment in many fields, and biotechnology in particular. ■

* Doctor of medicine and science, Alain Pompidou teaches at the René Descartes University (Paris). He is President of the STOA (European Parliament scientific and technological options assessment) and member of the Conseil d'Application de l'Académie des Sciences (France).

Ten years of reflection

The complex issue of the patentability of life has given rise to almost 10 years of debates culminating in a directive harmonising the regulations in force in the Member States. An initial proposal for a directive was adopted by the Commission on 21 October 1988. But it was 1 March 1995 before this was submitted to the European Parliament, where it was rejected by 240 votes against, 188 for and 23 abstentions. The Commission adopted a new proposal for a directive on 13 December 1995. This legislative procedure reached a positive conclusion on 6 July 1998 with the final passing of the directive which entered into force on the day of publication in the Official Journal of the European Communities, on 30 July 1998.

On course for in vivo imaging of gene expression

Three European medical-imaging centres are making rapid progress towards perfecting a new kind of diagnosis that will prove crucially important to the development of gene therapies.

The information stored in a gene directs protein synthesis. For this information to be 'expressed', the DNA segment that constitutes the gene is first copied into an RNA molecule, which acts as a messenger. This messenger then leaves the cell nucleus, in which the DNA is confined, to join the cellular machinery, which uses it as a template in order to synthesise the specified protein.

Given its role in the process, the messenger RNA (mRNA) is a prime target if you want to block the expression of a gene, perhaps in order to stop the production of a pathogenic protein. Scientists have learned to manufacture small segments of DNA or RNA, so-called antisense oligonucleotides, which can attach themselves to a given mRNA and block the translation into a protein. It is thus possible to inhibit a retrovirus by blocking the messenger required for its replication.

This operation, which is particularly interesting from a therapeutic point of view, and could be a way to inhibit a virus such as HIV, is nevertheless very delicate. Oligonucleotides find it difficult to penetrate cells and are rapidly eliminated by the organism. Scientists are therefore looking for ways of overcoming these problems, in particular by chemically modifying the antisense oligonucleotides.

Prospects for a diagnostic innovation

In parallel with this therapeutic line of inquiry, scientists from the laboratories of the Frédéric Joliot hospital in Orsay (France)⁽¹⁾, came up with the idea of investigating another way of using antisense oligonucleotides as non-invasive diagnostic tools. It seemed that by injecting a radioactive oligonucleotide, and following its evolution using an

and the Medical Research Centre at Groningen University in the Netherlands. "Our first goal," he explains, "was to develop a means of preparing the radioactive oligonucleotides and to show how it is possible to monitor their pharmacokinetic⁽²⁾ progress through the body."

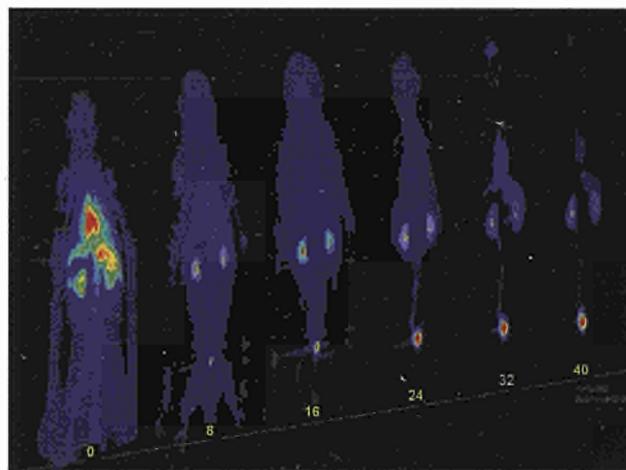
Positron emission tomography

The researchers opted for the advanced imaging technique known as positron emission tomography, or PET for short. This process allows in vivo tracing of, for example, the fixation or elimination of substances by the organism.

Each patient is injected with a minute amount of a radioactive pharmaceutical, or tracer, that closely resembles a natural substance used by the body, such as glucose, in which a stable atom has been replaced by its radioactive, positron-emitting counterpart. A positron is an anti-electron, and when it meets an electron, its corresponding

antimatter, both are annihilated, producing two gamma rays going in opposite directions, which are detected by the PET scanner.

Compared with conventional nuclear tomography, which uses radioactive atoms that emit gamma rays naturally, PET allows the injected molecules to be more precisely located and quantified.

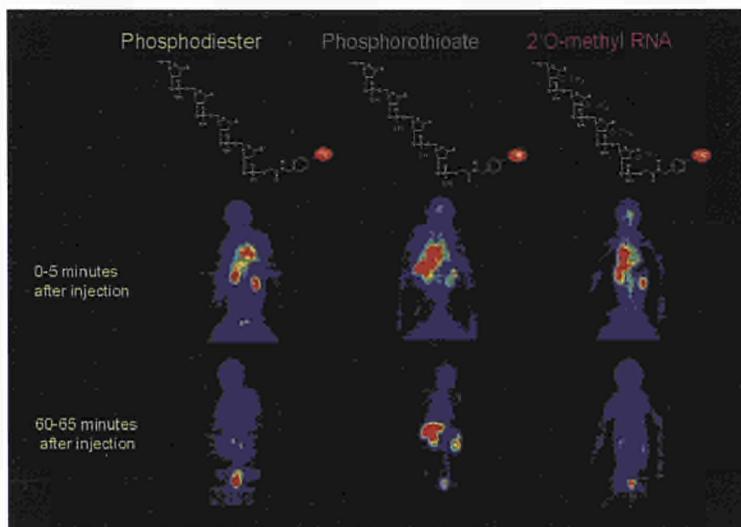
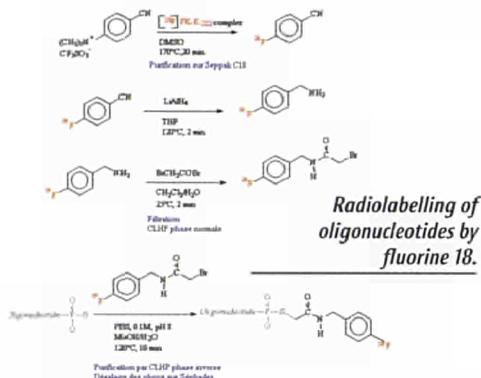


Example of an image sequence obtained by PET after the injection of an F-18 oligonucleotide. By means of the colour scale which indicates radioactivity concentrations, ranging from blue (low) to red (high), it is possible to detect, over time, elimination by the kidneys and then the bladder.

imaging technique, it should be possible to watch the expression in vivo in the organs or tissues of a given pathological gene - such as one responsible for propagating cancerous or viral cells.

Thus it was that, in a project supported since 1996 under the Biomed 2 programme, Luigi Di Giamberardino brought together two other major European imaging centres: the Cyclotron Unit at Hammersmith Hospital, London

In vivo, the distribution of an oligonucleotide varies depending on its chemical nature. The three oligonucleotides here have the same sequence, but only the phosphorothioate (in the centre) settles in the liver.



Hitting the headlines in Nature

"The fundamental problem posed by this imaging technique lies in the fact that the radioisotopes used have a very short life, just under two hours for fluorine-18, for example," points out Bertrand Tavitian, head of the "New tracers" team at the Frédéric Joliot hospital. The process of labelling the antisense oligonucleotides, which must then be injected into the body, and their pharmacokinetic progress there monitored, represents a formidable challenge.

A challenge the laboratory was able to meet by producing injectable oligonucleotides, which were then tried out successfully on a monkey. The result made headline news in the April issue of the prestigious journal, *Nature Medicine*⁽³⁾.

"At this stage," continues Bertrand Tavitian, "we had opted for orphan antisense oligonucleotides, characterised by the fact that they were not required to recognise any messenger, because what interested us primarily was to use tomography to observe the pharmacokinetic progress of oligonucleotides through the body. Whereas previously such an analysis required a considerable amount of time - and the sacrifice of hundreds of rats - we succeeded, in a single experiment, and without any harm to the monkey, in tracking the progress of antisense oligonucleotides wherever we wanted, with a spatial resolution of 50 mm³. This represents a fundamental step towards the first trials on man."

This is indeed the reason for the interest aroused by this scientific first, particularly at pharmaceutical and biotechnology companies that are ultimately interested in developing an oligonucleotide therapy. "The tests clearly show that the least change to the chemical structure of antisense oligonucleotides alters their path through the body," explains Luigi Di Giamberardino. "This suggests an almost infinite number of pharmacokinetic analyses. The resulting methodologies which we are introducing to this field could thus turn out to be highly innovative."

In the pipeline: a model for biological demonstration

This project by three European partners has yet to achieve its diagnostic goals. The present aim of the researchers is to show, by means of a convincing biological model, the feasibility of such an antisense imaging which is able to image or visualise a gene expressed in a precise organ. The obstacle - and it is a considerable one - remains the difficulty encountered by oligonucleotides in penetrating cells. "We are at present working on a model which we believe is very promising. Our knowledge of the chemistry of oligonucleotides is constantly progressing and we have good reason to be optimistic," concludes Luigi Di Giamberardino. ■

(1) In particular the INSERM research unit headed by Luigi Di Giamberardino and the CEA Radiochemistry Laboratory, headed by Christian Crouzel. The research was also encouraged by André Syrota, head of the CEA's Life Sciences Department.

(2) Pharmacokinetic: the characteristic interactions of a drug and the body in terms of its absorption, distribution, metabolism, and excretion.

(3) *In vivo* imaging of oligonucleotides with positron emission tomography, *Nature Medicine*, 4, pp. 467-471, 1998.

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Where do low wages lead?

What is the contribution to the European economy of "odd jobs", of all those occasional, part-time and underpaid jobs? Are jobs like this better than no job at all? And to what extent do they lead to poverty and exclusion? Researchers from the LoWER network have been analysing the complex facets of low-wage labour, a phenomenon which has become commonplace. The aim is to provide Europe with new weapons in the fight against social division.

In 1996, fourteen economists, experts on employment and wages from universities in Finland, France, Italy, the Netherlands, Spain, and the United Kingdom, joined forces in a thematic network. Christened LoWER (European Low-Wage Employment Research Network), the group was granted three years' financing under the Targeted Socio-Economic Research Programme. The aim? To study the mechanisms likely to lead those in low-wage jobs to social exclusion. By analysing the situation throughout the European Union, it would hopefully be easier to identify and evaluate the phenomenon, compare national situations, and develop actions to counter the slippery slope which all too often leads from precarious employment to social exclusion.

Defining the terms

But first of all, what exactly do we mean by a "low wage"? The OECD defines it as a wage which is less than two thirds the national median wage. The LoWER researchers are less categorical. Wage differences and the process of exclusion vary from one country to another and an individual's possible marginalisation is not a factor of low income alone.

"A lot of parameters must be taken into account in order to build up a complete and realistic picture of this situation," explains Wiemer Salverda, a lecturer at Groningen University in the Netherlands and the LoWER co-ordinator. "A census must be taken of the number of workers on low wages in each country, defining the concept both in absolute terms and in relative terms linked to the national economy. A number of characteristics must also be indi-

cated for each individual, such as sex, age, level of training, and the numbers of hours worked each week."



Odd jobs seem to lead more surely to no job at all than to a real job.

Collecting the data

The first task for the teams was to collect and evaluate national and European data on low-paid jobs. Various sources of socio-economic information (social security and tax statistics, surveys of household incomes, etc.) were consulted in 14 countries⁽¹⁾ and as many elements as possible collected in order to improve the comparisons. The data collected - varied, incomplete and sometimes far from

recent - highlighted the need to develop a methodology making it possible to quantify this phenomenon by means of indicators which can be applied throughout Europe.

"At the company level," continues Wiemer Salverda, "we also need to be able to determine the supply and demand situation for low-wage employment by sector, size of company, etc." In this area too, there are no systematic data. The only recent figures (1995-1996) covering EU Member States come from the European Structure of Earnings Survey (ESES), but these are far from complete. They do not include public companies or SMEs employing fewer than 10 people, for example, or, in certain countries, the "micro-businesses" which represent more than 40% of national employment - the very sector in which you often find the lowest wages.

Comparing situations

"Another essential element in any comparison must be parity of purchasing power," adds the LoWER co-ordinator. "You cannot compare wages in one country with those in another simply on the basis of exchange rates between their currencies. Differences in consumer prices must also be taken into account."

Moreover, all this information must be analysed over time. "Data which tell us how long individuals have been in low-wage jobs are also very incoherent. Nevertheless, those we have been able to collect show that many of these people are unable to extricate themselves from such a situation. Our research has also identified an almost inevitable "progress" from badly paid employment to no employment at all. Low wages lead more surely to unemployment than to a fair wage for an honest job."



*"There is a real need in the services field.
But the cost of such services usually makes them inaccessible to those who need them."*

And, when it comes to comparisons, what about the low-wage jobs across the Atlantic? Invited by the LoWER researchers to address their London Conference, Professor Richard Freeman of Harvard University analysed the relationship between low wages and the growth of employment in the USA. "More odd jobs means more employment, but it can also lead to greater poverty if they have the effect of pulling down minimum wages," he explained.

Vicious circles and grey areas

"The situations in Europe and the United States are not comparable. In Europe, the roots of social exclusion lie principally in unemployment," adds Wiemer Salverda. "We find ourselves in a vicious circle at present. There is a real need in fields such as domestic services for elderly people and home helps, which could create jobs. But the cost of these services make them inaccessible at present to most people, while those providing the services could only increase the wages of their staff and the quality of their services by charging even more. The only way to break this vicious circle is for the public authorities to come up with incentives to stimulate supply and demand. There are a number of examples of such incentives, such as the *chèques emploi* service in France or the 'white cleaning ladies' who clean people's houses in the Netherlands. That is one way of improving this situation."

Finally, how can it ever be possible to take real stock of the situation without also taking into account undeclared work, the so-called "parallel economy"? Clearly the figures are anything but transparent once you move into this area! In addition to this

undeclared and thus illegal work, the figures also fail to take into account odd jobs amounting to just a few hours a week, which are legally exempt from social security contributions and tax (employers more often being individuals than companies). All in all, the LoWER researchers certainly have some avenues for inquiry. Moreover, the network they have created should have the effect of stimulating new research in the field of low-wage employment. ■

(1) Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom.

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Would you like to know more?

Seminars

The network has organised three conferences: Conference on Low-Wage Employment (Bordeaux 1997); Analysis Conference (London, 1997); Policies Workshop (Milan, 1998). The next event (Conference on Policies regarding Low-Wage Employment in Europe) will be held in Groningen (NL) on 20-21.11.98.

Publications

- *LoWER Newsletter*: published several times a year, reporting in particular on seminars organised by the network.
- *Statistical data available on low-wage employment in the European Union and its Member States*, Special Report, April 1997, published by LoWER
- *Low Pay and Earnings Mobility in Europe* and *Low-Wage Employment in Europe*, two publications collecting the contributions to the Bordeaux Conference, published by Edward Elgar (UK)
- *Policies for Low-Wage Employment and Social Exclusion*, FrancoAngeli, Milan, 1998 (aimed at a wider public, this book presents 15 points of view on the subject).

Database

An updated database on research in the field of low wages can be consulted on the LoWER web site (<http://www.eco.rug.nl/lower/html>).

Science and the News

How do Europe's principal TV news programmes present science? A comparative study, co-ordinated by the Centre National de la Recherche Scientifique (F), looks at the different coverage in eight European countries - coverage which usually leaves much to be desired.

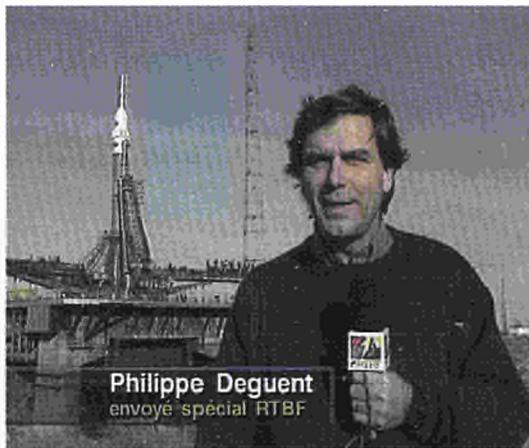
October fourth 1994. Three astronauts, the German Ulf Merbold, the Russian "veteran", Alexandre Ritorenko, and his fellow Russian, Helena Kondakowa, boarded the Soyuz spacecraft to join the orbiting space station, Mir. "After America, Europe is now going into space," reported a scientific journalist broadcasting live from Baikonur for RTBF Belgium's French-speaking state television. Belgium had a special interest in this launch, because Soyuz was taking into space an experiment developed at Leuven University on a new form of aluminium, designed to stand up to very high temperatures. On German television, attention was naturally enough focused on Ulf Merbold. He appeared on the TV screens on a number of occasions - at the pre-launch press conference, and for interviews during the flight. "Ulf Merbold represents the European Space Agency," explained ZDF.

Apart from these two countries, the only other mention was on the Swiss television news. The way this space mission was presented also varied a great deal from one station to another, some stressing the presence of a woman on board the Mir, others drawing attention to the practical applications of experiments conducted under conditions of weightlessness.

Different - or indifferent - stations

This comparison of the different approaches to the same event - amount of coverage, motivations, commentary/interview mix, interest in institutional, scientific, social or anecdotal aspects, etc. - is presented in *La Science dans les journaux télévisés européens*, a research pro-

ject conducted by the Laboratoire Communication et Politique du Centre National de la Recherche Scientifique (France). It illustrates one of the subjects analysed by this comparative study of 15 public and private TV stations in eight European countries⁽¹⁾ carried out from 1 to 31 October 1994.



RTBF - 4.1.94. Live from Baikonur at the launch of a European space mission on board Mir. The fact that the Soyuz was carrying a Belgian scientific experiment is part of the reason for the interest in the subject.

TV news coverage of four fields (medicine, technology, the environment, and fundamental research) was studied, stating on each occasion whether it was national or international news. "There is not exactly massive science coverage," the study concludes. Yet at the same time, "the TV news is the principal forum for public discussion of scientific news and the principal source of information on this subject."

French and German TV viewers are the ones kept best informed, with an average of more than two subjects per day, while the Italians, with just 8-12 for the whole month, are the least well informed.

Europe hardly gets a look in

Apart from major media events, different stations cover different subjects and present them in a different way. "Rather than being a true reflection of any external reality, the media, by virtue of the selection they have to make from so much news, in fact create the world they present to us." Ireland and Switzerland favour technical subjects, while Italy and the United Kingdom favour medical subjects. TF1 is more "technical" than France 2 and ZDF more so than RTL. The environment generally receives a good level of coverage, while fundamental research scarcely gets a look in - despite the fact that the survey was carried out during the same month as the Nobel Prize awards. The European Union is also largely ignored in its capacity as an active player in the world of science.

"It is worrying that Europe receives so little coverage," note the authors of this publication. "Science, in the widest sense of the term, is one of the elements in a shared culture which is essential to the future cohesion of Europe." But are the media solely responsible for these "oversights"? Or is it that the specific dimension of European science, i.e. its value added, is a message which Europe itself does not deliver clearly enough? Whatever the case, the results of this survey must certainly provide food for thought for managers of European research projects. ■

(1) Belgium (RTBF, RTL-TV1), France (TF1, FR2), Switzerland (DRS, TSR), Germany (ZDF, RTL), Italy (RAI1, TV5), Spain (TV1, TV2), United Kingdom (BBC, ITN), Ireland (RTE).

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