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Magazine for European research

September 2000

Genome

Accelerating into a new age



Forward studies



The challenges for the City of Tomorrow

International cooperation

North-South scientific partnerships



FIFTH FRAMEWORK PROGRAMME

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A message from the new Director-General

Achilleas Mitsos was appointed Director-General of the Research DG on 13 June 2000. Dr Mitsos, whose PhD is in economics, started work at the European Commission in 1985, where he has held several senior positions. Prior to his appointment as director-general, he was director of the training and mobility of researchers programme for four years.

The recent decision by the Commission to appoint me to the position of Director-General is obviously a source of personal satisfaction, but – more importantly – it also presents me with a major challenge for the years to come.

The size of this challenge can be measured by the goals that the Commission has set out in its communication *Towards a European Research Area*, which was adopted on 18 January 2000 at the initiative of Commissioner Philippe Busquin, and which has received widespread support from the European Parliament and at the Research Council held on 15 June 2000. The main objectives are to break down the barriers that separate the different research policies, to open up instruments and programmes, to promote exchanges, and to foster national initiatives and existing good practices.

It is on the creation of this European Area that the Commission – especially the Research DG – will be focusing its efforts in future, in cooperation with Member States, the relevant European institutions, and the worlds of science and industry. The challenge can be met only by persuading as many as possible of those involved in research to join us in a collective effort to overcome the weaknesses of European research and – even more importantly – to take advantage of its strengths.

An important step in this direction will be taken in the next few weeks when the Commission publishes its strategy for creating the European Research Area and implementing related initiatives. The achievements to date of Community research initiatives are clear, with cross-border cooperation between researchers now an everyday occurrence thanks to the framework programmes. But to this we need to add a more strategic dimension which will reinforce the catalytic effect Community activities have on research as a whole in Europe. Other aspects of the European Research Area will be spelled out in the coming months by various Commission documents, such as the reports on the relationship between science and society within the European Union. I am counting on the goodwill and cooperation of everyone who wishes to join us in working to construct this common research area which Europe so urgently needs.

Achilleas Mitsos
Director-General,
Research DG



Douglas

A millennium milestone

If man was looking for an event to mark his entry into the third millennium, it seems he has found it. More than advances in space or micro-electronics which marked the end of the 20th century, the announcement on 26 June of the first complete sequencing of the human genome will go down in the annals of history as the first step in a radically new era in the destiny of mankind.

The final sprint by the scientists symbolised the importance of this advance and the hopes it brings – but it also triggered a sudden awareness of new ethical questions that must be resolved. Who, what organisation, will society credit with 'ownership' of knowledge of the mechanisms of life? That is the essential and urgent debate highlighted by the spectacular rivalry (see page 4) between the huge international public research effort of the Human Genome Project (HGP) – in which Europe is a very active partner – and the privately owned biotechnology giant headed by the US scientist Craig Venter.

What is more, decoding the approximately 3.2 billion 'nucleotide letters' of the human genome – still at the 'draft' stage – is just the beginning. The task now is to unravel the genuinely useful genetic information that is no more than a minute fraction of this immense message. This will mean identifying tens of thousands of genes, the functions of many of which will long remain a mystery.

'Post-genomic' specialists therefore have many years of research to look for-

ward to, not just on the human genome front, but in all areas of life sciences. It is a field in which – thanks in particular to the European Union's research strategies – European science has some clear advantages (see page 6).

However, there still remains the difficult marriage between these advances and the society within which they are taking place. The latest Eurobarometer survey (see page 10) shows that while citizens have high hopes for certain biotechnological developments – such as new forms of medical treatment – they have serious reservations when it comes to other possible applications.

Hence the need for information, education and, above all, a genuine democratic debate between the scientists, the decision-makers and the general public. The geneticist Axel Kahn, who chairs the scientific group recently charged by the European Commission with the task of advising it on the life sciences, talks about this on page 8, and of the crucial importance of this dialogue between research and society.



Accelerating into a new age

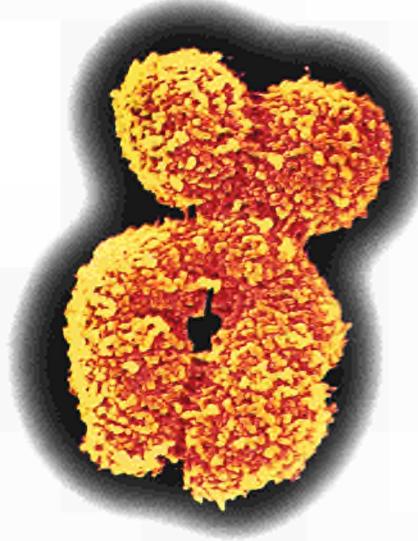
The full sequencing of the human genome is being completed - spectacularly - 15 years ahead of the initial target date. An example of the formidable increase in the speed of modern genome research - due to the partnership between basic science and the computer - and of the fierce competition between public and private research which helped generate the momentum. This is a competition which also lies at the heart of the ethical debate on the 'ownership' of mankind's genetic heritage.

In the early 1980s when, together with a number of other visionary scientists, James Watson, one of the researchers who discovered the double helix of DNA, launched the age of 'conquest' of the human genome, the task seemed as vast and difficult as sending a manned spaceship to Mars. Even the most optimistic believed it would take 20 to 30 years (until 2010 or 2020) to successfully complete the project at a cost of at least 3 billion euros.

Yet little by little, the ambitions of these pioneers were seen to be an achievable challenge. Rapid advances in molecular biology over the past two decades - especially the sequencing technique developed in 1977 by the British researcher Frederick Sanger, a 1980 Nobel prizewinner - had clearly shown the possibilities that would be opened up by the identification of human genes. At that time, nearly 3 000 of them had already been provisionally identified. Not many perhaps, but a start.

The birth of HUGO

Progressively, the idea of decoding all 3 billion bases strung out along our 23 chromosomes began to look increasingly possible. Realising the need to pool all public research efforts worldwide before embarking on such an enterprise, in 1988, at the initiative of British biologist Sydney Brenner, a team of scientists decided to set up an international coordinating structure: the Human Genome Organisation (HUGO).



'The challenge now is to identify between 30 000 and 100 000 genes (the number itself is the subject of much discussion) which are in fact just 5% of the total sequence'.

Two years later the United States gave the sequencing starting signal when it set up the famous HGP (Human Genome Project), cofinanced by the NIH (National Institutes of Health) network and the Department of Energy. In 1992 the United Kingdom came on board, thanks largely to the considerable financial support the Wellcome Trust decided to grant the Sanger Research Centre in Cambridge. In the mid-1990s, France, Germany, Japan and China all joined the HGP, that by then had become a vast intercontinental consortium under the leadership of an American, Francis Collins of the NIH. US scientists completed 55% of the total sequencing, the British 33%, and France, Germany and Japan between them the remaining 12%.

The outsider

The initial research stage was laborious. Everything had to be organised, in particular the allocation of tasks and the infinitely complex storage of the data obtained. Above all, it was vital to boost the speed and cut the cost of the decoding methods. This was where in 1992 Craig Venter, a brilliant NIH biologist, came onto the scene, causing quite a surprise by setting up his own private research centre and, in 1998, founding Celera Genomics. Dr Venter very quickly took the stance of a formidable rival to the public researchers at the HGP by developing his own sequencing technique, known as *Shotgun*. Unlike the HGP method of sequencing DNA fragments, arranged in advance by the physical mapping of the human genome, the *Shotgun* method permits the random sequencing of unmapped fragments. At the end of the process, this method requires a vast computing capacity (several terabytes - thousand billion bytes - of RAM) to reconstitute the human genome on the basis of these randomly sequenced fragments. In short, this *Shotgun* method can be described as quicker and cheaper - but less systematic.

It was under the stimulus of this competition between public and private research (Dr Venter keeping up the media interest - and reassuring his financial backers - with regular announcements of his company's successes) that genome research moved into top gear. 'This race to the finish boosted the scientific performances. In



The EU chips in

1993, the HGP's objective was to sequence 80 million of the 3 billion base pairs of the human genome within five years. Today, with the automation of sequencing techniques and the extraordinary power of computers with memories of several terabytes this same number of base pairs can be decoded in a week,' explains Jacques Remacle, the scientist responsible for genomic research at the European Commission.

Patenting life?

But behind this competitive 'sporting scientific spirit' lie the huge ethical implications and financial stakes of the genomic age which are the real reason for this fierce rivalry. There are two opposing stances. On the one hand are the HGP researchers who fear any appropriation of humanity's common biological heritage and who have consistently made their sequencing results available on the Internet within 24 hours of obtaining them. On the other is Celera Genomics which, while denying any designs on monopolising the human genome, has never concealed the fact that it had the firm intention of reaping the rewards of its investments.

At present, the mobilisation of public research and its stupendous effort to cross the finishing line at the same time as its private competitor has obliged the politicians to 'show their hand'. Celebrating the announcement at the White House with Tony Blair on 26 June, Bill Clinton repeated the US wish - shared by Europe and most other countries - for the basic genomic data to be a part of man's common heritage.

It remains to be seen how such statements of principle shape up in the dawning 'post-genomic' age which, over the coming decades, is going to demand even more strenuous research efforts than we have already seen. The challenge now is to identify between 30 000 and 100 000 genes

In addition to the commitment of those individual Member States involved in the HGP, many European genomic research projects have received support from the EU over recent years (see page 6). The current Quality of Life programme attaches great importance to genomic research in relation to a number of human complaints (cancer, infectious diseases, inherited deafness, autism, muscular dystrophy, etc.). Other projects concentrate on the use of genomic tools for developing diagnosis and treatment methods. The Commission also plans to adapt the Fifth Framework Programme to take account of the new prospects opened up by the accelerated rate of progress in sequencing the human genome. This autumn, Commissioner Philippe Busquin will be submitting a new initiative to the Research Council and European Parliament aimed at increasing the capacity for scientific cooperation in the new 'post-genomic' field.



(the number itself is the subject of much discussion) which are in fact just 5% of the total sequence. Francis Collins, the director of the NIH's National Human Genome Research Institute, likens it to finding a needle in a haystack but 'even more difficult ... because at least a needle is different from hay, while a gene is a piece of DNA like any other.'

It is as the researchers advance with this formidable undertaking - and the medical discoveries are made - that the problem of the patenting of life will assume its full significance.

In Europe, European Directive 98/44/EC (July 1998) laid the foundations for a general rule that a DNA sequence can only be patented if its knowledge permits a demonstrable technological application. Is this principle enough? In the spring of this year, two MPs, Jean-François Mattei of France and Wolfgang Wodarg of Germany, drew up a petition against the directive, signed by many prominent European politicians and scientists. Present difficulties in transposing the directive into national legislation - especially in France - show that the debate is far from settled. ■

A trip through cyberspace

- Explore the world of research on the human genome at the HUGO/HGP site: www.gene.ucl.ac.uk/
- Visit the European centres of excellence involved in the HGP project:
 - Sanger Centre, Cambridge (UK) www.sanger.ac.uk/
 - Max Planck Institute for Molecular Genetics, Berlin (D) www.mpimg-berlin-dahlem.mpg.de/
 - The Institute for Molecular Biology, Jena (D) genome.imb-jena.de/
 - GBF - Dept of Genome Analysis, Braunschweig (D) genome.gbf.de/
 - Génoscope, Evry (F) www.genoscope.fr/
 - Institute of Molecular Biology & Biotechnology - Foundation for Research & Technology Hellas, Heraklion (GR) www.imbb.forth.gr/



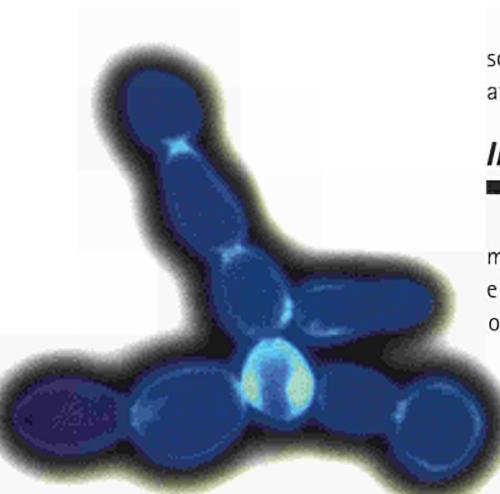
European firsts

*At the same time as participating very actively in the international Human Genome Project, Europe has also been developing its expertise in all areas of genomic research into the living world. Over the past decade, European research programmes have supported many projects that have resulted in some spectacular 'firsts' - such as the sequencing of organisms including yeast, the bacteria *Bacillus subtilis* or the plant *Arabidopsis thaliana*.*

Decoding the human genome is an ambitious undertaking which is constantly drawing on the results of an extremely active exploration of the living world as a whole, including viruses, bacteria, plants and animals. Take yeast as an example. The agri-foodstuffs and pharmaceutical industry is extremely interested in the genome of this small, common fungus. In April 1996, this was the first eukaryote and the most complex organism to be fully sequenced, thanks to the combined efforts of 100 European laboratories. But in addition to the direct industrial interest in yeast itself, this decoding revealed the underlying unity of life as many of the yeast genes were seen to be similar to certain human genes implicated in diseases of genetic origin. 'These observations opened up new avenues of research on diseases as varied as colon cancer, amyotrophic lateral sclerosis, and breast and ovarian cancer,' explains Stéphane Hogan, the information officer for the Research DG's Life Sciences directorate.

Intercontinental cooperation

It was then the turn of *Bacillus subtilis* to give up the secrets of its full chain of base pairs. Launched at the end of 1989, the programme initially brought five European partners together, who were later joined by a further 23 teams and a consortium of one Korean, two US and seven Japanese laboratories. *Bacillus subtilis* is a model for various



Apart from its industrial interest, the decoding of all the yeast genomes (1996) highlighted the underlying unity of life by revealing similarities with, most notably, certain human genes involved in genetic diseases.

infectious agents, such as staphylococci and streptococci. Many of this bacteria's genes are involved in the production of proteins with antibiotic properties - thereby creating the prospect of new treatment products and major new markets.

The sequencing of *Arabidopsis thaliana* genes is now complete, too, and is a major first in which European scientists have played a leading role. This humble weed which is so familiar to researchers was the very first plant to reveal all its secrets (see box). 'Europe is constantly strengthening its position as a leader in the field of plant genomics,' stresses Jacques Remacle, the

scientist responsible for Genomic Research at the European Commission.

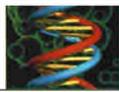
In search of animal models

Unravelling the genomic sequence is most certainly an important stage in enhancing our knowledge of the living organism. However, the sequence itself only contains the coded information of the genes and does not enable us to deduce their biological functions. The next step is therefore to determine the potential function or functions of a gene and to identify the malfunctions that could be linked to a genetic disease. This means experimenting on model living organisms, such as mice, the famous *Drosophila melanogaster* fly, the *Caenorhabditis elegans* worm, or yeast.

The genomic sequencing of mice is a research priority as biologically the mouse is similar to man in many respects. More than 95% of human genes have an equivalent in mice. By comparing the rodent's genome with that of the human being it will be possible to identify the 'orthologous' genes and, by means of experimentation, to eliminate one of those in the mouse in order to determine its function.

En route to the post-genomic age

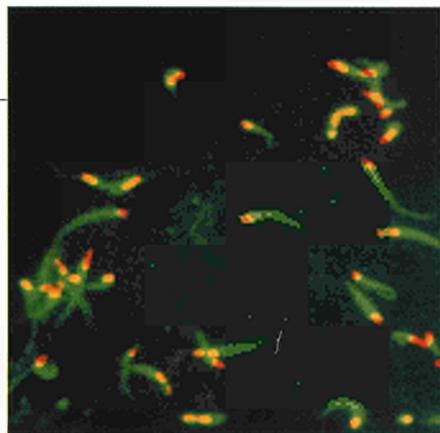
The European Union's Fifth Framework Programme for Research places considerable emphasis on post-genomic activities.



Fighting Listeria

Europe clearly had good reasons to support the sequencing of the *Listeria* genome, a bacteria that survives at refrigerator temperatures. It is a subject of less concern to our American cousins, who have little liking for cheeses or untreated milk. But now it is a job well done! In April, a consortium of ten European research laboratories completed the full sequencing of *Listeria monocytogenes*. The work was coordinated by the Institut Pasteur (Paris, France) with both German and Spanish teams working on the project. This bacteria poses a very real and serious threat to the food safety of many European products, as listeriosis kills between 20% and 30% of people who become infected. Among other benefits, the sequencing of *Listeria* will permit a much earlier diagnosis of the disease.

Info *Listeria genome fully sequenced - analysis launched*
europa.eu.int/comm/research/press/2000/pr1804en.html



Cells infected by Listeria monocytogenes. In red: bacteria. In green: cellular actin that the bacteria polymerises to move intra- and intercellularly.

Under the six key actions and generic research lines of the *Quality of Life* programme, more than 60 projects directly aimed at the exploitation of results or new fundamental explorations were launched in 1999 following the first call for proposals. With a budget of over 100 million euros, it is possible to support research themes ranging from the study by genomic methods of the interaction of bacteria with leguminous roots, to the identification of the human genes responsible for multifactorial diseases (type II diabetes, autism, inherited deafness, muscular dystrophy, etc.). ■



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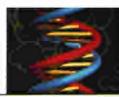
The lessons of *Arabidopsis*

In December 1999, the sequencing of two *Arabidopsis thaliana* - mouse-ear cress - chromosomes marked a considerable advance in the field of plant biology. Initiated in 1996, at a time when just 10% of its genome had been explored - this research was conducted by two networks of European laboratories involving some 30 partners in the 10 countries of the European Scientists Sequencing *Arabidopsis* (ESSA) project. This consortium is part of the *Arabidopsis Genome Initiative* which includes laboratories in the United States and Japan.

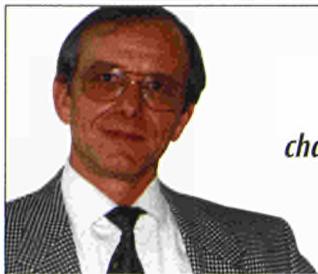
Arabidopsis has the advantage of possessing a very short genome (135 million bases compared to 2 billion for maize) - a fact which does not prevent it from providing a new basis for studying the genetic make-up of other cultivated plants.

However, 40% of the *Arabidopsis* genes bear no resemblance to other genes already identified, and their function is not yet known. It is by deactivating the plant's genes one by one and observing the effects of this change on its development that researchers hope one day to identify the role of each one of them. The European Union is supporting the continuation of this research.

Info *A world first: the sequencing of two plant chromosomes*
europa.eu.int/comm/research/press/1999/pr1412fr.html



The right to information



Last April, Philippe Busquin, European Commissioner for research, announced the establishment of a Biosciences High-Level Group. The French geneticist Axel Kahn,⁽¹⁾ charged with heading the group, describes the tasks now facing this 'team' of 11 eminent scientists. He also speaks about his personal feelings on some of the current major debates sparked by advances in our knowledge of the living organism.

What tasks has the Commission asked this advisory group on life sciences, which you have agreed to head, to undertake?

Axel Kahn: I should first like to explain that it is a committee made up exclusively of scientists. In no areas should its work interfere with that of other bodies, such as the International Bioethics Committee chaired by Noëlle Lenoir, whose members are drawn from a broad spectrum of society. When our life sciences group gives its opinion on interactions between the life sciences and society it will be doing so on behalf of scientists.

We will be mainly concerned with how to launch and conduct the public debate on the priorities of European research. As scientists and therefore players in science's impact on society, we must justify the efforts made and remain informed of public expectations and concerns.

We therefore envisage three types of activity. The first will start by preparing a huge European forum on the life sciences and society, planned for November of this year. We will interact with all the partners concerned - the NGOs, patients' associations, consumer organisations, etc. The aim is to initiate a process designed to really open up this essential dialogue. A second type of activity will be to respond to matters referred to us by the European Commission. Finally, we will conduct studies on subjects we consider important and these initiatives will be the occasion, if necessary, to inform the European Commission of issues of concern to society.

“There can be no compromises when it comes to informing the public. What is required is to respect their safety and, at the same time, democracy: concepts with a different underlying logic.”

The European Parliament has just approved a law on genetically modified organisms which some consider to be too easy on producers. What is your reaction to the suspicions many people have of GMOs?

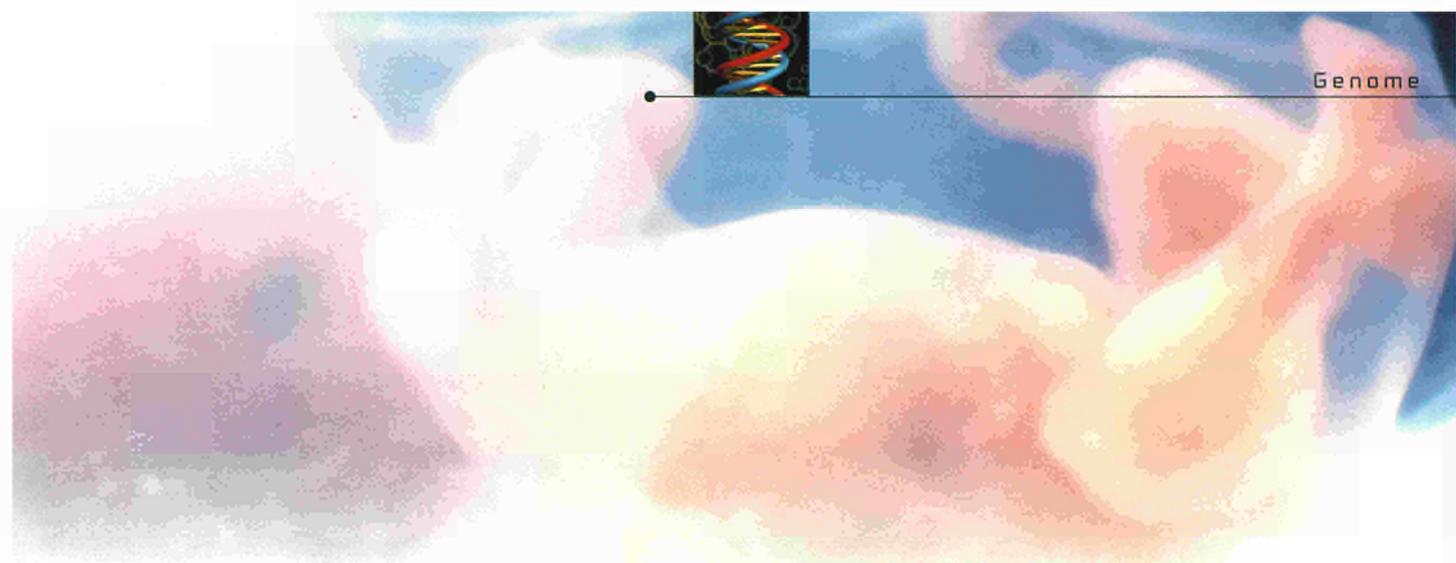
It is important to first set out the various issues inextricably linked to this question, namely the evaluation of the risks of GMOs, their economic benefits, their acceptability to the general public, and finally the need to ensure that people are well informed. There can be no compromises when it comes to informing the public. What is required is to respect their safety and, at the same time, democracy: concepts with a different underlying logic. If a transgenic plant proves dangerous to health, clearly it must be banned. But the fact that such a plant may be harmless does not in itself make it desirable for Europe. At this level it is up to the citizen to express his or her views in a democratically acceptable manner.

For my part, I would argue unreservedly for precaution. But the rigorous application of precaution means comparing the respective risks and benefits of the various procedures on a case-by-case basis. Take resistance to insects, for example, here we must

assess the relative risk of genetic resistance compared to the use of chemical pesticides. Respecting the precautionary principle means choosing the safest method, whether this corresponds to the *status quo* or to the most innovative procedure.

That said, nobody should be surprised to find a general dislike of the genetic modification of plants. There is no demand for this from the European public; they are dreaming of natural food. Proposing transgenic plants imposed by the agri-foodstuffs multinationals - often initially for such unattractive projects as soya cakes produced by the Americans to feed our cattle - is obviously not going to be able to satisfy consumers whose confidence has been shaken by the BSE episode. But the fact that one may not like something does not mean it is dangerous, in the same way as the absence of risk does not necessarily generate support.

That is why it is so necessary to distinguish between these levels if we are to have a more transparent debate. Let me give you an example. One of the originators of transgenic plants, the Belgian Marc Van Montagu, who is also a member of our life sciences group, is now concentrating on the



'When, between the end of the 19th century and World War II, biologists became sociologists or philosophers, the result was dramatic - save for a few exceptions. Look at eugenics or certain racist theories, for example.'

objectives of North-South cooperation. He is carrying out molecular biology studies on plants which are useful in developing countries. But in order to develop this scientific activity, international solidarity - and European solidarity in particular - must have the means to justify and finance it.

There is also another debate in which transparency is lacking: human genome sequencing. How do you view this unbridled competition between a private US company, Celera Genomics, and the HGP public research programme?

By engaging in this race to the finish, Celera Genomics - and remember that this is an American company which has been greatly helped by cheerfully dipping into public databanks - will at the same time certainly have given a considerable boost to the work of the HGP consortium. The two competitors reached the finishing line neck and neck. That said, the effectiveness of the *shotgun* sequencing method has yet to show its worth at the '*post-genomic*' stage and the commercial appetites clearly advertised by Celera Genomics are more open to question. The sequences used in the pharmaceutical industry (the coding elements of genes) represent just 5% of the genomic DNA that must be identified from among the millions of sequenced fragments. Since 1992, a large part of these

'useful' sequences have already been sequenced by companies such as HGS and Incyte in the United States. Then there is the unanimous reaction by the international scientific community against the privatisation of this knowledge.

This competition has, in any event, per-

scientists are involved in the philosophical debate on the sciences.

I would like to see them question their practices and reflect on the relationship between science and ideology. Biology is at a disadvantage in this respect. When, between the end of the 19th century and

World War II, biologists became sociologists or philosophers, the result was dramatic - save for a few exceptions. Look at eugenics or certain racist theories, for example. Because it is working on the human being, this discipline easily leads to reductionist excesses. Also, the biologist bases his thinking on Darwinian evolution, a mechanism with no grand design, but based on selection within a random diversity. It is completely different for physicists who are more inclined to metaphysical questioning. Their dream is a universal law. This no doubt partly explains the greater

number of physicist philosophers - and also their present interest in biology. ■



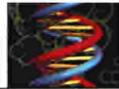
'Nobody should be surprised to find a general dislike of the genetic modification of plants. There is no demand for this from the European public; they are dreaming of natural food.'

mitted a great leap forward for biology and pharmacological research, especially as the genome programme does not in the end seem to be to the detriment of physiology. Genetics has given a fantastic boost to this discipline, giving it the opportunity to draw up pertinent models.

In your latest book, '*Et l'Homme dans tout ça*',⁽²⁾ you express regret that so few

(1) Axel Kahn is head of the Research on Genetic and Molecular Physiology and Pathology Unit at INSERM, Paris.

(2) Axel Kahn, *Et l'Homme dans tout ça. Plaidoyer pour un humanisme moderne*, éditions Nil, Paris, 2000.



Public opinion and the life sciences

How do Europeans view the life sciences and their applications? What are their fears and hopes in the face of the explosion in biotechnologies? What information sources do they trust in this field? For the fourth time since 1991, an opinion poll on biotechnology has been conducted throughout the European Union. It reveals growing scepticism and suspicion.

The latest Eurobarometer survey, *The Europeans and Biotechnology*, carried out at the request of the Research Directorate-General, is particularly detailed. At the end of 1999, a total of 16 000 people aged 15 and over were interviewed in all EU countries. Although the replies vary depending on the technology in question, the country, the socio-cultural profiles and gender, the survey also shows a common sensibility reflected in two major

shifts since the 1996 survey. There is less confidence in the information sources in this field (consumer organisations, seen as the most credible source six years ago, are not spared this general scepticism), and a clear loss of enthusiasm when it comes to agriculture and transgenic food. Two-thirds of those surveyed say they would never buy genetically modified fruit, for example, and more than half of them would be prepared to pay more for 'traditional' products.

Food and health

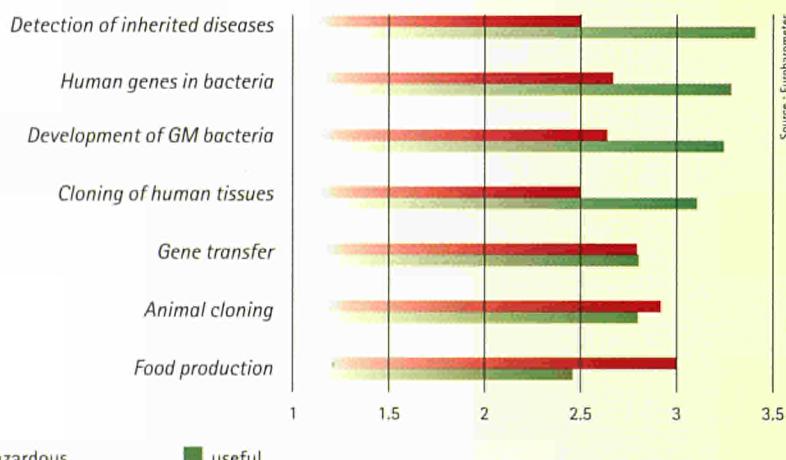
When asked about how they view the inherent risks and benefits of various biotechnological applications, Europeans take a much more positive view of research in the field of health than in the field of food (see graph). As in the 1996 survey, four applications were the subject of more precise questions: the introduction of human genes in bacteria to produce medicines or vaccines; the use of genetic tests to detect inherited diseases; the use of biotechnology in food production; and the genetic modification of crops to make them more resistant to insects. In three years, the perception both of the utility of these developments (down by 11 points to 14% compared to 1996) and of their moral acceptability (down by 11 points to 15%) has suffered a significant setback. Logically enough, advances in these fields are not deemed to merit encouragement (down by 12 points to 16%).

Are biotechnology applications useful?

The usefulness of biotechnology in food production does not exceed the 2.5 mark. For other applications, opinions are either less categoric (animal cloning, gene transfer), or they are mostly accepted as useful.*

Are they hazardous?

Are the various biotechnology applications hazardous? The applications all lie between 2.5 (mid-point) and 3 (mostly agree). None of them really escapes the criticism of Europeans, even the use of genetic tests to detect inherited diseases.



*Fully agree = 4; Mostly agree = 3; Mostly do not agree = 2; Do not agree at all = 1; mid-point = 2.5.

Mixed feelings

In another section of the survey people were asked what modern technology, including genetic engineering, means to them. They then had to define their 'feelings' (positive, neutral, negative on a scale of 3 to 1) with respect to five principal areas of technology. The subject 'scientific research - health - technological development' was viewed most favourably (2.32), followed by 'the environment' (2.11) and 'genetically modified food' (1.78). But feelings vary greatly from one country to another. Scientific research and health are viewed most positively in the Netherlands;



Cloning comes first

Greece is least enthusiastic about GMOs (genetically modified organisms); West Germany is most environmentally conscious. Ethical or philosophical issues arouse greatest interest in Luxembourg, Sweden and Austria.

Differences are found in other areas too. When asked who they trust to obtain objective information on biotechnology,⁽¹⁾ the most trustworthy are deemed to be consumer organisations (26%), the medical profession (24%) and environmental protection organisations (14%). The universities came in fourth with just 7%. Confidence in the medical profession drops, however, with an increase in the respondent's level of education. The 25-39 age group places most trust in consumer organisations, whereas environmental protection organisations obtain the best scores in Austria (24%), Ireland (21%) and Luxembourg (20%), and the universities are deemed particularly trustworthy among the Finns (19%).

Could do better

But do these subjects really interest Europeans? Apparently so, as 72% of them say they would be willing to spend more time finding out about the advantages and disadvantages of advances in biotechnology. To test their knowledge, each survey is accompanied by a 'quiz' in which respondents have to reply 'true' or 'false' to a dozen statements on a wide range of subjects, most of which feature in the survey. Examples include: 'It is the father's genes that determine whether or not a child is a girl', and 'Musical abilities are mainly learned'.

The report concludes that during the 1990s 'the knowledge of Europeans in the field of genetics does not seem to have increased.' However, the 'true or false' section is no doubt more than an indicator of knowledge alone. It is also subjective,

When Europeans are asked what comes to mind when they think of biotechnology, including genetic engineering, 43% of them reply 'the cloning of animals and human beings.' This association is made by the majority of people aged between 15 and 54 (47%), and especially among executives and students. It also 'increases very dramatically the more modern biotechnology is discussed' (61% of people frequently discuss this subject).

Europeans also seem to have a certain degree of information on a subject which commands a lot of media attention. Most of the correct replies in the 'quiz' section concern the statement 'the cloning of human beings produces perfectly identical human beings' (almost 20% more correct answers in 1999 than in 1996).

Cloning arouses negative feelings, especially in France, the United Kingdom and

Greece, and scores 1.61 (on a range of 1 to 3 points) at the EU level. This feeling is confirmed when Europeans have to assess 13 statements on a scale of 1 to 5, some positive ('animal cloning will benefit a lot of people'), some negative ('the idea of animal cloning frightens me'), and many of them quite subtle. The statement 'even if animal cloning has certain benefits, it is fundamentally against nature' receives the strongest support (4.24). 'Cloning animals poses no danger for future generations' scores 2.19 - a low average, close to 'do not agree'.

On this complex issue, the 'for' and 'against' vary on the different statements according to socio-professional category and age. But there is one constant: on each occasion women are more reluctant than men when it comes to the idea of identical reproduction.



reflecting hope or concern. In 1999, citizens seem 'more doubtful about the potential of biotechnologies, as more of them believe that a person's genes can be changed by consuming a genetically modified fruit'. ■

(1) The following sources were proposed: the press, industry, ethical committees, consumer organisations, universities, environmental protection organisations, government, food safety bodies, farmers' associations, religious organisations, and the medical profession.

Info *The Europeans and biotechnology - Eurobarometer 52.1 - Report drawn up by INRA (Europe) - ECOSA for the Research Directorate-General and the Education and Culture Directorate-General.*
europa.eu.int/comm/research/pdf/eurobarometer-en.pdf

Prevent, adapt or suffer?

The risks of climate change are serious. What could they mean for Europe? And how should we respond? By analysing the scenarios and likely socio-economic consequences in relation to specific geographic characteristics, experts from Acacia are bringing policy-makers, industrialists and social players face-to-face with realities that can no longer be ignored - and the changes they will require.

Since 1996, even if they have no 'conclusive proof' of the role of the greenhouse effect, climatologists from the IPCC (Intergovernmental Panel on Climate Change) global forum have been sounding a double alarm: the Earth's climate is warming and all the indicators 'suggest a discernible influence of human activities' on this trend. Their warnings have been heeded and given rise to the first international response: the Kyoto agreements under which policies to cut CO₂ emissions are now starting - laboriously - to be implemented.

But apart from this preventive measure, three other fundamental questions must be answered. If global warming continues what scale will it reach in this century? What will the environmental and socio-economic effects be? How can society adapt?

A scientific inventory

The Acacia⁽¹⁾ project is the biggest-ever European attempt to bring combined, interdisciplinary, scientific expertise to bear on these three questions. Over a three-year period it harnessed the knowledge of some 40 top experts on climatology, the environment and the human sciences from 12 EU countries. 'The aim was to draw up a *scientific inventory* of the likely scale of climate change in Europe over the coming century and of the concrete effects of these hypotheses for our continent's major regions,' explains project coordinator Martin Parry, director of the Jackson Environmental Institute in Norwich (United Kingdom).



The number of days of exceptional heat recorded in southern Italy increased from 52 for the years 1950-1959 to 123 in the decade 1960-1969, 165 in the period 1970-1989, and 230 for the years 1990-1999.

The first inventory concerns the present state of the climate. Europe's average temperature rose by almost one degree during the 20th century, with a clear acceleration over the past decade. The temperature of the surface waters in our seas has increased by several tenths of a degree. Rainfall increased by between 10% and 40% in northern Europe, while southern Europe experienced a 20% increase in drought. Among the most notable indicators of the scale, speed and geographical distribution of these trends are the retreating glaciers at high altitude and, in Arctic regions, a continuing decrease in the thickness of the ice cap.

(1) A concerted action towards a comprehensive climate impact and adaptations assessment for the European Union.

(2) In its *Special report on Emission Scenarios*, the Intergovernmental Panel on Climate Change (IPCC), set up under a UN framework agreement on climate change, has drawn up a series of scenarios through to the year 2050, based on differentiated developments in global variables (world population, total emissions, CO₂ concentrations in the atmosphere, effects of reduction policy, etc.). The IPCC forecasts are an accepted authority and serve as a basis for international negotiations under the Kyoto agreements.

Scenarios for the century

How will the 21st century evolve? On the basis of the projections developed by the IPCC⁽²⁾ in 1999, the Acacia experts drew up four detailed climatic scenarios at the European regional level for temperature increases of between 0.1°C and 0.4°C per decade.

'Even if such projections incorporate uncertainties - in regard to greenhouse gas emissions and their impact on climate - we have sufficient information to show that, in the case of the strong hypothesis of a 0.4°C increase, seasonal climatic modifications in Europe are likely to be very pronounced,' stresses Professor Parry. Cold winters will become virtually unknown and there will often be a more than 90% probability (compared to the present 10%) of scorching summers.

This phenomenon will extend far beyond the traditionally warm regions of southern Europe and affect not only the Alps and the North Sea but also the whole of Scandinavia and north-west Russia. The impact on the hydrologic cycle will result in an average increase in winter rainfall of as much as 4% per decade on the continent as a whole, with greater contrasts during the summer months, more serious drought throughout



Expect more tidal waves, floods, storms, landslides and forest fires, in northern and southern Europe.

the Mediterranean Basin, and rainfall increasing by 2% per decade in the North. Although we have no means of forecasting with certainty a relationship between global warming and an increase in extreme atmospheric events, we should be prepared for a likely increase in the frequency of natural disasters including tidal waves, floods, storms, landslides and forest fires, in northern and southern Europe. The rise in sea levels, ranging from 13 cm to 68 cm in the next 50 years depending on the scenario is another worrying possibility (see box *Fighting against the sea*).

Organising for the future

The response of Acacia's researchers to these forecasts, and in particular a pronounced warming of Europe's climate, has been twofold. They first tried to assess the possible impact of changes to the ecosystems on Europe's major sectors of activity and regions (see box *Who will pay what price?*). On the basis of this analysis they then began to think about how European society might develop realistic, pragmatic policies to prepare for these changes.⁽³⁾ 'Some of these could radically change the future of Europe a few decades from now. We are entering a field not just of scientific probabilities but of choices about how society is organised,' explains Prof. Parry. 'Changes to ecosystems and the scale of the effects will clearly depend on the measures adopted in response. Many of the political decisions taken in this decade will serve either to alleviate and contain the shock of change, or to aggravate the situation still further.'

To construct a framework of analysis for

this interaction between Europe's future socio-political functioning and climate change, Acacia adopted four types of society scenarios extrapolated from a range of conceivable trends. These were: the dominance of 'world markets', the individualist response of 'provincial enterprise', 'global sustainability', and the triumph of regional individuality in the form of 'local stewardship'. The organisation of society, economic growth, the balance between sectors of activity and between the regions, technological dynamism and – ultimately – the management of ecosystems, will each

assume a very different form depending on the scenario. 'This socio-political vision is very important,' notes the Acacia coordinator. 'It shows that our ability to adapt to environmental constraints depends to a significant degree on our desire to organise.'

•••

(3) These reflections will be the subject of conclusions and recommendations in the Acacia group's report, *Assessment of the potential effects of climate change in Europe*, to be published on completion of the project at the end of this year.

Fighting against the sea

Sea levels on the coasts of Europe rose by between 10 cm and 20 cm during the 20th century – and they look set to rise further: another 13 cm to 68 cm is forecast by 2050. In the north, this will be partly offset by a rise in the land mass elevation, while the south and centre of the continent will slowly 'subside' (a drop in height of 5 cm by 2080).

The effects for coastal zones will be many: shifting of marshland and land liable to flooding, coastal erosion, increased floods and storm damage, increased salinisation and drainage problems. These prospects are all the more worrying as one-third of Europe's population live within 50 km of the sea – and as many as 100% in some



places (in Denmark for example). The regions most at risk are those which are already below sea level, such as the west of the Netherlands and the Po delta. The solutions are limited. Defence and drainage infrastructures can be strengthened, but often it will be necessary to consider transferring activities further inland, even if it conflicts with local socio-economic development.

•••

These scenarios are theoretical, but they are necessary to open up a public debate in which everybody concerned by climate change must consider what the future may hold.'

Act now

The result of three years of in-depth research, Acacia's forecast table is now the most comprehensive reference on the subject and will provide a major European contribution to the IPCC's work. This approach highlights the crucial role that society must in future award to the need for clear-sighted policies on climate change,' stresses Nikolaos Christoforides, the scientist responsible for managing climate research at the European Commission. 'To date, the international community has been thinking of how to reduce man's influence on the greenhouse effect. Such a policy will only bear fruit in the very long term - whereas we are in great danger of having to manage the impact of climate warming in the relatively short term. So what action can we take now? That is the pressing question.' ■



Climate warming has already resulted in a thinner ice cap in Arctic regions and retreating glaciers at high altitude.

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Who will pay what price?

The Acacia researchers attempted to answer this question in a number of detailed studies on changes in water resources, the condition of soils, natural ecosystems, forests, agriculture and fishing. They analysed the vulnerability of systems and activities linked to nature, whether due to water restrictions, storm damage or changes in the distribution of plant or animal species (such as crop-ravaging insects or fish, which are very sensitive to temperature changes).

The increase in extreme climatic events (scorching heat, storms, floods, etc.) and the damage they cause was also considered. Apart from the natural environment, these can affect a wide range of other fields, including the insurance sector, transport, energy, industry, construction

and, of course, health. In regard to the latter, in addition to the increase in victims of violent weather and of the food poisoning associated with hot weather, there could be new risks of epidemic caused by movements in disease carriers. Leishmaniasis, encephalitis and even malaria could all appear. Special attention was also paid to the vulnerability of coastal areas and mountain regions.

In reality, depending on the degree of warming, not all the effects are necessarily negative for everyone. There could be 'benefits' for northern Europe in particular. Milder temperatures and a longer growth period for plants could prove beneficial for certain northern regions, by allowing crops to be grown which were previously impossible. They could also

benefit from a shift in tourist destinations. By contrast, the effect will generally be very serious for southern countries, mainly due to a further aggravation of already very acute water-resource problems. The pressure on ecosystems is likely to be particularly high in these regions, with serious consequences for human endeavour.

New composite sets sail

The thousands of small boatbuilders that flourish along the coasts and waterways of Europe will benefit from a clean, high-performance technology for moulding composite materials. An innovation which is sure to spread to many other sectors.

In April, UK boatbuilder Halmatic won the renowned 'JEC Composite 2000' transport innovation prize for the first boats produced using low-pressure moulding of continuous glass-fibre-reinforced polypropylene mats. The result of a European project, Envirocomp,⁽¹⁾ this new composite offers an alternative to traditional moulding techniques for classical glass-reinforced polyester structures, a process which raises important problems for the environment and health protection in shipyards.

Avoiding styrene emissions

In the EU alone, over 300 000 tonnes of polyester marine products are made each year. The process involves laying down by hand layers of glass-fibre matting impregnated with a liquid resin in an open mould.

Such products contain high levels of styrene monomer, a harmful solvent both for the environment and for health, and require strict measures for ventilation and removing emissions from the workplace. National regulations have already reduced acceptable styrene levels in the workplace to typically below 50 ppm in most of Europe. Even tougher levels are expected in new Commission directives.

In such a regulatory context causing increasing problems in the boat-building sector, the objective of the Envirocomp research consortium was to develop a technological alternative able to eliminate this solvent problem. The project was led by UK composite materials specialist Euro-Projects, and partners included boatbuilders, wind-turbine manufacturers, materials suppliers, research institutes and certification organisations from Denmark, France, Germany and the UK.



The Envirocomp solution is a thermoplastic process based on polypropylene. The process eliminates all the solvent pollution problems.

Using co-mingled glass and PP fibres

The Envirocomp solution is a thermoplastic process based not on polyester but on another polymer: polypropylene (PP). One of the partners, the French company Vetrotex, developed the Twintex composite, made of co-mingled strands of glass and PP fibres. The Twintex strands are woven into a fabric that is draped into a mould together with any cores or inserts and heated to melt the PP. A vacuum ensures the glass fibres are properly impregnated by the molten thermoplastic.

'The process eliminates all the solvent pollution problems. Moreover, advantages include cleaner processing, the ability to recycle offcuts and complete mouldings, resistance to water and chemical attack, and better impact performance and delamination resistance than polyester', claims Gerry Boyce of Euro-Projects. 'While material costs are the same as polyester, there is much less labour involved as it is possible to achieve the desired thickness with one shot.'

(1) Research, development and evaluation of environmentally friendly advanced thermoplastic composites for the manufacture of large surface area structures (Ref. BRPR960228)

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Focused European research

Polymer composites offer many benefits, including part integration, weight saving, safety and durability. Intensive research into material properties, improved production technologies and recycling is paying major dividends in automotive, aeronautics, construction and marine applications. Envirocomp is one of numerous examples of projects within the Targeted Research Action (TRA) on polymer materials, which consists of clusters of research projects funded by the European Union under the Brite-EuRam and Craft programmes. The network involves some 150 research institutions, SMEs (small and medium-sized enterprises) and large companies as well as relevant trade associations. See: www1.vr.nl/tra-pm.org/index1.htm

Open forum

This double-page forum aims to provide a flexible and informal platform for reports, thoughts, opinions and statistics which we believe warrant a wider audience. The forum is designed to be an invitation to discussion and debate, and a place for ideas - with which we trust our readers will keep us well supplied.

[Contact: Michel Claessens – Fax: +32-2-295.82.20 – e-mail: michel.claessens@cec.eu.int]

Research-society dialogue

Research should not aim to disseminate its results only within the research system. It also needs to listen to and draw lessons from the experience and concerns of a range of social players and protagonists. This concern of the Commission is expressed in a totally new initiative by the Research DG: the launch of 12 'dialogue workshops', the first of which was held last May. These workshops are intended to sensitise researchers to the expectations of the different forces in society, of decision-makers and of citizens' organisations, in the

light of the major changes facing Europeans today: new technologies, changing family structures, novel forms of work organisation, the single currency, the enlargement of the Union, etc.

In order to encourage broad and open discussion, each of these meetings brings together 50 or so participants from different disciplines and backgrounds. The first of them, which was held in May, looked at 'Technology, economic integration and social cohesion'. Another three workshops are to be held this year in Brussels: 'Work and welfare' (9-10 November); 'Regional dimensions of RTD strategies' (24 November) and 'Employment funding' (6-7 December). Another eight meetings are

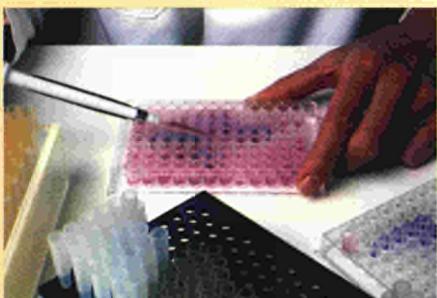
scheduled in 2001.

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The ERA is taking shape

The Communication on the European Research Area was adopted by the Commission last January. This concept, based on a 'bottom-up' philosophy, is being developed and refined by involving the largest possible

When it comes to numbers



■ **Research** – In Europe, between 9% and 19% of government expenditure on research goes to fundamental research, depending on the country. L'exception française – France's right to go its own way – holds good here, too, with a figure of no less than 26.5%. These figures were pre-

sented to around 200 rectors of European universities meeting last June at Trondheim (Norway). Most of them expressed concern at the 'short-termist' approach of governments and other public bodies that support 'pure' research. Whilst overall R&D expenditure is rising, it is applied research that is getting the additional money. 'The problem is that this shift has taken place without public debate,' said Heidi Diggelmann, president of the Research Council of the Swiss National Fund for Scientific Research.

■ **Green taxes***... – In 1995, income from environment-related taxes in OECD countries represented almost 7% of all tax income, or around 2.5% of GDP. These green taxes are flourishing in Ireland, Iceland and Portugal, but much weaker in the United States, Japan, Mexico and Poland. This said, those countries with the highest

marks are not necessarily the most virtuous. This type of legislation can improve taxpayer behaviour ... and so drive down tax income.

■ ... and environmental bills* – Making good the damage we do to the environment is expensive, whether we pay for it through taxes or in other ways. The consequences of atmospheric emissions such as volatile organic compounds, carbon dioxide and ammonia are estimated to cost 1% of the EU's GDP – 58.5 billion euros a year since 1990. Investment in water collection and treatment will have amounted to 0.15% over the period 1993-2005. The future bill for cleaning contaminated soil (over 300,000 sites in Western Europe) varies from country to country: 3-4% of GDP in Sweden and Denmark, 4% in the Netherlands and the United Kingdom, and an esti-

Letters

The article on building in RTD info 26 included a box entitled 'Steel houses'. Philippe Jodin of the University of Metz has reacted to the statement that steel 'permits earthquake-proof design and good fire resistance, plus a light and recyclable construction'.

As a specialist in building in wood and wood-based materials, I cannot let such a statement pass without comment. It is a well-known fact that steel buildings offer poor resistance to fire (not to be confused with reaction to fire). Do I need to remind readers of the famous 'Pailleron' school buildings, of unhappy memory in France? All fire chiefs will tell you that they will never send their men inside a steel-framed building, whereas where the structure is in wood, they will enter without fear.

When it comes to anti-seismic qualities, it is the way the frame of the building is designed that determines its ability to resist earthquakes. The ability of wood to absorb a high level of distortion energy is a vital factor in seismic design.

Earlier in the article, the author praises the speed and modularity of steel buildings, as well as their good thermal efficiency 'even in cold countries'. Here too, the author's statements are a little too quick off the mark: I can provide you with papers and research documenting the exemplary speed and modularity of building in wood. And as for thermal efficiency, are not traditional Finnish buildings made of wood? And even lived in! Whilst it is perfectly legitimate to promote a particular building material, I question the use of fallacious and dangerous affirmations such as 'the good fire resistance of steel buildings'.

In any event, my fellow researchers and myself would be happy to provide you with full documentation on building in wood.

Philippe Jodin
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number of players - researchers, industrialists and citizens - all of whom are concerned with European scientific and technological development. Various steps have been taken to gather the fruits of their analysis. 636 questionnaires have been sent out to entrepreneurs and industry. An initial seminar last May brought together scientists and academics with responsibilities in this area. The electronic forum, launched in the spring, is a success and is producing high-quality contributions.

Initial reactions are already pointing to certain key areas: the desire to strengthen European centres of excellence and research budgets, the wish to increase the mobility of researchers, a widely shared concern at the 'brain drain' and the declining image of science, the as yet unmet need to define what is 'ethically acceptable' in the life sciences, and some pretty severe criticism of the general burden of 'bureaucracy' that weighs down on research.

<http://europa.eu.int/comm/research/area.html>

In praise of chance

The wind that blew a few pieces of green fluff onto a bacterial culture in Alexander Fleming's laboratory at St Mary's Hospital in London one morning in September 1928

offers the example par excellence of a chance discovery. Fleming's response to this event, that most researchers would have considered as a banal contamination, is a perfect illustration of Pasteur's comment that chance favours only spirits that are ready to accept it, whilst Howard Florey and Ernst Chain's subsequent efforts demonstrate the difficulty and expense of converting a discovery into a practical application. It is very possible that if the war had not created exceptional needs and justified extraordinary expenditure, penicillin would not yet have been invented. Similarly, countless other antibiotics, not to mention the large number of 'mycins' which have been taken out of service because of their toxic effects, but which have been of inestimable help in biological research, would not perhaps have been available. Bacterial infections would have remained terrible diseases, and biology would still be groping its way towards many of the answers that are available today.

Chance has no favourites, but distributes its nuggets equally among every type of research project, from the most banal to the most sophisticated. Even if one would be stupid to rely on it, it is important that everyone remain awake and vigilant.

*Christian de Duve
Nobel Laureate in Medicine*

mated 5-25% of GDP in Germany. When it comes to climate change and global warming, the cost will depend on the use made of the Kyoto mechanisms, and could be of the order of 0.15% of the EU's annual GDP (€10 billion).

■ **Knowledge and growth*** - Of the 900 000 Europeans who graduate in science and technology every year, just 10% obtain jobs in the fields that they trained in. This is despite the fact that 70% to 80% of economic growth derives from new or improved knowledge - now key factors in international competitiveness. The contribution of technical progress to growth is estimated at between 25% and 50%, and can be much greater in the high technology area.

■ **Senior citizen jobs*** - Until the mid-1990s, the working-age population (20-64) in the EU rose by 1.5 million to 2 million

people every year. In 1999, this figure fell by just 500 000 persons. In 1995, 25% of the oldest section of the population (aged 65 and over) was still in work. By the year 2025 this figure could reach 38%. By then in the present Union (EU-15) this age group could consist of 85 million persons and make up 22% of the population (versus 15.4% in 1995). In 2007, the number of people in the working population aged 55-64 will exceed that of those aged 20-29.

* (Source: Report of the Futures project, carried out by IPTS (Institute for Prospective Technological Studies of the Joint Research Centre).

News in brief

The JRC – the Union's scientific arm

'The Joint Research Centre should transform to become an instrument of the European Union, providing services requested by the Commission, the Council and the [European] Parliament.' Thus runs the main recommendation of the report of the independent panel, headed by Viscount Etienne Davignon, which Commissioner Philippe Busquin invited last January to assess the activities of the JRC and to propose possible improvements.

The JRC's complex past. Set up 43 years ago as a source of European expertise in nuclear energy, the JRC has, over the years, become a vast, diversified and multi-faceted research institution and an integral part of the Commission. 2 500 people work at its five sites in Italy, Belgium, the Netherlands, Germany and Spain. 70% of its activity focuses on three areas: services to citizens, strengthening sustainable environmental policies and improving competitiveness.

In the view of the panel, the JRC's mission is at present unclear. In proposing that

it become the 'scientific arm' of the Union's three main institutions, the evaluation team has thrown the ball into the politicians' court. For the experts, it is essential that the Community institutions be conscious of the value of the Union having its own centre of expertise, properly structured, dynamically run and adequately resourced. In order to achieve this, the Centre needs to be able to deliver 'what the Institutions say they need, not what the JRC thinks they need, as has been the case in the past in the absence of clear guidance'.

Three major categories of needs have been identified: developing EU policies, monitoring their operation and implementation, and providing expert advice at times of crisis and unforeseen events. These needs relate in particular to the various aspects that directly affect citizens (such as health, food, the environment and privacy), economic leaders (e.g. fighting crimes related to the information society, and intellectual and industrial property rights), and external policymakers (including, in particular, the JRC's expertise in space). An essential element here is the need for scientific and technological expertise attendant on the enlargement of the Union, a process that

will remain high on the agenda for the next two decades.

Many of the recommendations are for reforms that would allow the JRC to move beyond its present status of administrative department embedded in the Commission - and with its budget linked to the global five-yearly appropriation for the framework programmes - to become a centre of expertise for the Council and Parliament as well. Such a development ought to feature an opening up of the JRC's management board whose responsibilities should be confirmed. The panel also insists on the need for an open, pro-active policy of strengthening and updating the JRC's skills and expertise. It calls for much more systematic mobility of researchers and for the use of outside human resources. These detailed recommendations may be consulted by downloading the panel's report from the Centre's website:

www.jrc.cec.eu.int/download/press/releases/davignon-report.pdf

Sites to discover

Growth Communication Centre

europa.eu.int/comm/research/growth/index.html

The Competitive and Sustainable Growth programme now has an Internet window, addressed at everyone involved in industrial research in Europe: researchers, engineers, entrepreneurs, scientific and technological policy managers, and specialist journalists. Here they will find easily accessible information on all initiatives and activities of the programme and its key actions, practical information on how to participate, and

analyses of the advances made by European projects in such diverse areas as marine safety, anti-doping tests in sport, and reducing aircraft noise.

Life sciences and society

biosociety.dms.it/

As a new 'biosociety' evolves, socio-economic researchers need to team up with life scientists to measure how these changes affect individuals, society, the environment and economic life, and to suggest political responses. The Quality of Life programme is trying to integrate this concern into European life-science research as far as is possible.

The Biosociety site has just been launched in order to permit a growing exchange between researchers on the social aspects of advances in life sciences - in particular on how they are perceived by the general public - and on the needs for regulation and control. The site's databases will include practical information, studies and reports from various sources, and catalogue all European research on the impact of life sciences. It will also include a 'bio-glossary' of around 800 technical-scientific terms and subjects, a legal section and a database of the main experts in this area.

Research Council: benchmarking the ERA

On 15 June, the Research Council held under the Portuguese presidency confirmed the need to give priority to setting up a European Research Area. Among the proposals put forward for achieving this objective, ministers adopted that of 'benchmarking' the performance of national research policies in six areas: human resources (especially in terms of the 'attractiveness' of scientific and technical careers), level of investment (public and private), scientific and technological productivity, impact on economic competitiveness and employ-

ment, promotion of science and technology and the scientific culture of the public as a whole, the convergence of each country's potential and its comparison with Europe as a whole. The Council also stressed the importance of improving the mobility of researchers and of the forthcoming creation of the Community patent.

ue.eu.int/newsroom/

To follow the activities of the Research Council under the French Presidency in the second half of 2000, visit:
www.cordis.lu/france/en/

Newropeans or Young People's Europe

One of the major events of the French Presidency of the Union will be the 'Newropeans' conference, to be held in Paris from 5 to 7 October. The event is being held under the patronage of President Jacques Chirac, and speakers include Commission President Romano Prodi, the Secretary-General of the EU Council, Javier Solana, and various European commissioners and key players in national governments. At the conference, which is organised by Prometheus-Europe, Newropeans will have the opportunity to 'push forward [their] ideas. Realise projects, formalise leads for tomorrow's Europe' and tackle the new challenges facing them. Topics such as the impact of the new technologies on employment, how to organise a European knowl-

edge zone, the role of European citizens, and education and training in Europe in 2010 will be analysed during two days of thematic seminars.

The accent will be on young people, with the 2500 participants including around a thousand students and another thousand young people who have just entered the world of work. The idea is to offer Europe's decision-makers an opportunity to listen to the generation that will be tomorrow's Europe. The closing speech by French Prime Minister Lionel Jospin will be followed by a televised debate in which six well-known personalities and sixty European students will set out their views on the future of their continent.

www.newropeans.org/index-en.htm

Finally, a European patent

It has been 30 years in coming. Finally, last June, it received the political go-ahead from the European Council at Feira (P), where the Union's heads of state or government expressly called for the new Community patent to be introduced by the year 2001. This will replace the present cumbersome and innovation-blocking system of 'European' patents delivered by the EPO (European Patents Office),⁽¹⁾ with their expensive translation requirements, and with legal disputes settled by the various national courts. In future, Community patents will be filed

with the EPO in the EPO's three working languages only - English, German and French - and will be valid throughout the Union. The Commission is also proposing setting up a single jurisdiction, under the auspices of the European Court of Justice, to settle disputes relating to counterfeiting and the validity of patents.

(1) The average cost of registering a patent in Europe is €50 000 (including €17 000 for translations alone), or five times higher than in the United States.

European Science and Technology Week

The programme of this week, being held from 6 to 12 November, will include the following.

- *Physics on stage* - A conference to be held at CERN in Geneva to present and discuss innovative ways of popularising physics.

Coordination: Richard West, ESO
rwest@eso.org

- *Learning from nature* - An audiovisual production for European TV stations which shows the extent to which nature is an excellent source of inspiration and knowledge for science and technology.

Coordination: Brian Davies, European Physical Society

brian.davies@scienceswords.demon.co.uk

- *Raising Public Awareness in Mathematics* - Distribution of posters for display in public transport areas illustrating the importance of mathematics in scientific and technological progress.

Coordination: Mireille Chaleyat-Maurel, Université Paris 5

mcm@ccr.jussieu.fr

- *Radioactivity - A facet of nature* - Three exhibitions in Paris, Frankfurt and Milan will present the importance of nuclear science applications for the new century

Coordination: Alessandro Pascolini, Istituto Nazionale Fisica Nucleare
pascolini@pd.infn.it

- *Euro S&T Week* - A conference on climate change for young people and teachers from all over Europe

Coordination : Brian Gamble, BAAS
brian.gamble@britassoc.org.uk

- *European Project on the Sun* - Mock-up of a space vessel containing a travelling interactive exhibition on the relationships between the earth's ecosystem and the sun. The five modules will be designed with the help of young people and science-lovers in various European Research Centres, and then assembled and presented during the week.

Coordination: Walter Staveloz, Ecsite
wstaveloz@ecsiste.net

Contact | Stephen Parker,

Research DG

stephen.parker@cec.eu.int

Calls for proposals: overview

Deadlines**2000****2001****QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES (www.cordis.lu/life/)**

KEY ACTIONS	OCT ⁽²⁾	NOV	JAN	FEB ⁽³⁾	MAR	APR	MAY	JUNE	JULY	SEPT
Food, nutrition and health	11			9						
Control of infectious diseases	11									
The "cell factory"	11			9						
Environment and health				9						
Sustainable agriculture, fisheries and forestry	11			9						
The ageing population and disabilities				9						
Generic research	11									
OPEN CALLS⁽¹⁾	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Training: Marie Curie individual fellowships	11						11			
Research training networks				1						
SME Measures (exploratory awards / cooperative research)			17			18				19 ⁽⁴⁾
Accompanying measures	11			9						12
Support for research infrastructure	11			9						

(1) Call published on 6.3.1999. (2) Call published on 15.12.1999. (3) Indicative dates: call planned for 15.11.2000. (4) CRAFT projects only (no exploratory premiums).

USER-FRIENDLY INFORMATION SOCIETY (www.cordis.lu/ist/)

KEY ACTIONS	OCT ⁽¹⁾	NOV	JAN ⁽²⁾	FEB	MAR	APR	MAY ⁽³⁾	JUNE	JULY	SEPT
Systems and services for the citizen	31		15				X			
New methods of work and electronic commerce	31		15				X			
Multimedia content and tools	31		15				X			
Essential technologies and infrastructures	31		15				X			
Cross-programme themes	31		15				X			
Future and emerging technologies ⁽⁴⁾	31		15				X			
OPEN CALLS	OCT	NOV	JAN	FEB ⁽²⁾	MAR	APR	MAY ⁽³⁾	JUNE	JULY	SEPT
Future and emerging technologies ^{(5) (6) (7)}				15			X			
Support measures ⁽⁷⁾				15			X			
SME Measures (exploratory awards / cooperative research) ⁽⁸⁾			17			18				19 ⁽⁹⁾

(1) Call published on 25.07.2000. (2) Call planned for September (subject to confirmation). (3) Closing in May of a call planned for February (subject to confirmation).

(4) Proactive initiatives. (5) Open area. (6) Evaluation at least every 3 months. (7) Call published on 10.02.2000. (8) Calls published on 16.03.1999. (9) CRAFT projects only (no exploratory premiums)

COMPETITIVE AND SUSTAINABLE GROWTH (www.cordis.lu/growth/)

KEY ACTIONS	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Innovative products, processes and organisation	29 ⁽⁵⁾				15 ⁽²⁾					
Sustainable mobility and intermodality	29 ⁽⁵⁾				15 ⁽²⁾					
Land transport and marine technologies	29 ⁽⁵⁾				15 ⁽²⁾					
New perspectives for aeronautics	29 ⁽⁵⁾				15 ⁽²⁾					
Generic research	29 ⁽⁵⁾				15 ⁽²⁾					
Measurements and testing research	29 ⁽⁵⁾				15 ⁽²⁾⁽³⁾					
Support for research infrastructure	29 ⁽⁵⁾				15 ⁽²⁾⁽³⁾					
OPEN CALLS⁽¹⁾	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Training: Marie Curie individual fellowships						21				19
SME Measures (exploratory awards / cooperative research)			17			18				19 ^{(4)*}
Accompanying measures						15				15
Expressions of interest on research needs						30				

(1) Deadlines for receipt, calls published on 16.3.1999. (2) Periodical call planned for 15.12.2000. (3) Targeted call planned for 13.10.2000. (4) CRAFT projects only (no exploratory premiums). (5) Correction: closing date announced as 15th in RTD Info 26 and postponed to 29th - Call published on 6.6.2000.

ENERGY, ENVIRONMENT, AND SUSTAINABLE DEVELOPMENT (www.cordis.lu/easd/)

KEY ACTIONS	OCT	NOV	JAN	FEB ⁽¹⁾	MAR	APR	MAY	JUNE	JULY	SEPT
Sustainable management and quality of water					15					
Global change, climate and biodiversity					15					
Sustainable marine ecosystems					15					
The city of tomorrow and cultural heritage					15					
Cleaner energy systems, including renewables					1					
Economic and efficient energy for a competitive Europe					1					
Support for research infrastructure					15 ⁽²⁾					

(1) Indicative date, to be confirmed at launch of call, planned for November 2000.

(2) Environment and sustainable development only.

Legends

Submission deadlines (for specific research actions)

Batch evaluation dates (for open calls)

For the latest information on calls for proposals and calls for tender, see:
www.cordis.lu/fp5/src/calls.htm

Deadlines**2000****2001**

OPEN CALLS ⁽¹⁾	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Generic research				1 ⁽²⁾		16 ⁽³⁾				
Training: Marie Curie individual fellowships				1 ⁽²⁾	21 ⁽³⁾					1 ⁽²⁾
SME Measures (exploratory awards / cooperative research)			17			18				19 ⁽⁶⁾
Accompanying measures ⁽⁷⁾				1 ⁽²⁾ (5)–15 ⁽³⁾	15 ⁽⁴⁾			15 ⁽³⁾		19 ⁽³⁾

(1) Calls published on 18.11.1999. (2) Energy only. (3) Environment and sustainable development only. (4) Environment and sustainable development only: advanced studies courses. (5) including OPETs. (6) CRAFT projects only (no exploratory premiums). (7) See corrigendum published on 09.02.2000.

NUCLEAR ENERGY (FISSION) (www.cordis.lu/fp5-euratom/)

KEY ACTIONS	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Nuclear Fission ⁽¹⁾			22							
OPEN CALLS ⁽²⁾	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Generic research			22							
Support for research infrastructures			22							
Training: Marie Curie individual fellowships ⁽³⁾			12						13	
Other training actions ⁽⁴⁾					26					
Accompanying measures					26					24

(1) Call to be published on 16.10.2000 (2) Call published on 20.03.1999 (3) Types 30, 40 and "return" (4) Special courses, research training networks, cooperation with third countries

INTERNATIONAL COOPERATION (www.cordis.lu/inco2/)

CALLS BY COUNTRY GROUPS	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
States in pre-accession phase ⁽¹⁾		16			16				16	
NEI & PECO non-candidats ⁽¹⁾		16			16				16	
Mediterranean partners (INCO-MED)			16 ⁽²⁾		16 ⁽²⁾				16 ⁽²⁾	15 ⁽³⁾
Developing countries (INCO-DEV)			16 ⁽²⁾		16 ⁽²⁾				16 ⁽²⁾	15 ⁽³⁾
Emerging economies and industrialised countries ⁽²⁾	16			16				18		
Fellowships for Japan						1				

(1) "Support for participation in conferences" calls opened (2) "Accompanying measures" calls opened (3) Calls for research, concerted action and thematic networks projects Planned publication dates: 15/4/2001.

INNOVATION / PARTICIPATION OF SMES (www.cordis.lu/innovation-smes/)

OPEN CALLS ⁽¹⁾	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
SME Measures (exploratory awards / cooperative research) ⁽²⁾			17			18				19 ⁽³⁾
Economic and technological intelligence projects ⁽⁴⁾		3			2					
Awareness and assistance actions in the field of IPR and in the field of Innovation finance			15 ⁽⁵⁾							
Pilot-projects: access to private innovation finance and tools for better knowledge exploitation ⁽⁶⁾	6									

(1) See also the Cordis site for calls for offers and calls for specific promotion and encouragement actions. (2) Call published on 01.04.1999. (3) CRAFT projects only (no exploratory premiums). (4) Call published on 23.04.1999. (5) Indicative closing date for a call planned for 15.10.2000 (subject to confirmation). (6) Call published on 07.07.2000.

HUMAN POTENTIAL (www.cordis.lu/improving/)

OPEN CALLS	OCT	NOV	JAN	FEB	MAR	APR	MAY	JUNE	JULY	SEPT
Research training network ⁽¹⁾							4			
Marie Curie individual fellowships ⁽²⁾⁽³⁾					14					12
Marie Curie industry host fellowships ⁽⁴⁾		3								
Marie Curie development host fellowships and training sites ⁽⁵⁾							16			
Research infrastructure cooperative networks and exploratory workshops ⁽⁶⁾				15						
High-level scientific conferences ⁽²⁾				1						
Awards for first-class research ⁽⁷⁾							9 ⁽⁸⁾		20 ⁽⁹⁾	
Raising public awareness of science and technology ⁽¹⁰⁾							16			
S&T policy strategy: thematics networks and Accompanying measures (Strata) ⁽¹¹⁾								29		
S&T policy strategy: Accompanying measures (Strata) ⁽¹²⁾				Open till 28/6/2002					15	
Accompanying measures for the programme ⁽¹³⁾				Open till 28/6/2002						

(1) Call planned for 15.12.2000. (2) Calls published on 16.03.1999. (3) Individual bursaries, return bursaries, bursaries for experienced researchers. (4) Call published on 15.02.2000. (5) Call planned for 15.02.2001. (6) Call planned for 15.11.2000. (7) Call planned for 08.12.2000. (8) Descartes Prize. (9) Archimedes Prize (10) Call planned for 16.01.2001. (11) Call planned for 01.03.2001. (12) Call published on 01.03.2000. (13) Call published on 16.05.2000

Diary

- Conference of Marie Curie fellows - 4-7/10/2000 - Crete (GR) iehrp@iesl.forth.gr
- Science and Governance - Organised by the JRC - 16-17/10/2000 - Brussels (B) guelperi.vural@cec.eu.int
- Bioproducts from Plants and Microbes - 18-20/10/2000 - Rothamsted (UK) www.biemarket.iacr.ac.uk/
- Food Safety in Europe - Challenges and Opportunities 19-20/10/2000 - London (UK) www.foodsafetyeurope.com/
- Biomaterial 2000 - International technology transfer day - 19-20/10/2000 - Erfurt (D) www.thati.de/biomaterial2000/
- ENERTEC 2000 - Renewable Energy Sources & Rational Use of Energy - 23-24/10/2000 - Brno (CZ) www.tc.cas.cz/enertec2000/
- FIREFOR/2000 - Preventing and Combating Forest Fires - 25-27/10/2000 - Teruel (ES) codinter@masterole.com
- Biopartners 2000 - The European Plant Biotechnology Network Industry Contact meeting - 26-28/10/2000 - Wageningen (NL) www.epbn.org/
- Sommet BIO / Biosummit - A social debate organised by the Commission's High Level Group on Life Sciences - 6-7/11/2000 - Brussels (BE) www.cordis.lu/life/
- EUROSAFE 2000 - Euratom Research in Reactor Safety - 06-07/11/2000 - Cologne (D) easd@cec.eu.int
- The Use of High Performance Computing in Meteorology - ECMWF Workshop (European Centre for Medium-Range Weather Forecasts) - 13-17/11/2000 Reading, UK www.ecmwf.int/pressroom/
- European Biotechnology Node for Interactions with China - 18/11/2000 Heidelberg (D) inco2@cec.eu.int
- European Wave Energy Conference - 4-6/12/2000 - Aalborg (DK) www.teknologisk.com/1347/
- GMOs: Methodological Developments in Relation to Regulatory Requirements - Organised by IHCP- JRC - 11-13/12/2000 irene.norstedt@cec.eu.int
- Pollutec 2000 - Selected Industrial Technologies for a Cleaner Environment - Joint CNISF / Research DG symposium - 18-19/12/2000 - Lyon (F) cnisf.allard.paul@wanadoo.fr
- Aerodays - 28-30/01/2001 - Hamburg (D) growth@cec.eu.int

Rethinking the infrastructures

Europe's increasingly numerous and sophisticated scientific and technological infrastructures, which are so vital for European research, are continuing to evolve. This reflects their changing roles, especially the fact that a substantial portion of the installations and equipment are being used for multi-disciplinary purposes, as well as for industrial research.

Resolving this problem of infrastructures is a central element in realising the maximum potential of the European Research Area. The conference on this topic that is being organised in Strasbourg on 18-20 September 2000 by the Commission, the French Presidency of the Union and the

European Science Foundation will start a process of reflection and discussion involving players from both research and industry. The task ahead is to define and implement a consistent policy for using and expanding European infrastructures. Information and contributions on this vast subject (which concerns access to infrastructures and mobility of researchers as much as the networking and financing of existing European capacities) can be consulted on the *Improving Human Potential site*: www.cordis.lu/improving/src/ari_conf_res_infr.htm melanie.kitchener@cec.eu.int

The Giant's first strides

Last May the Information Society Technologies programme received an initial 80 million euros in grant money to create Géant, the new broadband digital transmission network which will connect European research centres. This high-tech operation will involve the gradual updating of the existing TEN-155 network in consultation with all national research and education networks in member countries, as well as

the telecommunications service operators involved.

The Commission has stated that this financing should reflect the need for cohesion within the Union, so that scientists throughout Europe - including the countries applying for membership - might enjoy equal access to the network, regardless of differences in communication costs from one country to another.

The vital socio-economic approach

The research projects that the Union supports cannot turn a blind eye to the socio-economic dimension of the environments in which their work takes place and which this work could in turn affect. This philosophy, clearly stated in the Fifth Framework Programme, is the subject of a report⁽¹⁾ which especially aims to foster reflection and discussion. The report seeks to shed light on different questions, such as the attention paid to, and the significance of, this socio-economic dimension within specific programmes and key actions - and how this

dimension is reflected in project proposals. The report includes a detailed examination of how the socio-economic dimension is integrated into the specific programmes and a series of recommendations for paying greater attention to this aspect.

(1) 1999 annual report on the socio-economic dimension of the Fifth Framework Programme. This document can be downloaded from the Human Potential programme website (www.cordis.lu/improving/). A printed version may be requested by e-mailing improving@cec.eu.int.

Publications

Science and society

- *History of science and technology in education and training in Europe⁽²⁾* (374 pp) / ISBN 92-828-8708-1 / anita.mallada@cec.eu.int
- *Sciences, mythes et religions en Europe⁽²⁾* (196 pp) / ISBN 92-828-7397-8 / anita.mallada@cec.eu.int
- *Science and governance* / Special edition of IPTS Report (no 45, 6/2000, 44 pp) / GK-AA-00-005-EN-C / www.jrc.es/iptsreport/

Agriculture and food

- *Mycoplasmas of ruminants: pathogenicity, diagnostics, epidemiology and molecular genetics⁽¹⁾* (257 pp) / EUR 19245 / ISBN 92-828-9830-X / EurOp⁽⁴⁾
- Assessment of the commercial success of the ECLAIR programme (1988-93) / Examples of projects (158 pp) / EUR 19338 / ISBN 92-828-9144-5 / quality-of-life@cec.eu.int

Medicine and health

- *UV index for the public⁽¹⁾* (27 pp) / EUR 19226 / ISBN 92-828-8142-3 / EurOp⁽⁴⁾
- Inventory of public biotechnology R&D programmes in Europe (3 vol., 68, 280 and 263 pp) / EUR 18886 - quality-of-life@cec.eu.int

Environment

- *Mediterranean desertification⁽²⁾* (615 pp) / EUR 19303 / ISBN 92-828-8128-8 / easd@cec.eu.int
- *Advances in European tropospheric research⁽³⁾* (115 pp) / EUR 19311 / ISBN 92-828-8548-8 / easd@cec.eu.int

Industrial research

- *Steel research* / 22 project reports / For further details: growth@cec.eu.int

Nuclear energy

- *Full-scale engineered barriers experiment for a deep geological repository for high-level radioactive waste in crystalline host rock (FEBEX project)⁽¹⁾* (362 pp) / EUR 19147 / ISBN 92-828-9285-9 / easd@cec.eu.int
- *Euradwaste 1999: Radioactive waste management strategies and issues⁽²⁾* (599 pp) / EUR 19143 / ISBN 92-828-9420-7 / easd@cec.eu.int
- *A PalaeoHydrogeological study of the MOL site (PHYMOL project)⁽¹⁾* (101 pp) / EUR 19146 / ISBN 92-828-9344-8 / easd@cec.eu.int

International cooperation

- *Health systems and social development: an alternative paradigm in health systems research⁽²⁾* / marianne.braun@cec.eu.int

Education and socio-economic research

- *Flexibilisierung in der Arbeitswelt am Beispiel der beruflichen Erstausbildung⁽¹⁾* (236 pp) / EUR 19239 / ISBN 92-828-8600-X / EurOp⁽⁴⁾
- *Review of vocational education and training research in the United Kingdom⁽¹⁾* (170 pp) / EUR 19243 / ISBN 92-828-9829-6 / EurOp⁽⁴⁾
- *Research training networks⁽³⁾* (311 pp) / 18457 / ISBN 92-828-8519-4 / improving@cec.eu.int
- *Ion beam study of art and archaeological objects⁽¹⁾* (136 pp) / EUR 19218 / ISBN 92-828-7652-7 / EurOp⁽⁴⁾

Fundamental research

- *Synchrotron light and free-electron lasers⁽¹⁾* (31 pp) / ISBN 92-828-8506-2 / improving@cec.eu.int

Visiting cards for European research

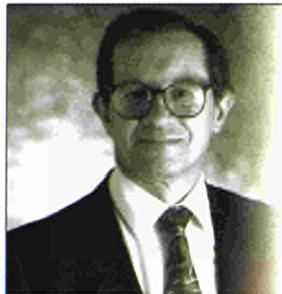
- *Man, Nature, Technology* / The three leitmotivs of Hannover's Expo 2000 reflected in advances in European research / Supplement to RTD info (36 pp, available in FR, EN, DE) / CG-AB-00-S01-FR-C / research@cec.eu.int
- *Europe: a research area* / General audience brochure (34 pp) / ISBN 92-828-8250-0 / Available in 11 languages / EurOp⁽⁴⁾
- *Research and technological development in Europe* - 36 examples of projects (II) (78 pp) / ISBN 92-828-7708-6; *Recherche et développement technologique en Europe* - 36 exemples de projets (II) (78pp)/ISBN92-828-7674-8; *Forschung und technologische Entwicklung in Europa*: 36 Projektbeispiele (II) (78 pp) / ISBN 92-828-7707-8 / research@cec.eu.int
- *Brochures presenting the four thematic programmes and three horizontal programmes of the Fifth Framework Programme* (available in FR, EN, DE, 16 pp) / research@cec.eu.int
- *A Quality of Life Special Edition* / Cordis Focus RTD Results Supplement (Issue 22, 4/2000, 44 pp) / CD-AF-98-043-EN-C / helpdesk@cordis.lu / www.cordis.lu/focus/fr/src/res-22.htm

Key meetings during the French Presidency

- *European Scientific Evaluation* - 9-10/10/2000 - Lyon (F) www.cordis.lu/france/en/diary.htm
- *Protection of the Planet, GMES* - 16-17/10/2000 - Lille (F) www.cordis.lu/france/en/diary.htm
- *SITEF 2000 - Innovation and Future Developments* - including a substantial European Commission stand - 18-20/10/2000 - Toulouse (F) www.sitef.com/
- *IST 2000 - The Information Society for All* - The annual conference of the Information Society programme - 6-8/11/2000 - Nice (F) istevent.cec.eu.int/
- *Towards a European Innovation Area* - Forum for innovative enterprises - 20-21/11/2000 - Lyon (F) amy.bearne@cec.eu.int
- *Innovation and enterprise creation - Statistics and indicators* - 23-24/11/2000 Sophia Antipolis (FR) www.cordis.lu/innovation-smes/src/statconf.htm innovation@cec.eu.int

(1) Project Report
 (2) Conference proceedings
 (3) Catalogue of projects
 (4) EurOp: eur-op.eu.int/general/en/s-ad.htm

The sustainable keys of the city



Today's cities are grappling with multiple and complex problems as they seek to ensure a sustainable development as the sole guarantee of quality of life for their inhabitants. 'The City of tomorrow and cultural heritage', a key action under the Fifth Framework Programme, is endeavouring to promote an in-depth and integrated approach to all the technological, socio-economic and environmental challenges facing our metropolitan areas. David Miles, who is responsible for this policy at the European Commission, explains.

Sustainability' is the new buzzword of urban planning. But what does this concept really mean in everyday terms?

David Miles: Today, 300 million EU citizens live in cities and large towns. They expect a quality of life based on prosperity, mobility, security. They want safe drinking water, alternative transport systems that will end traffic congestion and the polluted atmos-

sphere caused by cars and other vehicles, decent housing, and an active social and cultural life. The challenge of sustainability is to meet these demands without jeopardising our grandchildren's chances of enjoying the same advantages. We have to consider four interlocking aspects.

First, urban development must be **environmentally** sustainable. Cities are massive consumers of energy, water and building materials, and generate two-thirds of

Europe's CO₂ emissions – primarily from road traffic and heating systems. Municipal authorities need to find ways to reduce their 'ecological footprint'.

Second, development has to be **economically** sustainable. We must avoid burdening future generations with the cost of cleaning up our mess, and ensure that new buildings and infrastructures will continue to be useful well into the future. Since 90% of the structures which will be in use in 30 years' time have already been built, new solutions must also be applicable whenever renovation and refurbishment is undertaken.

Third, we must take sustainability's **social** dimension into account. New development should foster a real sense of community. Houses and apartments need to be comfortable and healthy, offering easy access to shops and workplaces as well as plenty of open, green spaces.

Lastly, **cultural** sustainability means preserving and improving access to the historic architecture and artefacts which shape local and regional identity across Europe – and which make an important economic and educational contribution through cultural tourism.

You say that these four aspects interlock. But everyone knows of cases where economic and environmental interests have clashed.

The whole point of sustainability is to reconcile such differences. A holistic approach is essential, capable of taking into account the needs of all those involved, and of identifying 'win-win' solutions. One of our current research projects is developing new sustainable refurbishment methods for large apartment blocks. They will dramati-

Targeting tangible progress

With a budget of just €170 million for the period 1998-2002, the key action on the '*City of Tomorrow and Cultural Heritage*' has been designed to produce, within a decade, measurable advances in economic development, environmental performance and quality of life which will directly benefit the 80% of EU citizens who now live in cities and large towns.

It will achieve this:

- by **concentrating** these resources on four specific areas (see below) where action is urgently required, and where there is untapped technological potential and strong demand for new solutions from cities themselves;
- by focusing primarily on the **integration** and co-ordination of outputs from other EU and national research programmes, thus avoiding duplication of effort;
- by selecting only projects likely to have significant regional and European impacts, managing and clustering them with a view to practical **implementation** and the

transferability of their results;

- by ensuring appropriate end-user involvement, and creating transnational **networks** with the capacity, opportunity and motivation to continue to exploit and disseminate results after the research phase is completed.

The four inter-related themes addressed by the key action are:

- improved, holistic urban planning and resource management;
- protection of cultural heritage as an integrated component of Europe's cities;
- socially, economically and environmentally sustainable construction and refurbishment;
- technologies and planning for more efficient urban transport systems.

A new vision of urban governance

The key action aims to draw on the best available research competence from across the EU in order to develop tools and procedures which facilitate the deployment of integrated solutions addressing all aspects of city life. As well as involving the major stakeholders from each participating city, all the projects involve cities from several Member States, either as full partners, or as test sites. They offer local

authorities, and citizens themselves, a more accessible entry-point to the research process than has ever been available before – indeed, increasing stakeholder participation in urban decision-making is among its primary objectives. New, participatory approaches to urban governance constitute a specific research theme, but the principle informs the entire key action.

cally reduce energy and water use, while improving the lifestyles of the tenants, at no additional long-term cost to the buildings' owners.

Traditionally, questions of land-use, transport, cultural heritage and social inclusion have been 'owned' by different stakeholders in local authorities, in industry and in the research world. But the implementation of a new sustainable transport form, for example, must be co-ordinated with land-use planning, and must integrate feedback from real users, if it is to fulfil its potential.

The purpose of the 'City' key action is the integration, demonstration and comparative assessment of results from different areas of research – many of which are individually supported by other parts of the Fifth Framework Programme. Projects address environmental, economic, social and cultural aspects. At the same time, each involves all the relevant stakeholders – not just researchers and industry, but also local project authorities and citizens.

Will the 'City' key action benefit EU citizens directly?

We only support projects if we are convinced that they will produce such benefits! The involvement of municipal authorities, and in many cases of citizens themselves, will do much to ensure that projects not only have an immediate impact during the funded demonstration phase, but that their results are rapidly and widely applied in other cities.

Not all local authorities want to undertake research work themselves, but we have made it easy and inexpensive for them to get involved as users. In this role, they can



The participation of municipal authorities and local inhabitants in new urban planning approaches from the research stage onwards is an essential condition for the success of the resulting solutions.

ensure that their real needs are understood, and that the results will be of practical use to them.

No two European cities are exactly alike, but they all share common problems. By working together they are mobilising the critical mass of expertise and resources necessary to identify and test solutions which can be applied throughout Europe. ■

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Citizens face the prospect of climate change

Would we be prepared to change our habits to counter the risks of climate change? Ulysses, a European project involving experts from the social and natural sciences, has been experimenting with a new kind of methodology for urban democratic participation.

Traditionally, science has been remarkably effective in individually controlling the mechanisms of nature,' explains Silvio Funtowicz, a researcher at ISIS (the EC Joint Research Centre's Institute for Systems, Informatics and Safety), and an active member of the Ulysses project.⁽¹⁾ Today it is being asked to manage the environment itself, that is to grapple with questions of a previously unknown complexity and scale and - if that were not enough - characterised by an inescapable uncertainty. 'We have entered the *post-normal* age of science, in which experts have to share the uncertainties of their knowledge with society, and to do this precisely on questions in which the socio-economic and cultural dimensions must be taken into account in decision-making strategies.'

Inventing participation

One example is the measures needed to counter the greenhouse effect. How is it possible to implement sustainable energy strategies with a profound effect on urban lifestyles without a public debate on the benefits and also the costs and uncertainties of such policies? The tools developed by the scientists to analyse global change exist. They are known as *Integrated Assess-*

ment Models (IAM) and incorporate the knowledge of climatologists, oceanographers, agronomists, etc., to make it possible to simulate the causal chains within the global processes of the ecosystem,' explains Carlo Jaeger, Ulysses coordinator at the University of Darmstadt. 'But while IAMs help decision-making, it is for society as a whole to choose.'

Participatory Integrated Assessments, during which these models are tested, were carried out among about 50 groups of public-sector managers, entrepreneurs and users in seven urban areas - Barcelona, Venice, Frankfurt, Manchester, Zurich, Athens and Stockholm.

Collage visions

Each group was placed under the guidance of a project facilitator armed with various computer models (most notably *Targets* and *Image*) specially developed by the National Institute for Public Health and the Environment (NL) to assess the effects of urban energy policy options on climate change and its consequences. In each city the exercise focused on concrete regional problems. In Venice, the prospect of rising sea levels was important, whereas elsewhere attention focused on air traffic and airport construction projects, or waste management.⁽²⁾

In Venice, the threat of rising sea levels was one of the major preoccupations discovered in the evaluation processes by researchers in the Ulysses project.

One of the Ulysses exercises was to 'measure the values' that urban players attach to the issue of climate change by expressing their vision of society in 30 years' time through collective collages using pictures from magazines. 'This produced a very pessimistic image of the future if society does not act,' observes Dr Jaeger. 'At the same time, the prospects for sustainable development are unclear, often seen as a return to the past, sometimes idealised, sometimes negative. This shows that this public debate is going to be more vital than ever in arriving at effective sustainable policies.'

(1) Urban Lifestyles, Sustainability and Integrated Environmental Assessment

(2) The results and educational aids are accessible at the richly documented Ulysses Internet site www.zit.tu-darmstadt.de/ulysses/

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The subtle equations of urban mobility

The sustainable development of urban transport is dependent on many variables, in terms of infrastructure, pricing policies and the allotment of land. That is why integrated planning tools are now being tested at a number of sites in northern and southern Europe, with a view to optimal mobility in the city of tomorrow.

Cars and cities make uncomfortable bedfellows. That much is clear from any urban area in Europe - or in the world for that matter. Regional and local authorities everywhere are facing clogged roads and the need to reduce their impact on the environment, at local and global level. 'Unfair competition from cars penalises other means of transport, whether collective or individual, such as the bicycle. This discrimination undermines the efficiency of the urban economy. It affects the quality of life of underprivileged sections of the population and thus contributes to social exclusion,' explains Tony May, an expert in transport engineering at Leeds University (UK).

A complex mechanism

Urban mobility is a complex mechanism. For almost ten years now, the team from the Leeds Transport Studies Institute has been analysing possible options and the relative use that can be made of them. Many and diverse variables are involved in transport systems: the frequency and price of public transport, charges for driving on certain urban roads, parking charges, improvements in infrastructure capacities, circulation plans, information for users, etc.

'Depending on the situation in each city, the authorities can also have different priorities - improvement in air quality, increased road safety, promotion of public transport,' continues Dr May. 'And when making choices, financial constraints and the public acceptability of policies must also be taken into account.'

Hence the numerous data collection exercises, simulations and research projects conducted over recent years in an attempt to develop *integrated transport strategies*. These are based on models which offer an optimal combination of measures to achieve

the costs directly linked to the transport systems,' notes Dr May. 'Integrated strategies must also incorporate another approach: town planning in metropolitan areas. The interaction of these two strands of urban policy, namely transport and land allotment - for housing, shops, offices, industry, leisure facilities - is a new field on which any sustainable approach must be based.'

Prospects⁽³⁾ is a new project coordinated by a team of researchers from Leeds and launched at the beginning of this year under the key action *The City of Tomorrow*. Its aim is to make up for this deficiency. On the basis of research carried out by six teams in six urban areas with a total population of 7.5 million - Edinburgh, Stockholm, Oslo, Vienna, Helsinki and Madrid - and tested with some 100 other cities, Prospects is preparing a set of tools to guide urban officials in assessing their needs and implementing strategies that are increasingly able to meet them.

- (1) Optimisation of policies for transport integration in metropolitan areas
- (2) Financial assistance for transport integration in metropolitan areas
- (3) Procedures for recommending optimal sustainable planning of European city transport systems.



The interaction between transport policy and land allotment for housing, shops, offices, industry, leisure facilities is of crucial importance in managing urban areas.

given objectives. Between 1995 and 1998, the Leeds team coordinated two European projects - Optima⁽¹⁾ and Fatima⁽²⁾ - which put these systems to the test in nine urban areas of very different size in the United Kingdom, Austria, Norway, Finland, and Italy. The objectives had been carefully defined with local transport officials. The results showed that the models made it possible to identify optimal strategies generating a 30% increase in the economic efficiency of the measures adopted previously.

Integrating transport and planning strategies

'But so far the economic optimisation of these models has only taken into account

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The big buildings set the example

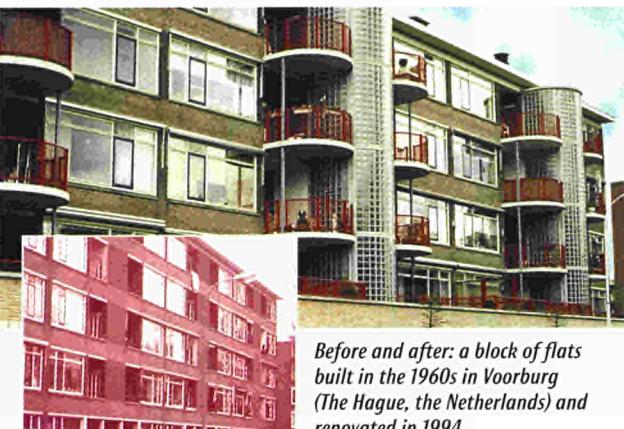
Fifty six million apartments, built after the Second World War, must be incorporated into new urban development strategies. Which is why energy- and water-saving measures, improved quality of life for residents, the management of household waste, and materials recycling are all being studied now by the building managers and researchers of the Sureuro project.

In Europe, nearly 170 million people live in huge apartment blocks on some 80 000 housing estates built in the immediate post-war decades of dramatic urban expansion. Designed in an age which demanded less in terms of the quality of life, these 56 million apartments are a construction feature of our towns and cities that must now be integrated into new strategies for sustainable urban development.

The views of the property managers

The public and private housing companies that manage this legacy are now faced with a growing need to undertake major and costly refurbishment. In particular, they are looking for competitive and integrated technological solutions which take account of environmental costs and the quality of life of the residents - their clients. It was to make their voices heard that this year seven representative European companies - managing some 212 000 apartments - teamed up with a number of research bodies and industrial construction firms to launch the Sureuro (*Sustainable refurbishment in Europe*) consortium under the key action *The City of Tomorrow*.

'The present situation is that for major investments of this kind the refurbishment techniques adopted by architects and the construction industry are dictated by the desire to reduce the duration of the works and initial outlay to a minimum,' explains Tomas Eriksson of the Swedish property management company Kalmarhem, the Sureuro coordinator. 'But if we also want



Before and after: a block of flats built in the 1960s in Voorburg (The Hague, the Netherlands) and renovated in 1994.

these works to incorporate constraints which respect environmental criteria and the comfort of residents, the technological solutions proposed remain too expensive and inappropriate for the large housing developments we manage.'

The aim is to develop innovative approaches in terms of energy savings, sustainable management and the quality of life of the residents of apartment buildings of this kind. 'Large blocks of flats have a major impact on environmental issues in an urban environment. There is the potential to cut their energy consumption - and thus polluting emissions - by as much as 40%. The same applies to water consumption, household waste management and materials recycling,' notes Karel Dekker of the *Building & Construction RTD Strategic Studies* department at the TNO research centre in the Netherlands, the science and technology coordinator with Sureuro. 'The long-term impact on maintenance costs for both the management companies and tenants can be considerable. As regards the architectural design of the apartments, a flexible use of space, air-conditioning, soundproofing, luminosity and the quality of the com-

mon areas and environment can all substantially improve the standard of comfort of this kind of housing.'

A European knowledge base

All the new concepts will be developed in close cooperation with the property management companies which initiated the project and which will, in turn, involve residents' associations and the local authorities responsible for low-cost housing and the urban environment. The solutions proposed are currently being put to the practical test as part of a refurbishment project involving some 13 000 apartments. On the basis of these tests, which will serve both to demonstrate and to validate solutions, technically and economically, Sureuro will propose a set of refurbishment models and tools collected in a computerised database.

'Such an information system - which is so sadly lacking at present - should permit a sustainable and economically viable approach to the refurbishment of clustered urban housing in Europe,' believes Mr Eriksson. 'It also will be of particular interest to the Central and Eastern European countries currently lining up for EU membership which have a major need to modernise their housing stock.'

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Caring for architectural heritage

Across Europe, from North to South, examples of brick architecture bear witness to the civilisations that have flourished on the continent at various times in the past. Unfortunately, ill-conceived restoration projects designed to protect this historic material have often had the opposite effect. A number of research projects are now studying deterioration of this kind and proposing lasting solutions which respect the building materials used.

The damage incurred is comparable from the Nordic countries to the Mediterranean. But we are particularly interested in certain cases of damage which we find repeated throughout history,' explains Rob van Hees of the TNO Bouw (Nederlandse Organisatie voor Toegepast Onderzoek/Dutch Organisation for Applied Research), coordinator of two European research projects - and active partner in another - who is studying the deterioration of brick architecture.

Expert system and Damage Atlas

The research conducted in this field has produced a very concrete result in the form of the Masonry Damage Diagnostic System (MDDS),⁽¹⁾ an expert system developed by the TNO under the management of Koen van Balen of Leuven University (B), in cooperation with Dutch, German and Italian teams. The MDDS makes it possible to assess the damage and its causes, provides information on the investigations to be carried out, and proposes non-destructive testing techniques for a precise diagnosis. It is used by KULeuven and the Milan Polytechnic University to train experts and, in Belgium and the Netherlands, in workshops organised for heritage managers and experts. 'The reactions have been very positive. We are now organising system user groups and would like them to be available via the Internet or Intranet.'

The Damage Atlas⁽²⁾ is a second tool which is also available to the experts now. This attractively illustrated work presents various well-defined cases of damage drawn from across Europe. The first work of its kind, it is particularly useful in providing the players with a common terminology.

Treatments and mortars

Another research project has studied the conservation treatments applied to historic buildings.⁽³⁾ 'Most of them are hydrofugal surface treatments which can prove very effective in the long term. But great care must be taken when using them. It is vital to make sure there are no contra-indica-

recent restoration works, notably on two of Amsterdam's historic bridges, the methodology (based on the MDSS 'philosophy') and technical investigations (mortar analysis) has been used with success.

'These three perfectly complementary projects have a number of common points,' concludes Rob van Hees. 'They all require an interdisciplinary approach involving scientists specialised in the physics of buildings, chemistry, geology and the history of art, as well as engineers, architects and SMEs. They all met with a positive response in the field as a result of particularly concerned groups of players - industrialists, restorers, public authorities, etc.' ■



A bridge in Amsterdam, restored using data gathered by the Masonry Damage Diagnostic expert system and technical investigations, especially of the mortar.

tions - such as the presence of salts or humidity. If not, examples of our cultural heritage which have remained in good condition for centuries can be damaged as a result.'

A subsequent project⁽⁴⁾ looked at mortar and more specifically the compatibility of present-day mortars and ancient materials. Fundamental research has made it possible to analyse the interaction between bricks and mortar. Case studies have shown examples of the incompatibility of modern mortars which have been partly responsible for cases of deterioration. By contrast, in more

(1) Expert system for the evaluation of the deterioration of ancient brick structures

(2) *Damage Atlas, Classification and Analyses of Damage Patterns found in Brick Masonry*, Fraunhofer IRB Verlag, published with the support of the European Commission (Protection and Conservation of European Cultural Heritage - Research Report n°8, vol.2)

(3) Evaluation of the performance of surface treatments for the conservation of historic brick masonry (Protection and Conservation of European Cultural Heritage - Research Report n°7)

(4) Maintenance of pointing in historic buildings: decay and replacement

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The Geopolitics of Science

Scientific and technical cooperation is a strategic card in Europe's relations with the developing continents - Asia, Latin America, Africa. Examples include the fight against Aids, urban health, agriculture, forestry and fisheries.

The developing continents account for four-fifths of humanity, a humanity which shares the challenges of global change, preservation of biodiversity and natural resources, health, demographics, trade, and the dissemination of knowledge. Such issues, which call for a fundamental scientific and technical effort, particularly need these countries to build up their own endogenous capacity to respond. This is also a key condition for the 'governance' of the current globalisation process, which is seriously threatened by

the ghost of an ever more pronounced social and technological split.

For over a decade, this science and technology priority in development strategy has been extensively reflected within the Framework Programmes in the implementation of hundreds of programmes which concentrate the efforts of thousands of researchers in the EU, Asia, Latin America and Africa on common objectives. This cooperation, based on scientific partnership, represents an attempt to tackle regional issues. It has made it possible to

set up networks to help many scientific communities in these countries to break out of their current isolation and, going beyond simple North-South links, they also contribute to the establishment of many South-South combined efforts.

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The sickness of the city

Three billion human beings live in increasingly sprawling and over-populated cities. The deterioration in the urban environment and the dramatic impoverishment of large sections of the population have assumed such a scale that they are one of the major causes of the worsening health of inhabitants, in the face of which health and care systems are failing. 'It is certainly necessary to adapt medical infrastructures in the light of new public health crises, especially in a public sector that is being increasingly neglected in favour of a privatisation of care. But prevention or care in a purely medical context is no longer enough,' explains Anna Karaoglu, who is responsible for research actions in the field of urban health within the INCO Development programme. 'If we do not act on all the political, economic and social processes involved in urban policy, this serious health problem, which primarily affects the poor, will go from bad to worse. The alarm bells are already ringing. What is



In Africa, Asia and Latin America, it is often public health problems that show up the need for action in education, the environment or social justice.

more, it is not just major metropolitan areas that are being affected, but increasingly smaller urban areas too.'

Four research networks operating on three developing continents are at present developing an interdisciplinary approach to problems of urbanisation in relation to health policies. Through actions in the field (in China, Brazil, Chile, Central America and sub-Saharan Africa), researchers are showing how public health concerns can and must become a primary driver for strategic options on the environment,

mobility, education, the development of infrastructures and social justice. 'This research is highlighting the essential need to actively involve local populations in identifying the most critical health needs and the measures able to meet them,' stresses Anna Karaoglu. 'No policy decided at the top can work.'

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Women against Aids

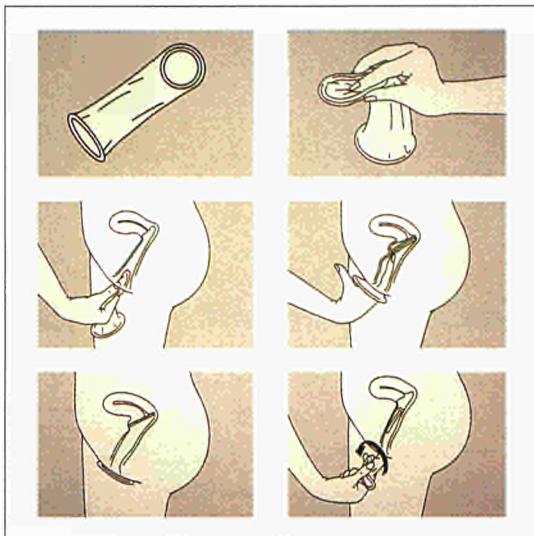
In Africa, where heterosexual transmission of the Aids virus is particularly virulent, women could play a major role in combating its ravages. New preventive microbicides, for women are currently being tested by researchers from Europe, Uganda and the Ivory Coast.

With an average contamination rate of between 10% and 15% of the adult population, Aids has become a full-blown public health catastrophe for the entire African continent. Sadly lacking in the resources for the costly treatment needed to stem the increasing mortality, prevention policies are the only weapons accessible to these countries. But the only one proposed to date - the use of the male contraceptive (condom) - still encounters opposition due to unchanged behavioural patterns. Hence the urgent need to look for alternative means of sexual protection over which women will have control. A particularly tragic aspect of the problem is that it is women, the passive victims of the epidemic, who transmit the HIV virus to the children they bear.

Four teams of European and African researchers are currently working - with European Union support - on two new microbicides with a potentially preventive action, Dextrane Sulphate (DS) and PRO2000. 'It seems that these two products are without side-effects, even at high doses,' explains Michel Pletschette, who is managing the project at the Research Directorate-General. 'This cannot be said of nonxyl-9 which has already been tested - without convincing results - in the form of a film and gel. The substances we are trying to develop appear to be safer and more effective.'

'Double-blind' tests

A toxicity study on these two products has been carried out in Europe. 'We are currently preparing for the second phase, to be carried out in Africa using the double-blind



The female contraceptive - or diaphragm - provides the most reliable protection against Aids and sexually transmitted diseases.

method,' explains Dr Charles Lacey of the Medical Research Council (London). 'Some women will be given the active product and others a placebo. Of course, none of the women, nor the doctors, will know whether or not they have the biocide. In Uganda, the tests are being carried out on healthy women, and in the Ivory Coast on prostitutes. Three hundred women should participate over a period of from four to six weeks.'

For these tests to be successful, the participants must be fully informed of the health issues at stake and the role they have to play. 'We are particularly anxious that the women do not stop using the products before completion of the trial,' stresses Dr Lut Van Damme of the Institute of Tropical Medicine, Antwerp. 'African populations are very mobile and this poses a major problem for long-term tests. That is why thorough preparation with the local teams is so important.'

Discreet protection

The researchers are drawing, in particular, on the findings of two sociological surveys,⁽¹⁾ carried out in Uganda, on the acceptability of protection methods - other than the male contraceptive - against the Aids virus and sexually transmitted diseases. A microbicide proposed in various forms (gel, emulsion, film, sponge) and the female contraceptive were tested by a group of Africans. They showed a clear preference for the microbicide in the form of a sponge. This can be introduced before sexual relations and left in place for a long time afterwards, the partner remaining unaware of its presence. The female contraceptive, reliable but not very discreet, comes second.

Although this option received less support due to its visibility, it offers a level of protection against the Aids virus and sexually transmitted diseases which is at present unequalled by any other method. ■

(1) G.J. Hart, Women's attitudes to condoms and female-controlled means of protection against HIV and STDs in south-western Uganda, *Aids Care*, 11, 6, 687, 1999; R. Pool, An acceptability study of female-controlled methods of protection against HIV and STDs in south-western Uganda, *International Journal of STDs & AIDS* (to be published).

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Improving maize to aid the South

Maize is a vital crop in Latin America and Africa. Unfortunately, the acid soils in these regions result in poor harvests. A number of research projects involving laboratories in the European Union and developing countries are now working on selecting plant strains to overcome this handicap.

Demographic growth coupled with changing diets is set to double demand for maize – one of the three most important crops in the developing countries – by 2020, resulting in a predicted shortfall of 60 billion tonnes. There are only two ways of avoiding this. One is to increase the cultivable areas, which is often not possible, while the other is to increase yields on the land farmed.

Acid soils, short roots

Agricultural production in South America and sub-Saharan Africa is adversely affected by acid soils with a high aluminium content. In the early 1990s, an initial North-South partnership project,⁽¹⁾ supported by the European Union, sought to achieve a better understanding of the physiological and biochemical mechanisms at work in the way in which maize adapts to acid soils. The researchers then went on to develop techniques for the rapid selection of the best strains, based on reliable molecular tests.

European, Brazilian, Cameroonian and Guadeloupean researchers were all involved in the research. This cooperation meant that scientists in the developing countries were able to work in European laboratories while their partners in the North were able to travel to these tropical regions to study the problems linked to maize production, and to conduct agricultural research.

'We established a clear correlation between the length of the roots and exposure to aluminium. The higher the aluminium content, the shorter the roots. This atrophy

is also closely associated with horny formations at the root tips,' explains Walter Horst, a professor at Hannover University and the project's coordinator.

The researchers developed a number of tests for selecting those strains that are best suited to acid soils, either by quantifying the root-growth inhibition on contact with aluminium or by quantifying the horny formations. A third, more direct, method involved measuring the accumulated aluminium content in the roots.

Genetics to solve the complexity

The studies carried out on 37 different strains from the various research stations in the field also revealed other complications. 'Soil acidity is a complex factor,' continues Professor Horst. 'In some cases the aluminium toxicity is combined with magnesium toxicity, and also with a phosphate, calcium or magnesium deficiency.'

In the meantime, another team of Spanish, German, Brazilian and Mexican researchers had been carrying out a genetic study of the resistance of maize to aluminium⁽²⁾ in the hope of possibly developing genetically modified strains. The researchers managed to isolate a gene and several



Cameroon - controlling maize growth in acid soils.

promoters active in this process. By over-expressing a part of the plant's genome, they showed that it was possible to increase its resistance to aluminium. They also discovered that the mechanisms involved played a positive role in the maize plant's ability to absorb phosphate. They had effectively killed two birds with one stone.

A new project coordinated by Professor Horst,⁽³⁾ built further on this research work by carrying out crossing programmes drawing on knowledge previously acquired in the physiological and molecular fields. 'It is a question of using existing international know-how to arrive at genuine agronomic improvements that can be made available to producers in these tropical countries.' ■

(1) Adaptation of maize to the acid soils of the tropics

(2) Genetic analysis and engineering of aluminium tolerance in maize and in model plants

(3) Maize for sustainable cropping systems on tropical acid soils - from molecular biology to field cultivation

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Sustainable replanting of tropical forests

To restore the forests of Southeast Asia's archipelagos, with their valuable tropical oils, Malaysian and Filipino researchers are developing advanced forest-care techniques in partnership with French, British and Finnish teams.

In Malaysia and the Philippines, Dipterocarpaceae – a family of tall trees comprising about 20 different varieties, traditionally highly valued for the quality of their wood and their aromatic resins. 'But there was a tragic lack of knowledge and techniques for sustainable management of these species, leading to irreversible over-exploitation,' explains Frédéric Lapeyrie, a microbiologist at the Institut National de la Recherche Agronomique (France), who was actively involved in the two scientific projects launched in the 1990s to meet this challenge, in which European researchers cooperated with teams from Southeast Asia. 'The only trees planted locally on a systematic basis in an attempt to restore the forest resources were exotic species introduced at the time of colonisation, mainly pines, eucalyptuses and acacias. Virtually nothing was known about the biology of these Dipterocarpaceae.'

It was an ambitious undertaking. Not only do certain Dipterocarpaceae only produce seeds every seven years, but their seeds sometimes germinate before reaching the ground, and the young plants have a high mortality. Therefore ways had to be developed of conserving and storing these seeds, as well as methods of propagation and cultivation to establish new trees and ensure their growth.

In the shade of the acacias

An initial project⁽¹⁾ completed in 1994 was devoted to these silvicultural techniques. At the same time, propagation methods were developed. A second project⁽²⁾ coordinated

by Dr Lapeyrie, which is still in progress, is exploring an additional aspect. Scientists have observed that Dipterocarpaceae grow more easily if they are planted beneath *Acacia mangium*. Is it simply a question of protection, the latter providing beneficial shade for the fragile young plants? Or is a more subtle process at work whereby the acacias provide them with nutritional elements by means of the filamentous fungi (*mycorrhizae*) which live in symbiosis with its roots and supply it with mineral salts?

The researchers are also isolating the various species of fungi associated with these trees and assessing their effectiveness in the development of the plants. They are improving the mass production techniques for inoculum and the techniques for inoculating the cuttings of the most interesting varieties. 'The mycorrhizal fungi introduced should be particularly beneficial in poor or very damaged soils in promoting the growth of Dipterocarpaceae,' explains Su-See Lee, a researcher at the Forest Research Institute of Malaysia (FRIM) and a partner on the project. 'In this way we could exploit toxic areas such as the former tin mines in Malaysia or the grassy steppes of the Philippines which are unsuitable for pasture.'

- (1) Dipterocarp domestication: factors controlling the establishment of valuable trees and reconstitution of the dipterocarp forest
- (2) Harnessing mycorrhizal symbiosis in mixed Dipterocarpaceae-*Acacia mangium* forest plantations in Malaysia and the Philippines



Typical ectomycorrhizae formed by *Pisolithus tinctorius* on dipterocarp roots in nursery conditions.

The virtues of mycorrhizae

'We are certain of one point,' continues Dr Lapeyrie. 'The Dipterocarpaceae roots sustain mycorrhizal fungi that can link them, through a network of filaments which colonise the soil, to the acacia roots. It remains to be established – something never before done for tropical species – if there is an actual transfer of nutritional elements from the one to the other.'

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Keeping fisheries and marine species afloat

African, South American and Caribbean experts are working together on an extensive European endeavour to promote the Ecopath model: a key tool for understanding the interactions between species and the responsible management of marine ecosystems.

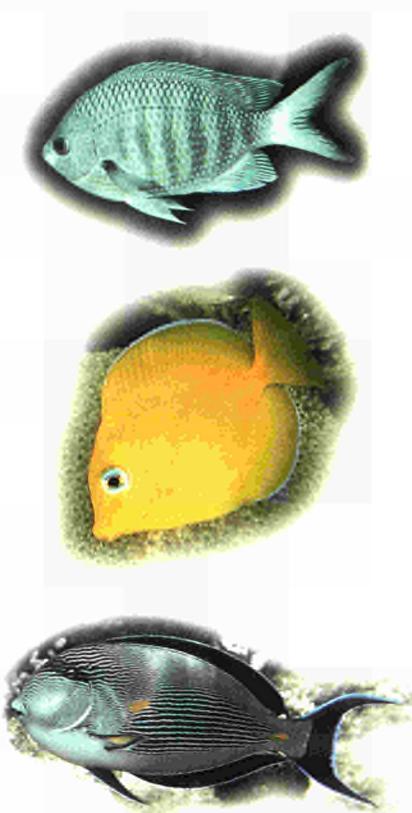
There's no getting away from the reality. All indicators, such as the significant decline in numbers of some of the most sought-after species, and the reduced age and size of the fish, show that fish resources are clearly declining at the global level,' stresses Cornelia Nauen, a scientist working at the Research Directorate-General who is responsible for cooperation with developing countries in the area of aquatic resources. 'Many scientists are now sounding the alarm and campaigning for a global, integrated management of marine ecosystems, which takes account of the need to maintain or restore the balance between species.'

As a result, an initiative spanning several continents,⁽¹⁾ which started in the early 1990s, made it possible to develop the Ecopath approach. The Ecopath family of analysis tools enables the diagnosis and management of marine ecosystems and is considered to be a particularly flexible standard useable for most fisheries in the world.

Disseminating tailor-made tools

From 1997 to 2000, a concerted action coordinated by the Danish North Sea Centre - involving five European oceanographic research bodies and more than 25 oceanography and fishery partners specialised in the management of tropical waters in the Atlantic, on the Pacific Coast of Latin America and in the Caribbean - concentrated specifically on ensuring the widest possible dissemination of the *Ecopath*⁽²⁾ modelling tools.

'The first step,' explains Dr Nauen, 'was to organise workshops in the various regions to harmonise the methodology. Each partner then constructed their own model



Some of the sea fish species included in FishBase currently being set up as a basis for the Ecopath methodology.

adapted to locally available data. Finally, the teams compared results in order to identify common factors and draw up a more general approach equally valid for tropical and temperate seas.'

Discarding received ideas

The dissemination of Ecopath has brought a radical reappraisal of traditional fishery policies, discarding a number of previously accepted ideas and practices. One example is the idea that by eliminating predators it is possible to catch more of the fish on which they used to prey. The ecosystemic

modelling shows, on the contrary, that imbalances in the interactions between species distort flows within the marine food web and, exacerbated by habitat degradation, seriously affect marine productivity.

Management models show the need to create protected areas within which ecological balance can be restored. But this will require a further research effort, in particular to understand the most effective sites and size. Among other things, this can lead to the creation of 'eco-labels' for fishery products obtained by respecting these biodiversity criteria.

'Huge progress has already been made,' concludes Dr Nauen. 'Ten years ago we started an international collaboration towards a database on all fishes. With EU support, FishBase has now completed information on 25 000 fish species as a basis for the Ecopath methodology. Continued expansion of this open-access database also helps promote the spirit of cooperation, and enables researchers and managers worldwide to adopt new strategies.'

(1) Involving the International Centre for Living Aquatic Resources Management (Philippines), the North Sea Centre (Denmark), the Fisheries Centre (Canada) and others.

(2) Placing fishery resources in their ecosystem context: cooperation, comparisons and human context

No e-economy without e-confidence

To win the confidence of companies and consumers in Internet trading, technology must not only create solid safeguards but also develop new guarantees of protection and recourse in the event of computer crime.

The year 2000 may have started well on the computing front, but the situation has deteriorated rapidly since. In February some of the US's major electronic commerce sites - Amazon.com, eBay, Yahoo, Buy.com and E*Trade - were brought down by denial-of-service attacks. A month later doubts were raised about the security system for smart cards when algorithms to break access codes were published on the Internet. Then, in May, *I love you* and other viruses, propagated via internauts' address books, caused global damage estimated to run into billions of euros. These spectacular onslaughts with their extensive media coverage dealt a severe blow to user confidence in the new economy.

Towards the E-economy

'The protection and guarantees offered to consumers and companies are vital to the whole development of electronic commerce,' explains Marc Wilikens of the Institute for Systems, Informatics and Safety (ISIS) at the European Commission's Joint Research Centre. 'As part of the e-Europe action plan launched by President Prodi, the ISIS provides scientific and technical support to back up the European Union's legislative work in fields such as the resolution of disputes, protection of personal data, combating cybercrime and the authentication of electronic documents. One of the main research themes concerns technical concepts and regulations for on-line systems for complaint management and dis-

pute resolution.⁽¹⁾ It must be possible to use these new tools at a pan-European - if not global - level in the event of international disputes between suppliers of goods and services, and consumers.'

An on-line forum is being set up to compile a body of knowledge on the subject and provide a foretaste of a possible future system. 'It is a question of providing the on-line technologies to allow the consumer to define his problem and obtain access to a mediator so that a solution can be found without having to go to the courts,' explains Mr Wilikens. 'To be effective such a system must be impartial, independent, accessible, secure and inexpensive - or free of charge - for complainants.'

Personal data at risk

Another worrying problem is the processing of personal data provided on-line. Many services available on the Internet handle sensitive or confidential data such as credit card numbers or the health details required when negotiating insurance contracts. 'Some technologies make it possible to draw up profiles of people who surf the net, collate these data and then sell them for profit to a third party, such as marketing companies. Some firms have made this a speciality, contrary to the directive on the protection of personal data,' continues Mr Wilikens. In this field too, the JRC is engaged in a research project which is trying to find technological answers to this specific problem to back up the regulatory solutions.

Similarly, the Trust CSP European project is trying to identify the minimum essential needs of approved service providers (CSP - Certificate Service Providers) which authenticate electronic signatures and certify documents exchanged by internauts. The method used consists of compiling CSP evaluation criteria to obtain certificates recognised in all the Member States.

Finally, the JRC has started to assemble the necessary equipment to create an open library of information on Internet abuse,⁽²⁾ as a means of taking the actual measure of cybercrime. 'We do not really know the real scale of the problem,' stresses Mr Wilikens, 'especially as - for reasons of credibility - companies are very reluctant to provide details of cases of fraud and abuse.' ■

(1) ADR - Alternative Dispute Resolution. dsa-isis.jrc.it/ADR/

(2) OSILIA (Open-Source Intelligence Library on Internet Abuse).

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GSM: it's best to be informed

Is there reason to fear the effect of mobile phones on the brain? Although scientists have no proof that mobiles are harmful, neither are they prepared to commit themselves to their absolute long-term safety. In an attempt to remove the doubts, this year saw the launch of the first large-scale international epidemiological study.

The GSM phone - an intense source of high-frequency magnetic fields held very close to the brain - has caught the experts on the hop. While studies to investigate the various alarmist theories - reduced fertility, brain tumours, memory loss, behavioural changes, or damaging effects on a child's development - are now being launched, there is as yet insufficient scientific basis for confirming or disproving them.

Presumptions = precautions

Last May, British experts recommended that 'a precautionary approach to the use of mobile phone technologies be adopted until much more detailed and scientifically robust information on any health effects becomes available' and to limit their use by children and when driving a car.⁽¹⁾ The report is based on the existence of 'a number of scientific presumptions regarding the possible effects of radio-frequency radiation on biological functions, especially for the brain'.

It is to identify such effects in one of the most worrying areas - the risk of brain tumours - that the Interphone project has been launched. As the most ambitious European and international epidemiological study ever carried out in this field, it has been allocated €4 million from the *Quality of Life* programme. The study is being coordinated by Elisabeth Cardis, Chief of the Radiation and Cancer Unit at the International Agency for Research on Cancer (IARC), a specialised WHO agency located in Lyon. It is being conducted in nine European countries: Great Britain, France, Italy, Germany, Austria, Sweden, Norway, Denmark

and Finland,⁽²⁾ as well as Australia, Israel, and Japan - and will probably be extended to include the United States too.

Sample: 17 000 people

'We will analyse the risk to organs which could be thought to be the most exposed,' explains Dr Cardis. 'Researchers will look at the past record of mobile phone use among

tumours (a salivary gland in the cheek) and 1 000 tumours of the acoustic nerve (running from the ear to the brain). Including members of the control group, the total survey population will be 17 000. It will be possible to establish the importance over time of exposure to close magnetic fields, specifically those emitted by the radio frequencies of mobile phones, and to study possible correlations with the occurrence - or not - of cancers.

The total process of collecting the information, carrying out the interviews and analysing the data will take about two and a half years. The initial results should be available at the end of 2003 or the beginning of 2004. ■



The precautionary principle, while the scientists find out more: restricting the use of mobile phones in cars and by children.

all patients showing new cases of tumours in the participating hospitals, and compare these cases to a control group. The latter will be selected to maximise the similarities - age, sex, place of residence - with the tumour cases analysed. To launch such an evaluation, we needed sufficient observations spanning an adequate length of time. These cancers can take years to develop. We therefore had to be sure that the use of mobile phones in the regions in question was sufficiently significant five or ten years ago for a study launched now to be of any use.'

Scientists will analyse around 6 000 cases of brain tumours, 600 parotid gland

(1) IEGMP Report on Mobile Phones and Health, better known as the Stewart Report. It can be consulted on the Internet at www.iegmp.org.uk

(2) The European Interphone partners (International case control studies of cancer in relation to mobile telephone use), coordinated by the IARC, are Leeds University, the London School of Hygiene and Tropical Medicine, the Danish Cancer Society (Copenhagen), the Radiation and Nuclear Safety Authority (Helsinki), l'Istituto Sperimentale di Sanità (Rome), l'Université Claude Bernard (Lyon), the Karolinska Institute (Stockholm), the Johannes-Gutenberg-Universität (Mainz) and the Norwegian Radio Protection Authority (Osteras).

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