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MAD COW DISEASE, A SOURCE OF WISDOM?



CLIMATE

Carbon sinks to combat
the greenhouse effect?



MEDICINE

Elusive
allergies

CEE: XII/51

Editorial

Transformation

It is no coincidence: just as the Commission is proposing a new approach for the framework programme for the period 2002-2006, RTD info is also changing, to improve its treatment of the challenges European research is now facing.

The proposal for the Commission's new framework programme (see opposite), currently before the Council and Parliament, features a number of innovations. First, it is an explicit part of the European Research Area, of which it becomes, in a sense, the financing arm. This approach is shown by the programme's actions, which are aimed, for example, at developing networks of excellence, increasing the mobility of scientists, making Europe more attractive to researchers, and strengthening the links between Community research efforts and national policies. This major transformation is largely the result of the strong support expressed by the various players, starting with the politicians. The concept of the European Research Area is now firmly on the agenda of the heads of state and government, having been discussed at two European Councils, first in Lisbon, last year, and then in Stockholm on 23 and 24 March. Although this political prominence is partly due to the need to stimulate research further, thus enabling the Union to join the knowledge-based society successfully, it is also the result of changed attitudes.

A second characteristic of the proposed framework programme is the concentration of research. Seven priority fields have been adopted on account of the high added value which European research can bring them. The final innovation is in the way the programme works, with the proposal for new instruments and greater operating autonomy.

To reflect these deep-seated changes, RTD info is also changing - in form and substance: a new presentation, which we hope will be clearer and more agreeable, and a new editorial line, which is more open to research in Europe.

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FEATURE BSE

Apart from triggering a health scare, the BSE crisis has also proved a revelation. Highlighting the tensions of the increasingly complex relations between science and society.

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A new look for European research

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MAY 09 2001



Philippe Busquin, Commissioner responsible for research

The Commission's proposals for the 2002-2006 framework programme embody an innovative approach which gives substance to the European Research Area, following the positive reactions to the concept in political, scientific and industrial circles.

ON 21 FEBRUARY, the Commission adopted proposals to be submitted to the European Parliament and Council for the next framework programme for research and innovation. In contrast to that of its predecessors, the context in which the European Union must today implement its traditional research activities is fundamentally new and innovative - that of the European Research Area (ERA), of which the framework programme is becoming the financing arm.

This initiative, instigated by Philippe Busquin, Commissioner responsible for research, aims to provide the Union with a genuinely common strategy - comparable to that of the single market and currency - designed to strengthen Europe's scientific and technological dynamism on an increasingly global stage. The concept of the ERA was extremely well received by Europe's politicians who have given the Commission a very clear mandate to implement it. The projected global budget (including Euratom activities) is €17.5 billion, a 17% increase on the previous framework programme. The framework programme consists of three main areas of action which reflect the main thrusts of the ERA.

1. Integrating research

The framework programmes to date have been instruments for stimulating and supporting collaboration between European researchers. Without actually disappearing, this mission must now be adapted to deliver the new strategy of the ERA by incorporating actions that will catalyse the integration of European

research. In specific terms, this means two key changes in the programme concept:

- ▶ concentration on a limited number of priority fields of research to which activities at the Union level can add real value (see table);
- ▶ strengthening of links between the Community research effort and national and regional research policies.

In the priority areas, the new framework programme will work mainly by supporting the development of cooperation within **networks of centres of excellence**. These networks will bring together the best research capabilities in Europe's regions to conduct common research programmes, enabling the emergence of 'virtual platforms of excellence' on a European scale.

Substantial resources might also be allocated to support **integrated projects** involving public and private partners, with clearly stated scientific and technological objectives and with a view to generating new knowledge and/or applications in the priority fields.

In this respect - and as authorised by the European Treaties - the new framework programme will innovate by using its powers of intervention to encourage **active participation in research programmes jointly implemented by a limited number of Member States**.

A substantial effort for SMEs

The participation of SMEs in the framework programme is a key aspect of Union policy. Under the Fifth Framework Programme they were allocated 10% of the key actions budget. The new framework programme plans to allocate them 15% of the funds available through the various thematic fields of the *Integration of European Research* programme, making a total of €1.9 billion.

...

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Budgetary proposal for the new framework programme 2002-2006

	In millions of euros
INTEGRATING RESEARCH	12 770
Genomics and biotechnology for health	2 000
Information society technologies	3 600
Nanotechnologies, intelligent materials, new production processes	1 300
Aeronautics and space	1 000
Food safety and health risks	600
Sustainable development and global change	1 700
Citizens and governance in the European knowledge-based society	225
Anticipating the EU's scientific and technological needs	2 345
STRUCTURING THE EUROPEAN RESEARCH AREA	3 050
Research and innovation	300
Human resources	1 800
Research infrastructures	900
Science/society	50
STRENGTHENING THE FOUNDATIONS OF THE EUROPEAN RESEARCH AREA	450
Support for the coordination of activities	400
Support for the coherent development of policies	50
TOTAL (excl. Euratom Treaty)	16 270
Funds allocated to research under of the Euratom Treaty ⁽¹⁾	1 230
Total budget of the new framework programme	17 500

(1) Treatment and storage of nuclear waste: €150m;
 Controlled thermonuclear fusion: €700m [including €200m for ITER];
 Other activities: €50m;
 Activities of the JRC: €330m [including €110m for treatment and storage of waste].

A research area open to the world

Within the thematic fields of the *Integrating Research* block of activities, the new framework programme plans to set aside €600 million for activities to encourage international scientific and technological cooperation.

2. Structuring the European Research Area

The ERA aims to correct structural weaknesses or deficiencies which could be described as 'transverse'. The most notable of these, already widely covered by previous programmes, concern:

- ▶ the strengthening of **bridges between research and innovation**;
- ▶ the renewal of the **human potential** for research and **mobility of researchers**. There must be an active policy to make the ERA a more attractive area for scientific and technological research, not just to stop the traditional deficit caused by the 'brain drain', but also so that it attracts the best foreign researchers.

However, there are two specifically innovative aspects of the programme which are destined to play a particularly important role.

- ▶ **Support for the development of research infrastructures**. Until now the Union has mainly tried to attract European researchers to the existing infrastructures of the Member States. In addition to this support for the mobility of researchers, the new

framework programme initiates a policy for the coherent development of infrastructures, in the form of integrated actions facilitating their networking and ability to deliver scientific services at a European level.

- ▶ **The attention given to questions of 'science and society'**. To achieve the necessary deepening of the Union's democratic foundations, better relations between 'science' and 'governance' and an improvement in the scientific and technological culture of the average European are seen as priorities by policy-makers, researchers and the general public.

3. Strengthening the foundations of the European Research Area

The new framework programme will also aim to strengthen one of its fundamental missions, which is to meet scientific and technological needs which arise in the implementation of Union policies in all fields where Community responsibilities are constantly growing - such as agriculture, fisheries, health and consumer protection, the environment, transport and the information society. The tasks assigned to the Joint Research Centre will come under this key programme activity.

Another important aspect is support in improving the coordination and coherence of research activities, at national and European level. This search for better coordination, which embodies the very spirit of the ERA, will aim to create opportunities for the mutual opening up of national programmes and cooperation between existing European scientific and technological frameworks.

A third element of this action plan, the flexibility of which will be guaranteed by annual budget management, is increased anticipation of the scientific and technological needs of European policies and the often rapid responses these require.

Apart from triggering a health scare, the BSE crisis also proved a revelation, by highlighting the tensions in the increasingly complex relations between science and society.

Mad cow disease, a source of wisdom?

DECEMBER 2000.

In announcing a ban on giving live-stock any kind of animal-derived feed and resolving to screen or slaughter millions of cattle aged over 30 months, the European ministers showed that drastic action was needed.

An exceptional crisis calls for an exceptional response. More than purely a precautionary measure, some also saw in this an action specifically designed to reassure and to calm - without being overly concerned with the scientific or economic bases for such a decision.

So was the measure 'mad' (on account of its enormous cost and exceedingly difficult implementation) or rather a 'wise' move to defuse a crisis which threatened to spin out of control? The question remains open and it is only the experience of the coming months which will provide the answer. But at least the ban has made it possible to take a close look at how things stand. Perhaps it is allowing time to ask the real underlying question posed by the 'shambles' of the past: how to renew a dialogue of trust between scientists, policy-makers, those with economic interests and the general public? (See also *So who are these experts exactly*, p.10).

However, we are not starting from scratch. After 1996, when the BSE issue first burst on to the European scene, a remarkable research effort quickly got under way. It is a long-term mission which is far from complete. Although science is beginning to unravel the 'tangle', it must also come down from the

pedestal on which our age has too often sought to place it. The fact is that science does not have all the answers. Furthermore, this crisis which so torments Europe has highlighted three specific needs: to reform the ambiguous relationship between scientific expertise and policy-making; to learn together the precautionary principle and how to manage risk; and to communicate with the public, bringing democracy back into the decisions made for society, decisions increasingly influenced by science and technology. It is issues such as these that underlie the discussion instigated by Commissioner Philippe Busquin on the relationships between science and governance in the context of a nascent European Research Area.⁽¹⁾

(1) see RTD info n° 28 p.18

Investigating the past to unlock the present

Whether it is advancing or 'blocked', science has problems when it comes to communication. An initial step, too often neglected, is to refer back to the past and retrace the complex meanderings of scientific thought, with all its doubts, oversights and uncertainties.



In 1997, the neurologist Stanley Prusiner was awarded the Nobel Prize for Medicine for having, with remarkable foresight, developed in 1982 the idea that the infectious agents causing degenerative disease of the brain could be abnormal proteins, which he called 'prions'. A decade later, his discovery is at the centre of all research on the animal and human forms of 'mad cow' disease.

See

The Prion Diseases by Stanley Prusiner
www.nmia.com/~mdibble/prion.html

IT WAS IN 1732 that zoologists first described scrapie, which was none other than the very first example of a transmissible spongiform encephalopathy. Apart from the infected sheep, there were no fatalities, and this common disease was accepted as just one of the hazards of sheep farming, one that man learned to live with without asking too many questions.

It was 150 years later, in 1920-21, that a new disease was discovered, affecting humans this time, and known as Creutzfeld-Jakob disease or CJD. This abnormal, fatal illness was extremely rare - 0.4 cases per million inhabitants - and affected elderly people. Its appearance seemed to be mostly sporadic (85% of cases) but it was also sometimes found to be hereditary.

For many decades science showed at best a moderate interest in these neuro-degenerative diseases, which were rare, difficult to characterise and mysterious in their mechanisms. Only the inquisitive few were intrigued enough by phenomena which reduced the brain - whether human or animal - to a sponge-like mass, to study them.

From the kuru syndrome...

In the 1950s, an American, D. Carleton Gajdusek, and an Australian, Vincent Zigas, drew attention to what was known as kuru. This was a new form of fatal encephalopathy of the CJD variety, found in certain tribes of Papua New Guinea who ate human brains during funeral rites. This pioneering discovery on the transmissibility of human neurological diseases earned Dr Gajdusek a Nobel Prize in 1976. It also served to refocus attention on this strange type of pathology which he described as 'slow evolution viral diseases'.

Interest intensified. Scientists found similarities between the human and animal forms and evidence of specific cases of infection with CJD during surgery. (1) Questions began to be raised regarding the 'species barrier' (the belief according to which these diseases are not 'inter-transmissible') and the viral nature of the infectious agent.

...to the invention of the prion

An important step was taken in 1982 with the theory of prions (standing for *proteinaceous infectious particles* and pronounced 'pree-ons') developed by an American neurologist working in California, Stanley Prusiner. He explained how, following the tragic death of one of his patients from CJD in the early 1970s, he set about studying all the existing literature on the disease. He was struck by the experiments of European radiobiologists which had shown the resistance of tissues infected with scrapie to radiation supposed to destroy any trace of nucleic acids constituting infection by a virus.

Professor Prusiner promptly sought to demonstrate that the transmission of this type of pathology was not of viral origin but due to a pathogenic transformation of the structure of natural proteins (known as PrP, whose natural function is still unknown to neurologists), omnipresent in neuronal systems, into a different model of proteins with an abnormal geometric configuration, which he called PrP^{Sc}. He showed that these deviant prions were invasive, contaminating all the normal proteins of this family and ultimately 'ganging' all the neuronal tissues.

This rather unorthodox thesis met with general indifference in biomolecular research circles. But the American neurologist was soon to have his day. Just four years later, the prion hypothesis was to become one of the most widely publicised of any scientific theory. In 1997, justice was done when Professor Prusiner was awarded a Nobel Prize. ■

(1) There was also the scandal of CJD transmission to children during the brief period when growth hormones were transplanted from the pituitary glands of human corpses.

Research in action

Devastating as it was, until the mid-1990s mad cow disease was a scourge limited to the United Kingdom. A fact which unfortunately obscured the need to manage the international dimension of the crisis. Nevertheless, European research programmes had been quick to take the measure of its implications.



'The need for a major mobilisation of Europe's scientific community was evident.' - Bruno Hansen

IT WAS IN 1986 that the Central Veterinary Laboratory in the UK first identified two animals infected with an unknown form of bovine spongiform encephalopathy (BSE) in two British herds. By the end of 1989, 10 000 cases had been recorded.

The emergency measures, including the ban on any animal-derived feed - quickly established as the origin of the catastrophe - had little effect. The situation worsened. By 1992 the epidemic had struck 37 000 cattle throughout the UK.

The scientific community - both British and American - followed the affair with stupefaction. However, almost by chance, the scientific community had the recent research on the prion to turn to - thanks to the 'solo' efforts of one Stanley Prusiner in the early 1980s (see *Investigating the past to unlock the present*). A number of research teams now set about pursuing this line of research, filling in the gaps in our scanty knowledge of these strange diseases.

At this time questions also started to be raised - albeit in muffled tones - about a hypothetical impact on man, known to be sensitive to this kind of infection via the CJD family. A first precautionary measure was taken: the abattoirs discarded from the human food chain all organs suspected of being clearly infected with BSE - the brain and spinal cord.

At the same time, in 1990 the British authorities took the first medical initiative by setting up the *CJD Surveillance Unit*. The mission entrusted to Robert Will of Edinburgh University was to set up a reinforced team for the screening and analysis of the symptoms of all cases of CJD in United Kingdom.

Rare diseases

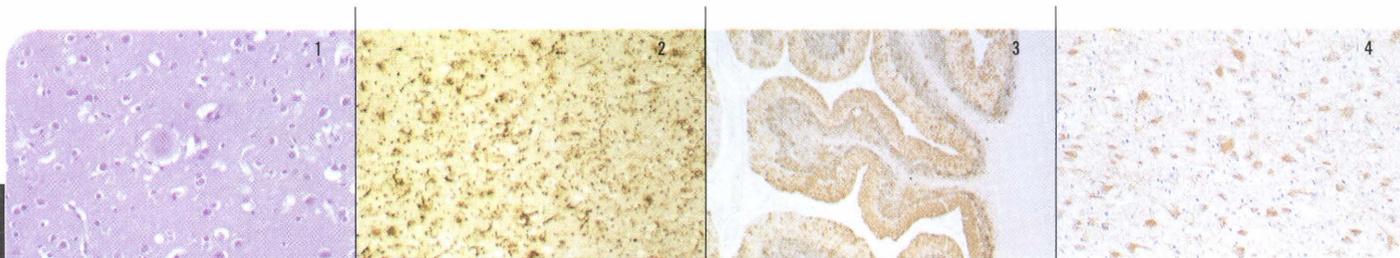
'Through circumstances which owed nothing to chance, the European Union was able to react very quickly to support the scientific community,' recalls Bruno Hansen, a director of European research programmes in the field of the life sciences. 'Taking the view that this was a particularly important and useful field in terms of trans-European co-operation, budgets had been made available for the study of so-called rare diseases under the Third Framework Programme.'

Beginning in 1993, the Edinburgh centre was therefore able to work in constant cooperation with Europe's very best CJD experts. 'This cooperation, which considerably increased the epidemiological data available to us, played a valuable role,' stresses Dr Will. 'It was thanks to this that, in 1995, we identified three suspect cases in young subjects. This was, alas, proof of the appearance of a new variant of CJD which was attributable to infection with BSE.'

Mobilisation

An article announcing this discovery, signed by Dr Will and other European scientists, was published in the medical journal *The Lancet*. It was a political and media bombshell.

'From this moment, the demonstrated inter-species transmissibility was perceived as a sword of Damocles hanging over public health, and the need for a major mobilisation of Europe's scientific community was evident,' continues Bruno Hansen. A panel of researchers, led by Charles Weissmann - one of Europe's most



The nvCJD signature - These four pictures show the characteristic symptoms of the formation of prions in brain tissue infected by spongiform degeneration due to new variant Creutzfeldt-Jakob (1: cerebral cortex; 2: basal ganglions; 3: cerebellar cortex; 4: posterior thalamus).

© Robert Will, CJD Surveillance Unit, Edinburgh.



prominent scientists in this field, who was working on the ideas developed by Prusiner - helped the European Union to determine the priority lines of research by extending them to transmissible spongiform encephalopathies (TSE) as a whole.

Things moved very quickly. At the end of 1996, the first call for proposals was launched for research on diagnosis and transmission mechanisms in bovines. Two other calls followed in 1997 and 1998, covering all the other fields of study. Out of nearly 120 submissions by European teams, 54 projects involving 150 multidisciplinary laboratories were selected and work began. The Commission's support for this first phase of research, which is still in progress, is 50 million euros ⁽¹⁾.

On all fronts

Faced with the many unanswered questions about TSE, scientists are waging an out-and-out war on many fronts in the fields of both animal and human research - and fundamental research first of all. While it is prion research which almost certainly holds the key to the mysteries, the processes involved lie beyond our increasingly substantial knowledge of molecular biology and genetic diseases.

Although the gene which codes for the production of normal protein PrP was recently identified, nobody yet understands the role it plays in the neurological systems of mammals. All that is known for certain is that the illness results from a transformation in the

configuration of the amino acid chains of the normal protein PrP, from the normally preponderant α -helices into β -sheets, when it degenerates into a PrP^{Sc} prion. Due to this change, the prion is able to develop a resistance to the protease enzymes which regulate the management of the healthy protein. This then triggers a chain reaction, leading to a general colonisation

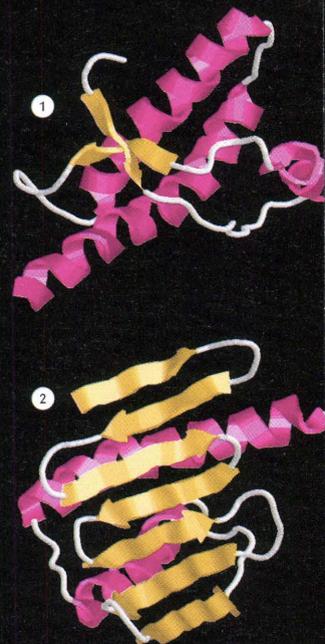
and irreversible degeneration of the neuronal system, culminating in the transformation of the brain into a 'spongy' mass.

Multidirectional research

The key questions as to why the protein transformation occurs, what mechanisms are at work in its long

A prion's passage

TSEs are especially worrying as they are transmitted through the ingestion of infected products. This then poses the essential question of what path the prions take in travelling through the body to attack their ultimate target, the brain. 'There are strong indications to suppose that the prions penetrate the central nervous system by way of the enteric nervous system [linked to the intestine] with the help of certain cellular systems and mechanisms,' explains Hans Kretzschmar, a German neuropathologist. These are the systems and mechanisms that must be deciphered to learn how the prion reproduces. It is the very question which lies at the heart of a European project involving French, Belgian, Swiss, Spanish and German teams, co-ordinated by Dominique Dormont of the neurovirology department of the Commissariat à l'énergie atomique (CEA), a leading research body on the problem of TSE in France and the president of the French Group of Experts on prion diseases.



Prion protein
1. PrP^c
Normal
2. PrP^{Sc}
Pathological

development, and how it is able to transform therefore remain. What is it that triggers the devastating invasive process? What is the mysterious route taken by the infectious agent which lends it its terrible power to contaminate - not only within a single species, but also between species? (See *A prion's passage*).

These questions have opened up a vast field of research in which scientists are trying not just to identify the fundamental bases of the disease, but also to develop the full range of possible responses to it (see *A testing race p.12*). On the animal front, due to the seriousness of the bovine disease, fundamental experiments are being conducted to permit both physiological and genetic approaches to the mechanisms of its development and transmission. This research also covers the study of the best known TSE, scrapie, as well as the opportunities for contamination in all areas of livestock rearing (poultry, pigs and fish) where animal-derived feed has been widely used.

The human impact

Then there are also, of course, the many studies on the human form of the disease. Epidemiological monitor-

ing, co-ordinated by the EuroCJD network, has increased considerably throughout Europe and remains a key element in the scientific framework now in place. It is essential to screen and identify all the clinical and psychological characteristics of new variant CJD - attributed to animal transmission - while at the same time improving our knowledge of all forms of the disease. Identification is a particularly complex problem since the incidence of the disease in humans in its transmitted form is still very low. The continuing exchange of data between specialists is now enabling a vast operation to harmonise the criteria for clinical diagnosis to get under way.

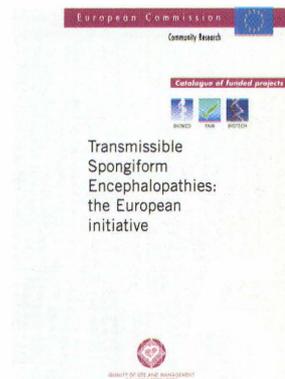
TSEs have a long incubation period. Several months, or even years, can pass between the moment of infection and the first appearance of identifiable clinical signs, which actually mark the final stage, by which time it is too late to do anything. In cattle, this dormant period is estimated to be a matter of months - hence the 30-month limit adopted for screening/slaughtering programmes.

In man, the incubation can be one or two decades, or even more - the length of the period further adding to the detection difficulties. This represents a major challenge, as the earlier the stage at which a screening method can be usefully applied, the greater the chance of developing treatment, which must be applied during the initial infection stage.

Unfortunately, we are only at the stage of tentative investigation. For example, the British neurologist John Collinge - who confirmed the work of Robert Will with experiments on transgenic mice that provided irrefutable evidence of the BSE 'signature' in new variant CJD, and is considered to be one of the world's leading experts on research on TSE - is coordinating a European research project in areas which could lead to new forms of treatment. Among other things, this research is attempting to synthesise peptides which can combat the formation of the abnormal proteins at the origin of scrapie. ▀

(1) See: europa.eu.int/comm/research/press/2000/pr1512en.html.

See also



This brochure presents a clear summary of the 54 projects supported by the European Union in the field of TSE, complete with the contact details of the scientists involved. ISBN 92-828-9581-5, 129 pages (EUR 22,00).
Contact
 Quality-of-life@cec.eu.int

On the Web

europa.eu.int/comm/research/quality-of-life.html
 News site
www.eurocjd.ed.ac.uk/

A few statistics

Between 1987 and 2000 almost 180 000 cattle were infected in the United Kingdom, compared with 1 325 cases recorded to date elsewhere in Europe (mainly in Ireland, Portugal and France). Almost 90 people are known to have died of new variant CJD in the United Kingdom, compared to two cases in France and one in Ireland. Worrying figures recently circulated in the United Kingdom put the number of potential victims at several thousand or even tens of thousands.

A priority for the ERA

After four years of major targeted European research action on TSE, Europe is currently considering what further action to take on this priority front in the light of the results now being produced.

On the one hand, under the Fifth Framework Programme, a series of new projects will be selected this year following the 'Quality of Life' call for proposals last November.

On the other hand, in the context of the European Research Area (ERA), the Council has given the Commission a clear mandate to make an inventory of current research undertaken on BSE and Creutzfeldt-Jakob disease in the Member States, to encourage the exchange of scientific information between research teams, and to identify research activities to be reinforced and new actions to be launched.

The BSE crisis left no doubt: European expertise would have to be more independent and more transparent, with the new European Food Safety Authority to set the seal on this by 2002*.

So who are these

NOT SO LONG AGO, the scientific advisory structures available to the Commission for matters of public health and consumer protection were in fact committees of national experts appointed by the Member States and scattered among the Directorates-General responsible for the principal economic sectors - arable and livestock farming, fisheries, industry, etc. As a result, when managing sensitive issues, their role as advisers could overlap ambiguously with the mission of ambassador. These experts also defended the positions and interests of their respective governments. But times have changed.

Independence

By 1996, partly due to the scale of the BSE crisis, a radical review was clearly needed of all European practices in the field of scientific expertise. In the summer of 1997, all powers of consultation in the field of food safety were brought

together within the new Health and Consumer Protection Directorate-General, which was considerably strengthened and freed from the traditional influence of the lobbies which like to haunt the Brussels corridors. First entrusted to Commissioner Emma Bonino, this DG is now headed by David Byrne.

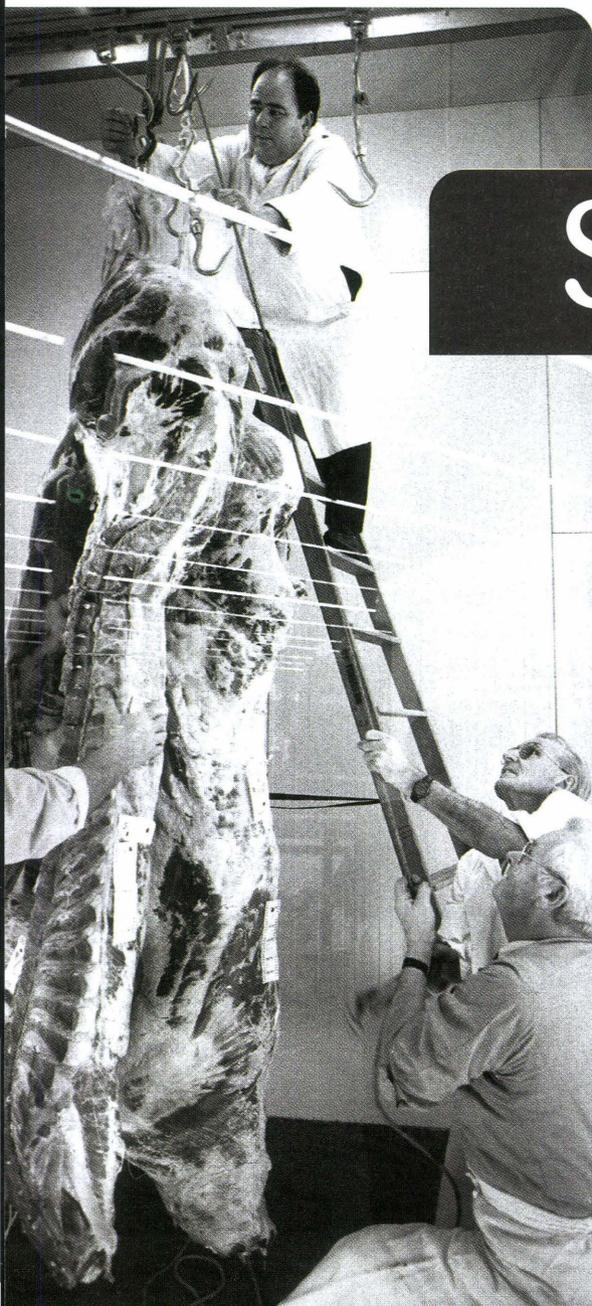
'A two-tier device ensures a clear division between risk assessment and advice on risk management,' stresses Paul Vossen, general secretary of the Scientific Steering Committee (SSC). This body coordinates a network of eight advisory committees specialised in various fields that evaluate the scientific data and then submit their conclusions and opinions to the Community authorities. The SSC itself, consisting of 16 members - half of whom assist in the work of the eight sectoral committees - gives opinions on multidisciplinary issues. All the conclusions arising out of this system of expertise are made public, some as 'preliminary opinions', when the experts consider that additional information or

British beef back

Was it crazy to do what the European BSE experts did and recommend, in their 1999 opinion, the lifting of the ban on British beef, albeit subject to compliance with some very strict conditions? In a special February 2001 issue devoted to food safety, the French monthly *La Recherche*⁽¹⁾ dealt with the subject at length. The said recommendation had caused a deep rift between France, the Commission and the other Member States which gave rise, at the end of last year, to a new episode in the BSE crisis which shook the whole of Europe.

The analysis of the French scientific journalists tended to a rational justification of the arguments put forward by

the Commission at the time. The decision to lift the British beef ban was based on the fact that the huge crisis experienced by the United Kingdom over the past 15 years had given rise there to an 'anti-mad cow' culture which had no equivalent elsewhere.⁽²⁾ The feeding of meat and bone meal to cattle had been stopped with strict checks in force for several years. Any animals aged over 30 months had long since been taken out of the food chain. And in the abattoirs the removal of any organs able to transmit the disease was enforced with almost military rigour. The result being that since 1993 (when 35 000 cases were reported), British BSE had decreased at a rate as fast as it had grown and was currently below the 1998 level. Although the British registration network - easily the most efficient and strict in Europe - still recorded 1200 cases in



experts exactly?

comments from the scientific world (or public authorities) is required.

The golden rule can be summed up in three words: excellence, independence and transparency. The committee members are appointed following an international call for proposals and selected on the basis of very strict criteria in terms of competence, expertise, ability and clarity with respect to the political, administrative or economic responsibilities they may have to exercise in their current professional activities.

Transparency

'In a case such as mad cow disease - which takes up 80% of our time at present - the SSC refers to the ad hoc Advisory Committee on TSE, which includes more than a dozen or so of the top international experts on animal epidemics and new variant CJD. The SSC is also free to set up new working groups of other scientists whenever it deems this necessary.'⁽¹⁾

The present concern to apply the precautionary principle to everything related to the BSE crisis involves adopting a very wide-ranging approach when it comes to the assessment of TSE-related risks. 'The SSC has issued almost 70 new opinions or updates on the subject in the space of three years. Most of the requests we deal with come from Community bodies - Council of Ministers, Commission services, European Parliament - but any representative organisation in the Union, public or private, or even an individual, is also entitled to submit a reasoned and justified request for an opinion to the Commission services.'

The scientific evaluation and risk assessment at the DG does not take place in a vacuum, but is closely linked to all projects relating to TSE under the Research DG's programmes. 'Many experts on the ad hoc group and the various specific working groups they consult are involved in the European research networks working on the sub-

ject. There is therefore a two-way circulation of information. The DG can refer to the latest research projects supported by the Union while the conclusions of the experts on the *ad hoc* committee and SSC are the basis for identifying new research needs.'

* see box p. 12.

(1) All quotations are from Paul Vossen.

On the Web:

europa.eu.int/comm/food/index_en.html

2000, this was less than 3% of the number recorded when the epidemic was at its peak.

The argument that British beef was as safe as - if not safer than - the meat circulating on the continent was perfectly rational. Paradoxically, this was confirmed by the fact that the panic which took hold a few months later had its origins in France. The fears were aroused when it was shown that infected animals had slipped through the controls and were very likely to have entered the food chain.

But is this not an excellent example of the limitations of a rationality which isolates decisions of policy and scientific assessment in a vacuum which often fails to take account of one major factor: public perception? It was no doubt not easy for the French authorities to convince the

public - and farmers in particular - to return to the starting point. Should not account also of have been taken of the fact that the United Kingdom was the place where the disease had originated (and suspected of having contaminated other countries) and where mad cow disease had been most devastating in its effects?

(1) www.larecherche.fr/

(2) See: the BSE Inquiry Report
<http://www.bse.org.uk/>
<http://sparc.airtime.co.uk/bse/>

A testing race

Reliable screening of contamination in cattle is the key weapon in making a realistic assessment of the extent and localisation of the epidemic and thus in guaranteeing the protection of human health. This is now the subject of a genuine research race.

Info

The JRC's February 2000 newsletter reports on the BSE tests
Contact: jrc-info@cec.eu.int
<http://www.jrc.cec.eu.int/download/press/newsletters/letter200102-en.pdf>

Post-mortem tests

See europa.eu.int/comm/food/fs/bse/bse12_en.html

HOW TO DO you tell a BSE-infected cow from a healthy cow? By finding a way of detecting whether or not it is infected with abnormal prions. A simple truth - but a considerable scientific challenge. One possible way forward is to develop an immuno-biological test to render an antibody capable, following the action of an enzyme within brain or nerve tissue liable to infection, of recognising the presence of abnormal prions.

Several teams are working on this problem. In 1998 three of them presented the first *post-mortem* tests, suitable for use on animals immediately after slaughter: *Prionics* (developed by the Swiss firm of the same name), *Biorad* (jointly developed by French public research and a US firm) and *Enfer* (Ireland). These distinct tests, which can be carried out by operators working in abattoirs, were approved by the Health and Consumer Protection Directorate-General after checks at the Commission's Joint Research Centre lasting several months. Five other tests (four European and one American) are currently being assessed at the JRC.

Warning and precautionary devices

The important measures taken by the Union since 1 January 2001 include the systematic screening of all cattle aged over 30 months (which currently means several million animals). But this is a precautionary measure rather than a guarantee of safety. The tests make it possible to recognise with certainty tissues which have reached an advanced stage of contamination and other tissues which are guaranteed safe. However, already infected tissues in an animal at a much earlier stage in the particularly long BSE incubation cycle may not react and can thus slip through the protection net.

Be that as it may, the use of tests - plus increased protection measures consisting of discarding a long list of cattle organs from the food chain and a ban on meat and bone meal for livestock feed - does provide an additional warning device, but one which does not necessarily lead to an easier management of the crisis. This is because the more effective the checks, the greater the number of cases discovered.

Towards a blood test?

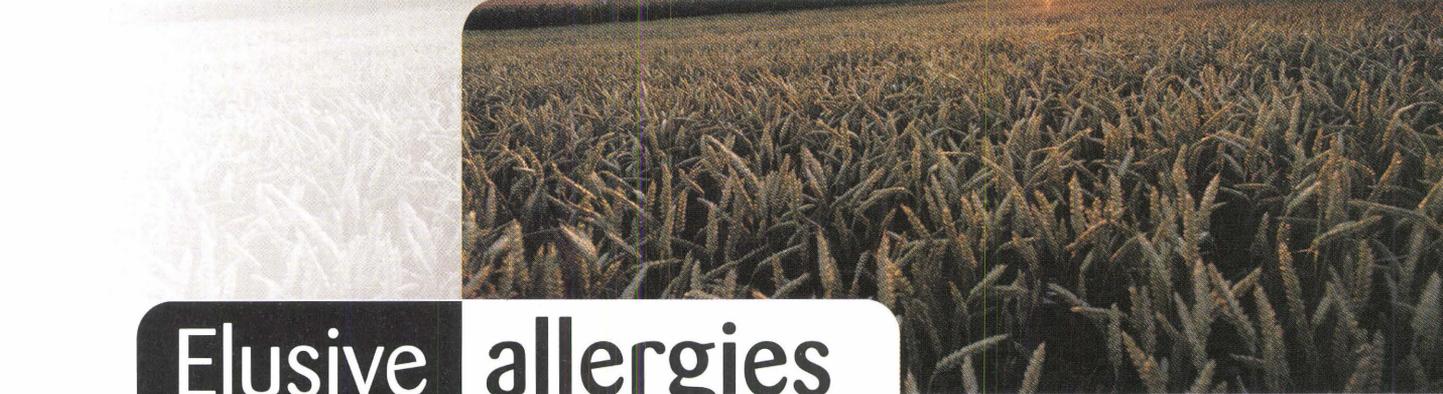
But the scientific battle on the test front - which also involves detecting the disease in humans - is far from over. And it would take an altogether different direction if we crossed the crucial barrier between the present stage of *post-mortem* tests and *in vivo* detection, permitting identification at an increasingly early stage in the disease cycle. Apart from the advance in terms of public health, such progress is eagerly awaited by farmers, who would then have a genuine tool for giving their herds a clean bill of health.

Hence the importance of the research on methods of diagnosis carried out by some 50 high-tech laboratories within over a dozen European projects. One particularly promising line of inquiry is being pursued by a team of Danish, Israeli, Swedish, Spanish and Swiss researchers. Coordinated by Hans Kretzschmar, a neuropathologist at Munich University, this project is concerned with the detection capacities of new specific monoclonal antibodies, opening up the possibility of blood tests, in both animals and man. ▀

A Food Authority for 100% vigilance

In November 2000, the European Commission submitted its proposals to the European Parliament and Council for the creation of the new European Food Authority, to be in place by 2002 at the latest. This will be responsible for developing a global strategy for analysis and advice on all matters relating to the safety of the food chain 'from farm to fork' (thus also including animal health and diet). By virtue of the rule of separating risk assessment from risk management, established by the Union in 1997, the EFA will have the status of an independent and autonomous body. It will be allocated substantial resources and will replace the current system of scientific consultation, with an extensive mandate to conduct a proactive policy of scientific assessments and recommendations, information gathering and risk identification, rapid warning in case of crisis and transparent communication to the general public.

On the Web: europa.eu.int/comm/dgs/health_consumer/library/press/press82_en.html



Elusive allergies

Nearly one in three Europeans suffers - or will suffer - from an allergy. 10% of children suffer from asthma. Described by some scientists as 'the real millennium bug', allergies have become progressively more common over the past two decades. And the social cost - in terms of health care and absenteeism, for example - is estimated at 45 billion euros a year. A major research effort is essential in this field where our knowledge shows some surprising gaps.

FIRST DESCRIBED by the Austrian physician Clemens von Picquet back in 1906, an allergy is an 'inflammation' which follows exposure to a specific substance or micro-organism, known as an allergen. The body responds to a usually inoffensive stimulus by triggering the action of immune mechanisms - just as it does when defending us against germs, but in this case for no real purpose. The body's reaction is violent and, in the extreme and rare cases of *anaphylactic shock*, can even prove fatal.

'There are many different types of cause,' explains Dr Alain Vanvossel, a scientific officer at the Research DG. 'Genetic factors and immunological aspects can all play a part, as well as pollution and other environmental factors, as can lifestyle, including diet. So all these avenues must be explored if we want to make any progress in preventing allergies.'

Allergies are made all the more complex by the fact that they are often triggered by a combination of factors which are difficult to identify. Their incidence can vary in the course of a lifetime and the phenomenon of crossed reactivity further complicates an already difficult diagnosis.

Increase in asthma

Respiratory allergies are among the most common. They include allergic rhinitis, such as the familiar hay fever, the incidence of which seems to have increased from 1% of the population at the beginning of the 20th century to between 15% and 20% over recent years, affecting adolescents and young adults in particular.

'This complaint should not be viewed as a minor irritation,' states the European Allergy White Paper.⁽¹⁾ 'Recent studies show that chronic allergic rhinitis, usually caused by the allergens found in buildings, cause a level of discomfort in the patient equivalent to that of moderate asthma. Some studies even suggest that this complaint can lead to asthma.'

The link is worrying, as asthma is another major allergy. It affects 10% of children, continues in 5% of adults and affects twice as many people as 20 years ago. Polluted air - with NO_x from vehicle emissions, for example - is increasingly being cited as the cause of the problem and some statistics show that asthma is more common in urban than rural areas. Socio-economic factors are also mentioned, as asthma is more frequent among the socially disadvantaged. Although the resulting mortality is low in Europe, the number of children who suffer from it is a cause for concern, as is the number of determining factors which remain unidentified and which are probably linked to the interaction between our genes and lifestyle.

Skin allergies

Skin allergies are another major category of allergy. A number of studies have found a worrying increase in atopic dermatitis over recent decades. Also linked to hereditary factors, in some regions of Europe as much as a quarter of the population is believed to be affected by this condition. Eczema and urticaria are also affecting a growing number of people, with experts predicting that between 40% and 60% of them are at risk of going on to develop respiratory problems.

(1) *European Allergy White Paper - Allergic diseases as a public health problem in Europe*, The UCB institute of allergy, 1997

••
Diet is very often seen as being responsible for these disorders. Here it is more a question of intolerance than of allergies proper as the symptoms are not due to an activation of the immune mechanism. But whatever the case, this hypersensitivity is also linked to a change in lifestyle.

Targeted research

'Europe is certainly not without its strengths in conducting the research required to combat this public health problem,' believes Dr Vanvossel. 'In addition to multidisciplinary teams of high-level scientists, it also has the diversity of populations, lifestyles, environments and public-health systems to permit a very targeted approach.'

The *Quality of life and management of human resources* programme under the Fifth Framework Programme for Research is already supporting studies by

over 50 European teams, many of them also cooperating with laboratories in EU-applicant countries (see examples below). Some are concerned specifically with asthma and the aetiology of allergies, some with food allergens, and some with methods of diagnosis and treatment strategies. 'The emphasis is clearly on prevention. That is why it is important to ensure that the results get back to the people in question, and that they are put to the best possible use, as it is often issues of lifestyle which are raised by these diseases,' concludes Dr Vanvossel. Further calls for proposals for research on allergies are planned for March 2001 and 2002 under the *Quality of life* programme. These will make it possible to finance a large number of innovative projects in this field. ▸

Breathing in Europe



THE ECRHS II (European Community Respiratory Health Survey) project is an ambitious study following on from an initial survey carried out in 1992-93. More than 10 000 young adults from 14 European countries will once again come under the scrutiny of scientists and doctors from 29 scientific centres. The aim is to determine the factors linked to the incidence (or remission) of allergic sensitivity and asthma, and to reduction in the pulmonary function. The ECRHS II project will compile an extensive database with multiple variables on

respiratory allergies - especially asthma - and risk factors (environmental, hereditary, etc.).

'We are also going to compile a blood bank for the purposes of DNA analysis,' explains Dr. Deborah Jarvis, the study co-ordinator. 'It will be possible to correlate these results with every type of incidence recorded. That will enable us to explore the associations between exposure and response at a really pertinent European level.'

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Intestinal flora



THE INQUIRY into intestinal flora is particularly innovative in that it is exploring the quite paradoxical association found by most epidemiological studies between a high risk of allergy and a Western upbringing under hygienic conditions. 'We found that children from small, well-to-do families, with sanitary housing, are at greater risk of developing allergies,' explains Agnes Wold of Gothenburg University (SE), co-ordinator of the **Allergyflora** (Impact of intestinal microflora on allergy development) project. 'Sanitary conditions in Europe are totally differ-

ent from those of 100 years ago, a time when allergies were virtually unknown.'

The hypothesis? The microflora of the intestine, the first system to be colonised by micro-organisms after birth, play a key role in regulating the immune system. The researchers believe that our children's microflora inhibit the development of tolerance to the antigens present in the digestive system. Three hundred babies living in Sweden, the United Kingdom and Italy will be monitored from birth, to enable scientists to confirm - or qualify - this position. The project's ultimate objective is to open up new avenues for prevention.

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Lines of research

Monitored pregnancies

THE EXPOSURE of expectant mothers to certain pollutants could make their babies more prone to develop allergies. This is the hypothesis being studied by researchers on the **Plutocracy** project (*Placental uptake and transfer of environmental chemicals relating to allergy in childhood years*). 'Placental contamination by pollutants in general, and PCBs and heavy metals in particular, could affect certain functions of the placenta - and thus the development of the foetus,' explains Dr. Margaret Saunders, the project

coordinator. 'We are looking for the link between the mother's exposure, the contamination of the placenta and the epidemiology of allergies in children.' This research is particularly important in seeking to reduce risks to children's health, starting in the womb.



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IS A LACK OF contact with germs from a very early age damaging to health? Does excessive hygiene lead to immune deficiency and risks of allergy? It seems that children in frequent contact with animals - on farms, for example - are less prone to allergies. The same is true of those brought up according to the principles of anthroposophy ⁽¹⁾ who, among other things, receive fewer vaccines and antibiotics, and enjoy a diet that is richer in fermented products. But why? That is what the researchers on the **Parsifal** project (*Prevention of allergy. Risk factors for sensitisation in children related to farming and anthroposophic life style*) aim to find out.

Country life

By exploring a number of avenues (diet, vaccinations, infections, contacts with animals, microbial contaminants, intestinal microflora, etc.), this study should help develop a prevention policy for allergies.



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(1) Anthroposophy, a doctrine developed by the Austrian philosopher Rudolf Steiner (1861-1925), advocates a harmonisation between the physical and the spiritual state, between man and the universe.

THE AIRALLERG PROJECT (*Effects of outdoor and indoor air pollution on the development of allergic disease in children*) is focusing on one of the prime suspects behind the increase in allergies: air pollution. Several hundred children in Sweden, Germany and the Netherlands are being monitored from birth. The researchers collect continuous information on the allergic sensitivity of the children and on the atmospheric pollutants to which they are exposed, both outdoors (such as the gases and particles emitted by vehicles) and indoors (mould, bacteria, tobacco, combustion gases from boilers and cookers, etc.).

Children and pollution

Professor Bert Brunekreef. 'First, we are seeking to establish associations between exposure to these substances from the very earliest age and the frequency of allergies in these same children at the age of four. We will then seek to identify interactions between exposure to certain specific chemical or biological substances and the frequency of sensitisation to common allergens and of allergies among children at the age of four.' This study will make it possible to shed light on the relative importance of a number of risk factors to which Europe's youngest inhabitants are exposed.



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'The aim is two-fold,' stresses project co-ordinator



The importa

European researchers have succeeded in growing blood stem cells - the source of white and red corpuscles and of platelets. This success makes what may otherwise be quite a major transplant operation much less daunting. And opens the way for growing stem cells from other human tissues.

ONE OF THE MAJOR CHALLENGES of cellular biology is to recreate, *in vitro*, human tissues designed to be reintroduced into the body. Tissue cultures originate in a very specific category of cells, known as *stem cells*. These stem cells are not only able to multiply - to replenish the stock - but also to differentiate and to become specialised cells.

Blood stem cells, also known as *hematopoietic stem cells (HSCs)*, are of particular interest to researchers and doctors. They are found in the red bone marrow where they produce all categories of blood cells (red corpuscles, white corpuscles and platelets). Growing these HSCs *in vitro* could therefore make it possible to grow white corpuscles to treat individuals with a bone marrow deficiency or red corpuscles for those suffering from anaemia - or even to create a complete blood substitute for transfusions.

Reproducing without differentiating

Any transplant requires a sufficient quantity of blood stem cells to re-implant and, above all, to regenerate the tissue. But donors for organs or for blood are rare. In the specific case of HSCs, produced by the red marrow of long bones - such as the femur or sternum - taking the sample involves major surgery which is an obstacle to finding more than one suitable donor.

The solution, therefore, is to *amplify* the limited HSCs available. But here the researchers face a twofold difficulty: the stem cells are cells at rest which do not spontaneously divide and when they do start to proliferate and to differentiate they die very quickly. The aim of the European project entitled Hematopoietic Bioreactor,⁽¹⁾ carried out by eight research teams over four years, was to *amplify* the HSCs *in vitro* and to induce them to reproduce automatically without differentiation or ageing.

The blood from a single umbilical cord (80-120 ml) contains as many hematopoietic stem cells as the 800-1200 ml of bone marrow usually taken from a donor. When amplified *in vitro* these cells enable an adult transplant to be performed without major surgery.

Umbilical cord and cell banks

The project partners first chose a source of hematopoietic stem cells which solved the problem of donors: the blood from the umbilical cord, which is usually destroyed after birth. The HSCs present in the umbilical cord are of better quality, less likely to be infected, and most importantly less aggressive for the patient than those obtained from bone marrow. 'We realised that the blood obtained from a single umbilical cord, that is between 80 ml and 120 ml, contained as many

Another kind of tissue culture

Another aspect of this project concerns the development of culture environments without any foreign protein in order to reduce the risk of transmitting pathogenic agents such as prions or viruses to man. 'We have developed an environment free of serum albumin and transferrin of bovine or human origin, these being transporters of the fatty acids and iron, respectively, essential for any cellular culture. We have replaced them with synthesised molecules which are

Importance of stem cells

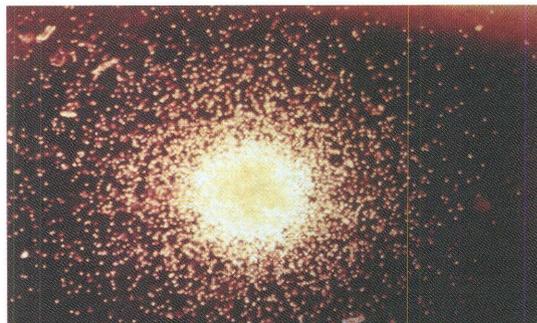
blood stem cells as the 800 ml to 1200 ml of bone marrow usually taken from a donor,' explains Dr Jacques Hatzfeld, the project coordinator. 'The small quantity of HSCs taken from an umbilical cord is sufficient to generate enough blood cells *in vitro* for a transplant in an adult patient.'

But another obstacle also had to be overcome before it was possible to grow these precious cells. As they are taken from the umbilical cord, they are usually kept in a rest state by the cellular-division inhibitors. The researchers managed to combat this by using molecules which block the action of these inhibitors thus enabling the cells to divide. They then managed to halt the irreversible process of differentiation, with the HSC culture continuing to reproduce for over 100 days.

In Europe – and in Germany, France, Italy and Spain in particular – umbilical and placental blood banks have been progressively built up in the form of frozen samples which can be subsequently amplified in bioreactors – environments whose composition is continuously monitored – using the technique developed by the project. This system makes it possible to reduce the waiting period for a transplant considerably. In the longer term, doctors would like to create a reservoir of compatible blood stem cells which can then be used as required.

therefore not contaminated but which play the same role,' stresses Dr Hatzfeld.

The development of the blood stem cells in a bioreactor used by European researchers is a model which is now being applied to other tissues, such as the liver, pancreas, bones and even muscles and brain cells. It is also attracting the interest of industrial partners. This project has therefore opened the door to the laboratory growth of stem cells from human tissues in Europe. ▸



A colony derived from a High Proliferative Potential-Quiescent cell. To obtain this colony, it was first necessary to block an inhibitor which kept it in the rest state: TGF-β. This inhibitor represses the expression of growth factor receptors and thus maintains the cell in an undifferentiated state.

Contact

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Helmut Hund GmbH, Wetzlar-Nauborn, Germany
Integra Biosciences GmbH, Fernwald, Germany
Novo-Nordisk A/S, Bagsvaerd, Denmark
Instituut Hematologie, Erasmus Universiteit, Rotterdam, The Netherlands

(1) The full title is Hematopoietic Bioreactor: a model for human somatic stem cell culture.

News in brief

Of mustard and men



The announcement in February 2001 of the complete sequencing of the human genome - undeniably a historic event - no doubt stole the limelight from one no less spectacular, announced two months earlier: the sequencing of the humble plant *Arabidopsis thaliana* (a type of flowering mustard). This sequencing of a plant genome for the first time is

of considerable significance for the future of agriculture and its effects could be felt much sooner than the decades it will take for the further genetic exploration of human DNA. Work on sequencing *Arabidopsis thaliana*, which grows in most latitudes, began 10 years ago, the plant being chosen for its genetic simplicity. Because decoding these genes is likely to advance relatively quickly, *Arabidopsis* is set to become a 'bio-model' unique in its class and the source of a mass of applications for many crops.

arabidopsis.org/home.html

From the Research Area to the Education Area?



There has been a lot of talk of the European Research Area since January 2000. It is an idea which is not only gaining ground, but also being 'exported'. Elly Plooij-van Gorsel (NL), an MEP who follows the Union's scientific and technological policy with particular interest, believes a European Education Area would be a useful complement to the Research Area. Her idea took 'informal' shape at an 'informal' meeting convened by the Swedish presidency which

invited Europe's research and education ministers to take part in a weekend brainstorming session in Uppsala from 1 to 3 March. On the agenda at the meeting were the issues raised by the need to boost Europe's scientific expertise, which is suffering on two scores:

- the growing trend among young people to reject science courses and careers, a problem that needs to be tackled at source - by changing the way young people perceive science and careers in science;
- population ageing - already apparent even within research teams - which ultimately raises the question as to the performance of European research and education systems in a global knowledge-based society.

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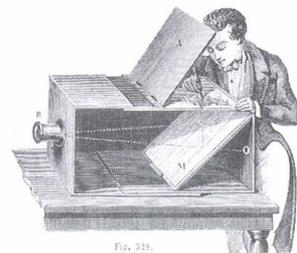


Fig. 519.

Opinion

What grabs media attention?

Why do some research subjects suddenly attract such media attention? Why does much more essential research work meet with such indifference? Is it always a question of jumping on the bandwagon? Physicist Dario Camuffo,⁽¹⁾ one of Europe's most renowned analysts of the microclimate of museums and conservation conditions for works of art, tells of his recent experience.

I imagine that these days newspapers are bored with repeating the mad cow story, and were wondering when would there be something new. One of them, *Corriere della Sera*, which is the most important Italian newspaper, remembered some research I was doing and presented it as the attraction of the day.

In that research, I used the paintings of Canaletto to measure the average level of high tide in Venice. There were two reasons for this: green-brown algae live in the area which is periodically wetted by tides, and the top of the green band coincides with the high tide level. It was possible to obtain an objective measurement of that level in the first half of the 1700s because Canaletto, Bellotto, Guardi and the painters of the school of *Vedutisti Veneziani* used a *camera obscura* to produce the sketches for their paintings. Before that, artists used to make a sketch on site, and then finish the painting in their ateliers. Canaletto needed a lot of money for his lifestyle, so he invented a way to produce his paintings very quickly. With a *camera obscura* he projected the image of the scene on to a sheet of paper or the canvas, and then drew all the outlines very carefully with a pen. As a result, all his paintings are like real photographs, but taken one century before Daguerre's invention.

This idea has driven half of Europe crazy. It has been reported in all the Italian newspapers, journalists and TV are searching for me continually; today I was interviewed from London, and the person told me that the news has already appeared in the *Herald Tribune*, the *Guardian* and the Chilean daily *La Tercera* and on various Internet sites⁽²⁾.

You see, you can work seriously your whole life, and nobody cares; but if you only mention an amazing triviality, this immediately goes round the world. *C'est la vie!*

Dario Camuffo

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(1) See RTD info 22, May 99

(2) See http://news.bbc.co.uk/1/hi/english/world/europe/newsid_1172000/1172437.stm

<http://dsc.discovery.com/news/briefs/20010226/venice.html>

Malaria: new vaccines

In Africa, a child dies of malaria every 20 seconds. Both a cause and a consequence of poverty, this disease has reigned supreme since the appearance of resistant strains and mosquitoes. New vaccines of particular interest for children are currently being developed by international teams of researchers from 11 countries (Brazil, Colombia, Denmark, France, Ghana, India, Lebanon, the Netherlands, Senegal, Tanzania, and Switzerland). The most advanced are MSP-3, produced by an EU-supported research project coordinated by the Unit of

Biomedical Parasitology of the Institut Pasteur (Paris), and GLURP, from the Institut Statens Serum in Copenhagen (DK). The latter will begin clinical trials later this year. These advances confirm the Commission's commitment to supporting advanced research on the principal diseases afflicting the populations of developing countries: AIDS, tuberculosis and malaria.

Contact:

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DataGrid, a new Web for science

Originally conceived by scientists in the 1980s, and subsequently appropriated and globalised for very different purposes, the Web has become a somewhat obsolete tool for researchers. Particle physics, biology and the earth sciences, for example, require simultaneous on-line access to – and intensive computation and analysis of – shared large-scale databases across widely distributed scientific communities all over the world. To meet such a demand, a new generation of hyper-specialised networks, or 'Grids', is currently being developed. Under

the aegis of CERN, six major European scientific centres have launched the DataGrid project. With 10 million euros from the Commission, this project will enable Europe to test the application of new, high-powered, shared-communication technologies and to acquire a first-class tool for scientific exploration.

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Opinion

The Credibility of Expertise

Why do American experts seem to enjoy a public confidence which is the envy of European scientists and decision-makers? Sheila Jasanoff, who is Professor of Science and Public Policy at Harvard University and specialises in the interactions of law, science and politics, explains.

'The apparent robustness of US expertise may well depend on its essential vulnerability. If US experts seem to be trusted, it may be because American law and administrative practice have created a wealth of avenues through which people can express, and if necessary act upon, their distrust of expertise...

Grounds on which the credibility of policy-relevant science can be challenged include not only dubious methodology, but also more overtly social criteria, e.g. untested disciplinary assumptions, inadequate peer review, conflicts of interest, and so forth. The result can be endless deconstruction of technical arguments... We can identify four mechanisms for preventing such disintegration and for successfully integrating expertise into public policy even under conditions of uncertainty and conflict:

Expert authorization. Scientific and technical policy justifications are accepted without challenge on the authority of expert advisory bodies. Although this approach seems to be quite widespread in the US, American advisory bodies (like many of their European counterparts) frequently represent multiple viewpoints, stakes, and interests. Accordingly, what looks on the surface like purely technical authorization often incorporates distinctly social and political elements.

Administrative exhaustion/judicial review. Expert judgment is accepted simply because it is the endpoint of a process that commands public trust, although not everyone necessarily agrees with the outcome. As demonstrated in the aftermath of the 2000 presidential election, even the most

contentious facts may be taken as final because the process through which the facts were ratified (here, a US Supreme Court decision) is believed to constitute the last word on the subject...

Public participation. Evidence relied on as a basis for decisions may be accepted because interested and affected parties played a role in producing them. US air pollution standards, for example, have sometimes been supported by research jointly funded by government and industry. Lawsuits, a favoured method of conflict resolution, illustrate the participatory principle in the purest form...

Normative accord. Not infrequently, scientific advice is accepted because it is deemed consistent with underlying normative judgments about what ought to be the applicable standard of proof or the appropriate level of protection. For example, even in the risk-based US regulatory process, something rather like the precautionary principle has come into play around the social consensus that children's health deserves special protection...

American experience suggests that the challenge for a post-BSE Europe is not to see how completely experts and their judgments can be insulated from social and political influences. Rather, it is to acknowledge that policymaking under uncertainty inevitably calls for consultation among many standpoints, and that modernity's vaunted institutions of governance may need substantial adjustment to take account of the complex wellsprings of credibility.

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Calls for proposals

Deadlines

2001

2002

QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES (www.cordis.lu/life/)

KEY ACTIONS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Food, nutrition and health											
Control of infectious diseases								18(2)			
The 'cell factory'								18(2)			
Environment and health											
Sustainable agriculture, fisheries and forestry								18(2)			
The ageing population and disabilities											
<i>Generic research</i>								18(2)			
<i>Genomics and human health initiative</i>								18(2)			
OPEN CALLS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Training: Marie Curie individual fellowships	11 ⁽¹⁾					10 ⁽¹⁾					
SME Measures (exploratory awards / cooperative research)	18 ⁽⁴⁾				19 ⁽⁴⁾⁽⁵⁾				16 ⁽⁴⁾⁽⁵⁾		
Accompanying measures			12 ⁽²⁾			11 ⁽²⁾				8 ⁽²⁾	
Support for research infrastructure						18 ⁽²⁾				8 ⁽²⁾	

(1) Call published on 06/03/99. (2) Call published on 15/11/00 (3) Call planned for June 01 (subject to confirmation) (4) Call published on 01/04/99 (5) CRAFT projects only (no exploratory premiums).

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

KEY ACTIONS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Systems and services for the citizen	25 ^{(1)*}										
New methods of work and electronic commerce	25 ^{(1)*}										
Multimedia content and tools	25 ^{(1)*}										
Essential technologies and infrastructures	25 ^{(1)*}										
Cross-programme themes	25 ^{(1)*}										
<i>Future and emerging technologies</i>	25 ^{(2)*}										
OPEN CALLS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Future and emerging technologies										28	
Cooperation with newly associated States										28	
Various support activities										28	
SME Measures (exploratory awards / cooperative research)	18 ⁽⁴⁾				19 ⁽⁴⁾⁽⁵⁾				16 ⁽⁴⁾⁽⁵⁾		

(1) Call published on 27/01/01. (2) Proactive initiatives. (3) Submissions in 2 stages. (4) Call published on 16/03/99. (5) CRAFT projects only (no exploratory premiums). *Work programme of 21/1/01.

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

KEY ACTIONS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Innovative products, processes and organisation		15 ⁽¹⁾									
Sustainable mobility and intermodality						17 ^{(1)*}					
Land transport and marine technologies						17 ^{(1)*}					
New perspectives for aeronautics						17 ^{(1)*}					
<i>Generic research: Materials</i>		15 ⁽¹⁾									
<i>Measurements and testing research</i>						17 ^{(1)*}					15 ⁽⁶⁾
<i>Support for research infrastructure</i>						17 ^{(1)*}					15 ⁽⁶⁾
OPEN CALLS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Training: Marie Curie individual fellowships					19 ⁽²⁾						20 ⁽²⁾
SME Measures (exploratory awards / cooperative research)	18 ⁽⁴⁾				19 ⁽³⁾⁽⁴⁾				16 ⁽³⁾⁽⁴⁾		
Accompanying measures					15 ⁽²⁾						15 ⁽²⁾
Expressions of interest on research needs	30 ⁽²⁾										
IMS (RTD projects)	19 ⁽⁵⁾				19 ⁽⁵⁾						

(1) Call scheduled for 1/6/01. (2) Calls published on 16/03/99. (3) CRAFT projects only (no exploratory premiums). (4) Call published on 01/04/99. (5) Intelligent Manufacturing Systems, call published on 27/01/01. (6) Call to be published on 15/10/01. *Limited number of priorities - See 2001/2002 work programme - 12/2000 edition.

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

KEY ACTIONS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Sustainable management and quality of water						15 ⁽¹⁾					
Global change, climate and biodiversity						15 ⁽¹⁾					
Sustainable marine ecosystems						15 ⁽¹⁾					
The city of tomorrow and cultural heritage						15 ⁽¹⁾					
Cleaner energy systems, including renewables								14 ⁽²⁾			
Economic and efficient energy for a competitive Europe								14 ⁽²⁾			
<i>Support for research infrastructure</i>						15 ⁽¹⁾					

(1) Environment and sustainable development only, published on 15/11/00. (2) Energy only, published on 24/10/00.

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

Deadlines

2001

2002

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

OPEN CALLS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Generic research						15 ⁽²⁾		14 ⁽¹⁾			
Training: Marie Curie individual fellowships								14 ⁽¹⁾			
SME Measures (exploratory awards / cooperative research)	18 ⁽⁴⁾						19 ⁽³⁾⁽⁴⁾		16 ⁽³⁾⁽⁴⁾		
Accompanying measures			15 ⁽²⁾				19 ⁽²⁾	14 ⁽¹⁾			15 ⁽¹⁾

(1) Energy (E) only - call published on 24/10/00. (2) Environment and sustainable development (ESD) only - Call published on 15/11/00. (3) CRAFT projects only (no exploratory awards). (4) Call published on 01/04/99.

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

KEY ACTIONS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Nuclear Fission									21 ⁽¹⁾		
OPEN CALLS	APR	MAY	JUNE	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Generic research									21 ⁽¹⁾		
Support for research infrastructures									21 ⁽¹⁾		
Training: Marie Curie individual fellowships			13 ⁽¹⁾⁽²⁾						9 ⁽¹⁾		
Other training actions						24 ⁽¹⁾⁽³⁾					25 ⁽¹⁾
Accompanying measures					24 ⁽¹⁾						25 ⁽¹⁾

(1) Call published on 17/10/00. (2) Including fission programme. (3) Special courses, research-training networks, cooperation with third countries.

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

CALLS BY COUNTRY GROUPS	APR	MAY	JUNE	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
States in pre-accession phase				16 ⁽¹⁾			16 ⁽¹⁾				16 ⁽¹⁾
NIS & other CEEC			15 ⁽⁴⁾	16 ⁽¹⁾			16 ⁽¹⁾				16 ⁽¹⁾
Mediterranean partners (INCO-MED)				16 ⁽²⁾	17 ⁽³⁾		16 ⁽²⁾				
Developing countries (INCO-DEV)				16 ⁽²⁾	17 ⁽³⁾		16 ⁽²⁾				
Emerging economies and industrialised countries			18 ⁽²⁾		17 ⁽²⁾⁽⁵⁾	16 ⁽²⁾					
Coordination			15 ⁽²⁾⁽⁶⁾								
Fellowships for Japan											1

(1) 'Support for participation in conferences' calls opened (2) 'Accompanying measures' calls opened. (3) Calls for research projects, concerted actions and thematic networks. Envisaged publication date: 15/04/01. (4) Copernicus 2 - reintegration of the Balkans (RTD projects, concerted actions, thematic networks). (5) Accompanying measures for the coordination of multilateral research - Diseases linked to poverty. (6) Accompanying measures: Diseases linked to poverty.

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

OPEN CALLS	APR	MAY	JUNE	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
SME Measures (exploratory awards / cooperative research)	18 ⁽¹⁾⁽²⁾						19 ⁽¹⁾⁽³⁾		16 ⁽¹⁾⁽³⁾		
Mechanisms facilitating the establishment and development of innovative companies				15 ⁽⁴⁾							
Innovation projects								15 ⁽⁵⁾			

(1) Call published on 01/04/99. (2) Close of call for exploratory premiums. (3) CRAFT projects only (no exploratory premiums). (4) Call for proposals planned for 15/04/2001 (subject to confirmation) - dates subject to modifications. (5) Call for proposals planned for 15/09/2001 (subject to confirmation) - dates subject to change.

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

OPEN CALLS	APR	MAY	JUNE	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Research training networks		4 ⁽¹⁾									
Marie Curie individual fellowships					12 ⁽²⁾⁽³⁾						13 ⁽²⁾
Marie Curie industry host fellowships							3 ⁽⁴⁾				
Marie Curie development host fellowships and training sites			16 ⁽⁴⁾								
Research infrastructure cooperative networks and exploratory workshops											
High-level scientific conferences										1 ⁽²⁾	
Awards for first-class research	6 ⁽⁵⁾			31 ⁽⁶⁾							
Raising public awareness of science and technology				2 ⁽⁷⁾							
S&T policy strategy: Groups of experts (Strata)											
S&T policy strategy: Thematic networks (Strata)				1 ⁽⁸⁾							
S&T policy strategy: Accompanying measures (Strata)				1 ⁽⁶⁾⁽⁹⁾							
Joint basis of indicators for science and innovation: thematic networks and RTD projects	17 ⁽¹⁰⁾				15 ⁽¹⁰⁾						
Accompanying measures for the programme		8 ⁽¹¹⁾									

(1) Call published on 15/12/00. (2) Calls published on 16/03/99. (3) Individual fellowships, return fellowships, fellowships for experienced researchers. (4) Call published on 15/02/01. (5) Descartes Prize: call published on 15/12/00. (6) Archimedes Prize: call published on 15/12/00. (7) Call scheduled for 03/04/01 (subject to confirmation.) (8) Call published on 01/02/01. (9) Open until 15/06/02. (10) Call published on 16/01/01. (11) Call published on 16/05/00.

News in brief

LETTER

Clarifications on the Community patent

In response to the article which appeared in RTD info 27 (p. 19).

The Community patent system will not replace either the European patent system or the national patents systems. It will supplement them. A Community patent will be obtained by filing a European patent application designating the Community area as a whole. This application can also designate non-Community countries (Switzerland for example). As has been the case since the European patent system was set up in 1978, French, English and German will remain the only languages in which the examination procedure can be conducted.

The Community patent will not bring any changes to the filing or examination of applications. It is only after the patent has been issued that the system will be innovative, in terms of the much reduced translation obligations (bringing a major cost reduction) and its unitary nature. The latter characteristic will allow legal disputes concerning Community patents to be the subject

of uniform decisions applicable throughout the Community territory, thus resulting in increased legal security.

Denis Dambois

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European Commission
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A FEW FIGURES

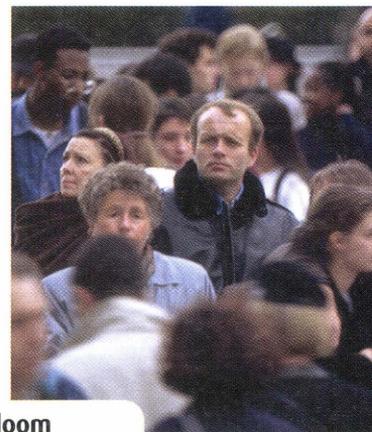
Biotechnology with the wind in its sails



European biotechnology is making headway - and the figures confirm it. A report published by Ernest & Young ⁽¹⁾ shows that in 1999 the sector's turnover of 5 368 million euros was 45% higher than in 1998, while employment grew by 17% (to 53 511) and the number of companies by 15% (1351). On the latter point, Germany has

overtaken the United Kingdom, France is also doing well and, among the 'small' countries, both Finland and Belgium performed strongly. And although the sector is continuing to lose money, the deficit is less: 1 189 million euros in 1999 compared to 2 107 million euros in 1998.

(1) *European Life Sciences Report 2000*



Europe's relative gloom

It seems Europeans are not altogether happy with the way Europe is going. A poll carried out by Louis-Harris for the French daily Le Monde in December 2000 sought to define Europe's image by interviewing 6637 people aged 18 and over in eight countries. Although most of them (56%) are not really pleased with the way Europe is going, young people (aged 18-24) are generally the most optimistic, with 50% holding positive view. Overall, just 35% say they have confidence in the European Commission with the Germans (only 21%) surpassing even the British (31%) in their scepticism. The citizens of the United King-

dom continue to welcome the fact that they did not opt for the euro. In fact, 71% of all those interviewed found the development of the single currency less than reassuring and 52% of them regretted the decision to scrap their national currency.

But such opinions are not the product of a general climate of gloom. Europeans say they are in good spirits and 66% of them say they have confidence in the future.

Another kind of Europe?

A second poll sought to gauge reactions to the proposal by the German foreign minister to create a genuine European federation (see diagram). 41% of the persons interviewed are in favour of this, with 40% against and 19% 'don't knows'. Other statistics reveal more of a 'European feeling': 57% favour the creation of a European army, 68% favour the harmonisation of judicial systems and 62% of tax systems, and 79% believe that environmental protection would be handled more effectively if the EU had more powers. And most people think this would also help when it comes to combating money laundering (71%) and illegal immigration (71%).

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New on the Web

europa.eu.int/comm/research/

European Research Headlines

Every week, the home page of the Research DG's website on the Europa server now offers a selection of brief news items in English related to the European Research Area. Each item is accompanied by contact points and Internet links to find out more.

Downloadable documents

- ▶ *Commission proposal for the new framework programme*
- ▶ *Towards a European Research Area* (11 languages)
- ▶ *Annual Report 2000* - The EU's research and technological development activities (11 languages).

'What's new?'

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

Released on 13/2/01

- ▶ **Genetics and the future of Europe** - A dialogue of European dimension (Brussels - November 2000)
- ▶ *Proceedings of the conference 'Agricultural Research in the European Research Area'* (Versailles, december 2000)
- ▶ **L'industrie automobile européenne dévoile le moteur de demain** (Paris, february 2001)
- ▶ *Biosociety - the socio-economic impact of new technologies:*
Join our BIOFORUM

Released on 29/01/01

- ▶ **Commissioner Busquin and the European aeronautics sector present their '2020 Vision'** (Hamburg - January 2001)

Publications

Just published...

- ▶ **Talking science...: European Science and Technology Week 2000 / Special issue of RTD Info** - January 2001 / research@cec.eu.int / On the Web : europa.eu.int/comm/research/rtdinfo/en/january01/
- ▶ **Biomass: an energy resource for the European Union** / 17 p / eesd@cec.eu.int
- ▶ **Energy from fusion** / 4 p / patricia.libert@cec.eu.int
- ▶ **Renewable energy sources, the path to the future** / New leaflet in the *European research in action series* / 10 p / Available in 11 languages / research@cec.eu.int
- ▶ **Research and technological development in Europe - Examples of projects** / volume 3 / 78 p./ Presentation of 36 research projects in a range of disciplines and fields / Available in FR (EN and DE versions available shortly / research@cec.eu.int
- ▶ **Ethics, RTD and evaluation** / *The IPTS Report* / December 2000 / Available in FR, EN, DE, ES / On the Web : www.jrc.es/pages/f-report.en.html
- ▶ **Supporting the fight against TSE** / JCR newsletter - February 2001 / On the Web : ww.jrc.org/download/press/newsletters/letter200102-en.pdf

... and as a reminder

(research@cec.eu.int)

- ▶ **Towards a European Research Area** / Full text of the Commission communication / Available in 11 languages / 52 p. / On the Web, with all the latest documents on the ERA: europa.eu.int/comm/research/area_en.html

- ▶ **Science, technology and innovation: key figures 2000** / An update of performance indicators for European science and technology compared to the rest of the world / 86 p. (also as a PDF file <http://europa.eu.int/comm/research/pdf/keyfiguresihp.pdf>)
- ▶ **Brochures on each of the four thematic and three horizontal programmes of the Fifth Framework Programme** / Available in FR, EN, DE / 16 p.
- ▶ **Participating in European research programmes** / A practical guide to submitting research projects / Available in FR, EN, DE / 100 p.
- ▶ **Research and technological development in Europe - Examples of projects** / 2 volumes of 78 p. each presenting 36 research projects in a range of disciplines and fields / Available in FR, EN, DE / On the Web : europa.eu.int/comm/research/success/en/success_en.html
- ▶ **Results and research for SMEs** / Available in FR, EN, DE / 2 volumes of 25 fact sheets.
- ▶ **European research in action series** / 10-page leaflets on the responses of European research to the principal challenges of our times/ Subjects available: natural disasters, water resources, global change, employment, health, road safety, protection of cultural heritage / Available in 11 languages.
- ▶ **Man, nature, technology** / The three leitmotifs of Expo 2000 in Hanover reflected in progress in European research / Brochure published as an RTD info supplement / 36 p. / Available in FR, EN, DE

A complete list of new scientific publications from the RTD programmes is placed on the research website every two months: europa.eu.int/comm/research/pub_rtd.html

Diary

Key meetings during the Swedish presidency

Technology Foresight - The Swedish Agency for Innovation Systems - 19-20/3/01 - Stockholm

- ▶ **Cooperation between Academia and Industry with focus on the IT sector** - Ministry of Education and Science (MES)-17-18/4/01 - Karlskrona

Research Policy: Cooperation and Competition - The Swedish Research Council - 25-26/4/01 - Stockholm

- ▶ **Council Working Party on Research and Joint Working Party on Research/Atomic Questions** - MES - 16-18/5/01 - Västerås
- The Role of Candidate Countries in EU Research* - The Swedish EU-R&D Council - 21-22/5/01 - Linköping

- ▶ **Scientific and Technical Research Committee (CREST)** - MES - 30/5/-2/6/01 - Visby

- ▶ **Bioethics in research** - MES - 11-12/6/01 - Umeå

- ▶ **Research Council Meeting** - MES - 26/6/01 - Luxembourg

Contact

Helene Lindstrand - Ministry of Education and Science (MES)
helene.lindstrand@education.ministry.se
www.eu2001.se/eu2001/calendar/

Other events

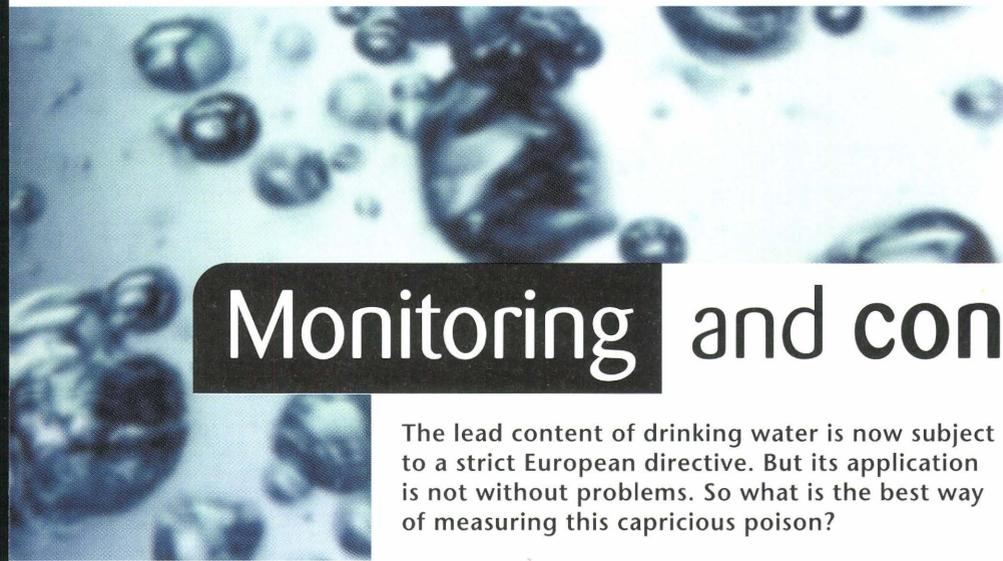
Minatec 2001: Micro and nanotechnologies for applications of the future / 2-6/4/01 / Grenoble (F) / www.minatec.com

Textures in the kitchen, how to get them / Workshop on Molecular Gastronomy 'N. Kurti' / 5-10/5/01 / Palerme (I) / hthis@paris.inra.fr

Refractory materials: manufacturing, methods of testing, application in metallurgical processes - Institute of Refractory Materials - 22-25/5/01 - Ustro - Poland - MJanik - imo22@imo.gliwice.pl

Food & Nutrition for Better Health (HEALFO) - Food, nutrition and health programmes & projects of the EC.- 14-15/6/01 - www.cmns.mnegri.it/healfo

A challenge for measurements - Institut de l'environnement industriel et des risques (INERIS) - 15-15/6/01 - Unesco Paris - www.env-conference.net/withfla.htm



Monitoring and controlling lead

The lead content of drinking water is now subject to a strict European directive. But its application is not without problems. So what is the best way of measuring this capricious poison?

TAP WATER must be fit to drink. That goes without saying. At the collection stage, distribution companies carefully analyse the water and carry out the necessary treatments to eliminate any pathogens. But after that another parameter comes into play, one which is singularly difficult to monitor and control: its lead content. Although there may not be a problem between the collection stage and transit through the principal distribution pipes, the risk comes through contact with the secondary pipes which carry it to the consumer's tap. Lead may contaminate the water as it passes through the branch pipes linking the public system for a particular street to the water meters in individual buildings, or as it passes through their old piping networks.

Because of its toxicity, lead is one of the most closely monitored chemicals under the new Community drinking water directive, which was adopted two years ago and was supposed to have been transposed into national legislation by 25 December 2000. The directive is based on WHO recommendations which set a maximum lead concentration of 10 micrograms/litre (compared to 50 µg/l at present). Member States have another three years to achieve an intermediate objective of 25 µg/l, and 13 years to meet the final target.

The new regulations will require a con-

siderable effort on the part of certain countries - France, Great Britain, Italy and Spain in particular - where a number of branch and internal piping systems are still made of lead. 'In Paris, the proportion is around 70%,' states Ierotheos Papadopoulos of the Environment Directorate-General. 'A socio-economic study financed by the European Commission puts the cost of making the necessary changes across the European Union at 35 billion euros.'

But there remains the matter of reaching agreement on how to assess the lead content of drinking water. When measured at the tap (as stipulated in the directive), the lead content varies considerably depending on the distribution zone, the individual building and even, within the same building, on the time of day or consumption habits. 'The stagnation time in lead piping is a crucial factor,' explains Alain Boireau, who is responsible for lead contamination at Vivendi Water. 'The longer the period of stagnation, the greater the amount of lead which is dissolved. Any measurement is therefore going to give very different results depending on the time of day it is taken.'

Measure for measure

Before the directive can be implemented coherently, the Member States must agree on a sampling method. A

recent study, supported by the Commission (*Developing a new protocol for the monitoring of lead in drinking water*), evaluated the various existing methods. None seems to be perfect. One of them, considered to be the reference method, was found to be very reliable in terms of obtaining a representative sample of the lead content of drinking water in a given building. It involves fitting a unit which draws off a small proportion of the water used to a flask. At the end of a week the flask contains a sample of water whose lead content represents the average for the building. However, apart from being difficult to implement, this method is also very costly.

Three other methods were evaluated on the basis of 300 samples taken in five countries. The first, known as *random daytime*, involves taking a sample at a random moment during the day in a randomly selected building. 'This method has no value as far as the individual building is concerned, but it can be a good indicator for a complete distribution zone, provided at least 30 samples are taken,' says Mr Boireau. 'The study showed that this was the most suitable method for compiling global statistics on a given country, region, town or neighbourhood. It is also the most economical of all the methods currently available.'

The second method, known as *fully flush*, involves taking a sample just

after the pipes have been cleared of any stagnant water. 'There is a need for campaigns to promote good practice,' points out Mr Boireau. 'It is advisable, for example, to use water for washing up before filling bottles with drinking water and to take your morning shower before drinking the first glass of water. On condition that people take these precautions, this method then makes it possible to check whether the lead concentrations present - after running off stagnant water from the system - are acceptable in terms of public health.'

The third method, known as 30 MS, involves sampling the water after 30 minutes of stagnation. This is then considered to represent an average lead

content for the user. The European study showed that this method gave results which were closest to the reference method, but also incurred a cost (an average of one hour on the spot to take the sample) which is unacceptable for routine health checks.

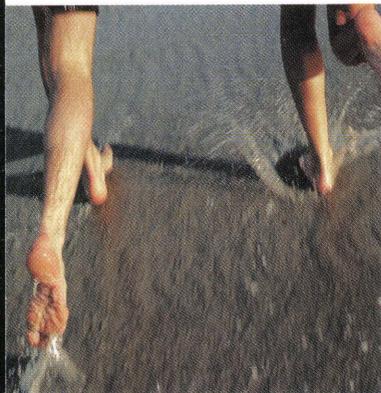
Pointers to a better choice

'The results of this study can serve as a basis for an interesting and concrete discussion,' believes Mr Papadopoulos. 'They have also highlighted the complexity of the problem and the importance of the precise moment when the sample is taken.'

Exposure to lead also depends on social, economic and cultural data

which are very difficult to determine. In southern countries, for example, old people more often live with their children than in the north, consuming water during the day and thereby limiting the stagnation. Similarly, houses which are permanently occupied differ from those which are empty part of the time.

The study results are now in the hands of the Commission, which plans to submit proposals to the Member States before the end of this year. ▀



Swimming in clear water

Thanks to meticulous monitoring, bathing water quality is improving considerably in Europe. But the lack of standardised microbiological measurement methods leaves the result open to dispute. A number of European research projects have tried to put an end to the discord, and, in the process, have provided good examples of what could become the 'support for Community policies' strand of the European Research Area launched by Philippe Busquin.

A POOR RANKING is bad for the image. Feared by tourist resorts, the European Commission's annual bathing water report, issued at the beginning of the summer, is awaited with bated breath. The latest edition (for 1999) notes a constant improvement in water quality for both coastal and river bathing water. In 1992, 84.9% of European beaches met the quality criteria laid down by the 1976 directive, in particular from a microbiological point of view. In 1999, the figure had climbed to 95.6%. For fresh water sites, the progress has been even

more spectacular: up from 47.5% in 1992 to 90.5% in 1999.

This optimistic picture is the result of constant efforts by the Member States and research carried out by laboratories with the aid of the Commission. But it remains open to debate. There is no standardised method for carrying out microbiological measurements in bathing zones - measurements designed to reveal possible faecal contamination. 'The 1976 directive remains vague on the methods of analysis, the result being that laboratories use very different meth-

ods. The measurements are not fully comparable,' explains Bert Van Maele of the Environment Directorate-General.

Disparities and limits

Since the early 1990s, the Union has therefore supported a number of research projects designed, first of all, to assess the disparities between the various methods used and, subsequently, to identify a standard method which all laboratories can adopt for their analyses.

••

Another drawback of the present system of monitoring bathing waters is that it is basically a retrospective method. Traditional microbiological tests take about 36 hours to give a quantified result. It is not therefore possible to envisage a day-to-day management of beaches on such a basis. The Commission's annual pre-summer report on bathing water quality is based on the average measurement taken every two weeks during the previous season.

It is therefore only general trends which are picked up, the effects of particular incidents often remaining undetected. A big storm, for example, can cause the drains in a coastal town to overflow for several hours with large quantities of dirty water flowing into the sea. The two or three days which follow could see a very sharp increase in the faecal microbe content of the bathing waters. If no measurement is taken during this relatively short period this increase could well pass totally unnoticed. 'Besides, at the present time we do not have the technical means at our dis-

posal to deal instantly with the problems of microbiological contamination,' explains Tristan Simonart, a researcher at the Pasteur Institute in Lille (FR). 'The tests do not yet exist. We will have to wait for a number of years.'

Forecasts and variables

A number of studies are being carried out at present to develop computer models that can forecast water quality on the basis of a wide range of possible influences, such as hydrography, weather, capacity of purification stations, population, drain design, etc. 'The purpose of these computer models is to predict a deterioration in bathing water quality so that, if necessary, certain beaches can be closed as a preventive measure,' explains Eddie Maier, a scientific officer with the Research DG.

The European Commission held a scientific workshop on this subject at Sitges (Spain) in June 1997. The experts concluded that a more proactive approach was 'technically possible' and would

provide 'a valuable and inexpensive instrument in many cases' in support of a directive on bathing water quality.

In its recent communication entitled *Developing a new bathing water policy*, the Commission notes that this research has given quite good results in the case of models for hydrographic basins which are small in size or only exposed to a small number of potential sources of pollution. But more extensive bathing areas with multiple potential sources of contamination require sophisticated forecasting models. Realistically, such models will probably be used only for the main bathing resorts. ▀

Choosing your microbes

Contact Jean-Marie Delattre

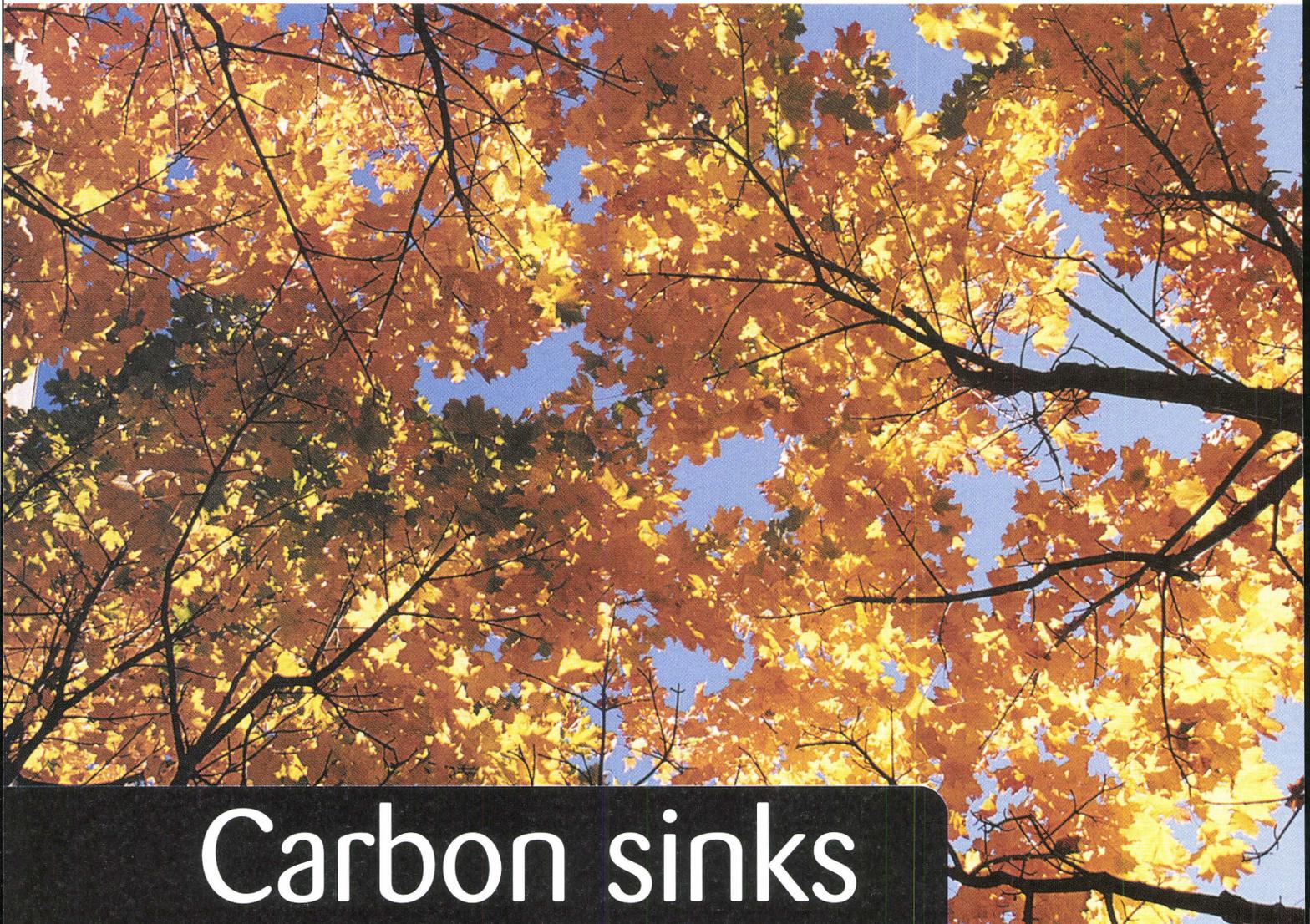
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The Microbath project (1996-1999), coordinated by the Institut Pasteur (Lille), set its sights on developing a standard method for analysing bathing water quality which could be used by all European laboratories charged with this task of protecting public health. 'It was first necessary to redefine the microbes selected as the best indicators of faecal contamination of the water,' explains coordinator Jean-Marie Delattre.

According to the 1976 directive, two families of bacteria are 'good indicators': heat-tolerant coliforms and total coliforms. 'The problem,' continues Jean-Marie Delattre, 'is that these families are much too big. They include many bacteria which have never seen an intestine in their lives. Today, everybody agrees that the best indicators are *E. coli* bacteria, and a group of four intestinal enterococci for recreational waters.' This selection is in line with the WHO proposal in its draft guidelines on recreational waters.

Sixteen European laboratories cooperated on the Microbath project which validated two microbiological reference analysis procedures for these two microbial indicators. The methods chosen allow a maximum margin of error of 5% and were tested on a samples of natural fresh water and sea water. During one season, the laboratories then compared their own methods with the new standardised methods. Today, the procedures adopted by the Microbath project are candidates for the status of CEN (European Standardisation Centre) standards.

The next Commission bathing water directive could make an explicit reference to a CEN or ISO standard. 'This means that the Member States should preferably use an ISO or CEN method,' points out Bert Van Maele (Environment DG), 'but they can also use other methods provided they show comparable results.'



Carbon sinks

to combat the

greenhouse effect?

Can forests reduce the concentration of carbon dioxide in the atmosphere, the principal cause of climate warming? This sensitive question was one of the reasons for the failure of the conference in The Hague in November 2000 which sought concrete international commitments implementing the 1997 Kyoto protocol. Such commitments are the subject of intense scientific debate, which the vast CarboEurope research network is seeking to help resolve.

'THE CONCEPT of carbon sinks is a recent one, originating around 1990 when climate change started to appear as a real threat,' remembers Riccardo Valentini of Tuscia University (IT), the co-ordinator of this research. 'Before that we had a static approach to the role of forest ecosystems in the carbon cycle, considering that, come what may, they were in a state of equilibrium, their carbon absorption capacities being offset by emission fluxes. Studies carried out in the meantime have shown that the concept of carbon sinks is indeed a reality and that the stocking ability of these sinks is far from negligible.' Research carried out by scientists over the past decade has brought us to an initial conclusion: terrestrial carbon sinks, globally estimated to average around 1.9 billion tonnes/year (gigatonnes) in the 1980s, rose to a capacity of 2.3 gigatonnes in the 1990s – an increase of almost 20%. This development represents a major potential for soaking up CO₂, one which the latest estimates put at about one quarter of present CO₂ emissions of human origin.

Opportunity in Kyoto

It was on the basis of this finding that the industrialised countries finally committed themselves to reducing greenhouse gases at the arduous Kyoto negotiations in 1997. According to the terms of the concluding protocol of this 'historic' conference (see box), carbon sinks resulting from deliberate policies of afforestation (the creation of new forests) or reforestation (the replanting of zones formerly given over to forestry, but abandoned since 1970) could earn countries green credits equivalent to a reduction in the sources of greenhouse gas emissions.

But this provision is proving a real problem due to the lack of an effective method for realistically quantifying such credits. Three years after Kyoto, the recent failure of the conference in The Hague has shown that some countries (most notably the United States) have seized upon this notion of forest carbon sinks as an argument for avoiding as much as possible any kind of restriction on their fossil fuel consumption. For its part, the European Union is showing itself to be much more reticent about this whole notion of carbon sinks: before backing this option of flexibility in reducing greenhouse gas emissions, it is demanding an effective and reliable quantification of the real capacities of terrestrial forest ecosystems to stock carbon.

The carbon cycle

A primordial element in the global ecosystem, carbon constitutes a fixed worldwide stock which is dispersed throughout the atmosphere, oceans and continents - according to a cycle governed by the continuous exchanges between each of these 'reservoirs'.

It is present in the atmosphere in the form of carbon dioxide (CO₂) and plays a vital role as a greenhouse gas, absorbing (together with clouds, dust and certain other gases such as high-altitude ozone) the infra-red rays emitted by the reflection of solar rays from the earth's surface. This ensures that average temperatures on earth remain temperate.

Carbon exchanges between the atmosphere and the continents are mainly produced by the breathing of living organisms (which release carbon dioxide) and plant photosynthesis (which fixes carbon to make organic matter). Natural disturbances (major forest fires, volcanic eruptions, etc.) can temporarily increase spontaneous emissions of considerable quantities of CO₂ into the atmosphere. But during the earth's long history, the continental reservoir has built up a quantity of carbon estimated to be three times the quantity present in the atmosphere, as a result of the processes of decomposition and fossilisation which are the reasons for long-term fixation in the form of coal, gas and oil. Since the beginning of the industrial age, the increasing combustion of fossil carbon, coupled with deforestation, has been the source of a permanent increase in the CO₂ in the air. Hence the increased greenhouse effect and the prospect of global warming.

The oceanic reservoir contains almost 20 times more carbon than the continental ecosystem. The considerable but largely unquantified exchanges of carbon dioxide between the air and sea are governed by a whole range of physical parameters, linked to solubility, and biological parameters, linked to absorption by planktonic micro-organisms. Vast quantities of carbon are stocked in the sea in the form of limestone sediments, too. Is it feasible to make use of the capacity of marine carbon sinks? Scientists believe that such action could lead to serious imbalances in oceanic ecosystems, in particular the proportion of oxygen essential to submarine life.

Many unknowns

The CarboEurope initiative aims to clear up the ambiguity and to advance our knowledge on these issues. Launched a year ago by the *Global change, climate and biodiversity* key action under the Fifth Framework Programme, it consists of eight multidisciplinary research projects involving 190 scientists and 69 institutions from 15 European countries.

Six of them, each developing their specific methodologies and then comparing their results, are concerned directly with Europe (Forecast, Carboage, Carboeuroflux, Recab, Aerocarb and Carbodata). Two others are studying important areas from the point of view of global carbon sink capacities, namely the carbon stocking capacities of the vast boreal (Eurosiberian carbonflux) and tropical (LBAcarbonsink, in Amazonia) primeval forests.

'The scale of the research reflects the many unknowns science is facing in this field, which require real scientific teamwork if they are to be resolved. To evaluate the phenomena, local measurements must first be carried out. These are then incorporated into models making it possible to extrapolate the results in space and time, leading to a final estimate of their contribution to the carbon cycle at the global level.'

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Treetop sensors



The Eddy Flux sensor technology developed by the Euroflux project (which preceded CarboEurope) is based on the measurement of rapid fluctuations in vertical wind speeds and carbon dioxide concentrations in the atmosphere. Placed on towers above treetop level, these devices carry out 20 measurements a second and calculate a net carbon dioxide flux between the vegetation and the atmosphere every hour. 150 of these instruments are currently operating worldwide, 50 of them in Europe.



The results obtained from these measurements in forests of every age and variety show that carbon fixation by European plant carbon sinks is far from insignificant, contrary to what earlier studies had suggested. It can be as much as an average of 6 tonnes per hectare per year, with boreal forests fixing less carbon than forests in the centre and south of Europe. In particular, the results show that these ancient forests fix more carbon than was previously thought.



From stock to source

According to CarboEurope's initial estimates for the European continent, every year 0.3 gigatonnes of carbon are fixed for every 2 gigatonnes emitted. 'These quantities are therefore far from negligible, but, more importantly, they are not constant,' believes Professor Valentini. 'The interannual differences can be considerable, of the same order as the sinks themselves, in particular due to the permanent variability of climatic conditions. When you have a global perturbation with a cycle extending over several years, such as that repeatedly triggered by the El Niño phenomenon or that of the *North Atlantic oscillation*, plant growth is greatly influenced and a forest sink can reverse its effect from one year to the next and become a source of CO₂ emissions.' But the uncertainty is not limited to the quantity of carbon dioxide absorbed by the continental biomass as there are also major questions regarding the limits and stability of this stock. 'The sinks can only be a temporary solution,' stresses Professor Valentini. 'Sooner or later the system's saturation level will be reached and the carbon dioxide stored released. The time gained in this way - 50 to 100 years at the very most - can be used to develop alternative solutions. But it is to be feared that the problem of carbon sinks will be used by the States as an excuse for delaying the vital emission reduction measures which are needed.'

All quiet on the environment front

What is more, reforestation solutions are also causing local and environmental decision-makers to ask some questions. When evaluating the impact of a reforestation project, every dimension, including subtle interactions, must be taken into account. Over the last two decades, the abandoning of agricultural land certainly contributed to a major increase in forest sinks between 1980 and 1998 in the European Union. It is estimated, however, that 4% of this increased carbon absorption is being offset by a constantly growing demand for wood, leading to increased imports and thus deforestation elsewhere on the planet.

Paradoxically, the Kyoto protocol highlighted the role of reforestation while remaining quiet about the huge problem of the destruction of ancient forests, in particular in the tropics. Deforestation in these areas, largely due to man, totals something in the region of 2 gigatonnes/year, or the equivalent of the gains expected from a policy of carbon sinks. But these virgin forests also represent stocks of an irreplaceable biodiversity which it has taken hundreds of years to create. Their destruction cannot be offset by accounts based on new tree plantations, which would necessarily take the form of monocultures over extensive surfaces. In this respect, the Kyoto protocol is in flagrant contradiction of another international convention, originating from the 1992 Rio de Janeiro conference, concerning protection of biodiversity (CBD). ▀

Kyoto, a questionable step forward

The Kyoto protocol, signed in Japan in 1997, will no doubt remain the symbol of a first historic step: the recognition of the need for humankind to unite in adopting a global policy when facing up to its responsibilities vis-à-vis the global ecosystem of which we are a part. Accepting the scientific evidence for man's impact on the Earth's climate, the industrialised countries unilaterally agreed - i.e. without requiring developing countries to make a comparable effort, which would be unsustainable given their current under-consumption of energy - to reduce their greenhouse gas emissions, principally the

carbon dioxide (CO₂) produced by burning fossil fuels. The agreement calls for an average 5% cut in greenhouse gas emissions - 8% for the European Union - compared to the 1990 emission levels. This is to be achieved over the next 10 years or so, that is by 2010-2012. But when it comes to implementing measures to achieve these ambitious objectives, the Kyoto protocol remains quite ambiguous. It simply recommends a number of measures to cut emissions - by increased development of energy-saving measures and the use of non-fossil fuel - while allowing some flexibility, the terms of which remain to

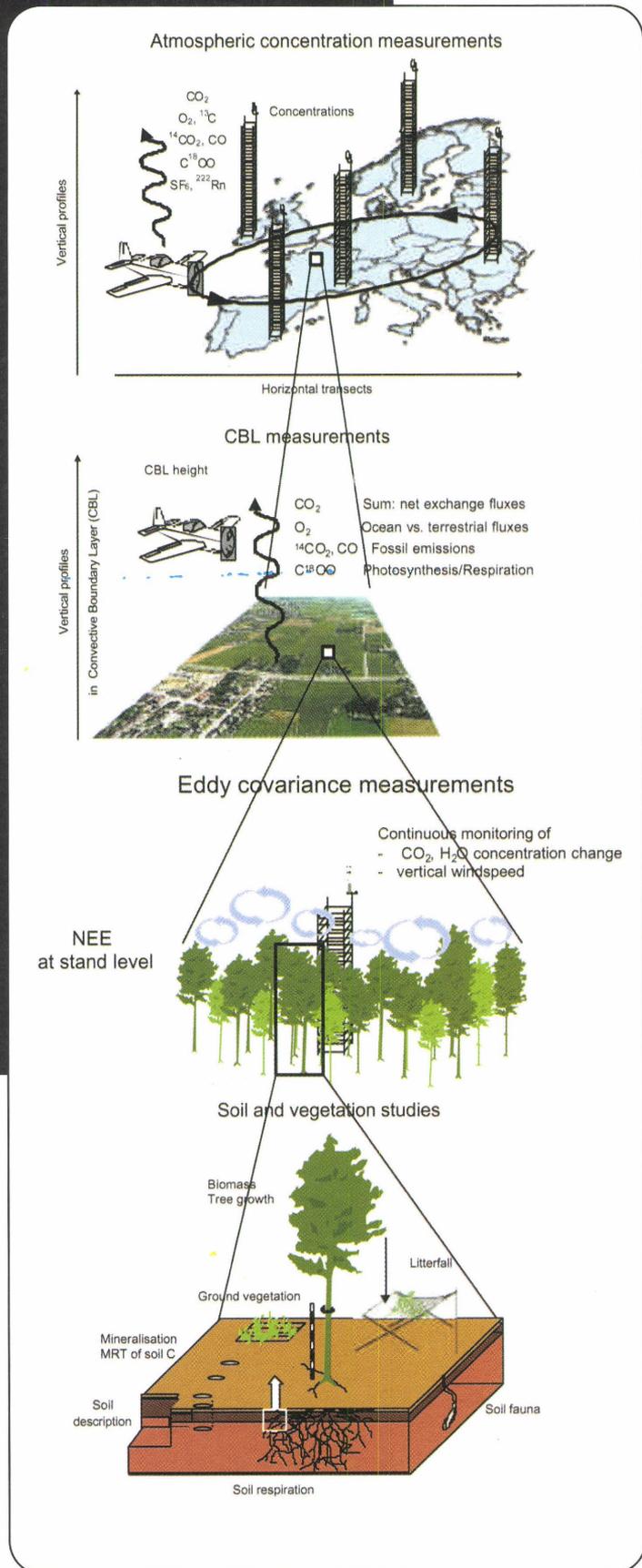
Bottom-up strategy, top-down verification

For local measurements, CarboEurope uses a new methodology, based on the measurement of radioactive carbon, which permits a better definition of the key role played by the soils in forest ecosystems. These forest soils – previously thought to be reservoirs without any major variation – can, in fact, capture as much as 30% or 40% of the total carbon fixed, depending on the type of forest and the climate. In the Italian birch forests, for example, the forest soil fixes 1.5 tonnes of carbon per hectare per year.

It is therefore necessary to record the net flux of carbon between the atmosphere and vegetation for the forest or any other planting for which a carbon exchange result is sought. This measurement is carried out by Eddy Flux technology (see box). This technology has been adapted for aerial measurements by scientists working on the Recab project, making it possible to work on the scale of 100 square kilometres and to incorporate data at a regional level. The principal advantage is to take account of all the carbon dioxide emissions caused by human activities.

Finally, the so-called reverse modelling method has made it possible to measure the carbon balance in the upper atmosphere (troposphere). Measurements of carbon dioxide concentrations made from the air enable carbon fluxes to be assessed at a continental level. As the carbon dioxide emitted by fossil fuels, the biomass and oceans have different isotopic characteristics, it is even possible to quantify their contributions to the carbon sources and sinks.

be defined. 'Emission licences' can be traded, for example, between rich and poor countries (in return for implementing clean energy development projects in the latter) while mention is also made of the storage of carbon in the vegetation.

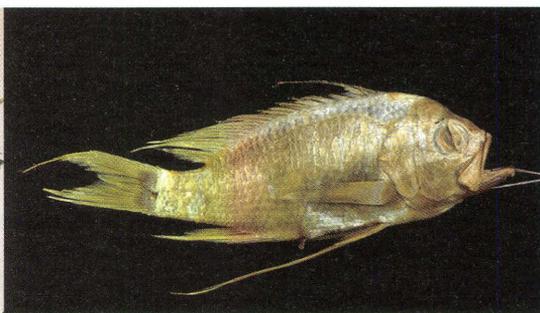


The hidden heritage

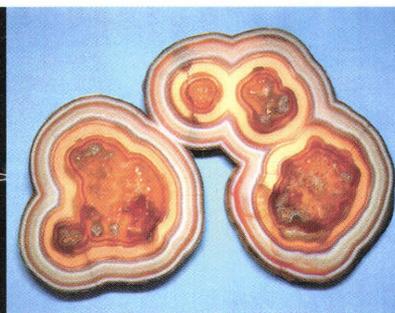
In its museums, botanical and zoological gardens, and universities, Europe has the richest collections of natural science in the world. But this valuable scientific heritage is too often ignored. Now, thanks to the ENHSIN project, a network of interconnected databases is set to combine these resources in a coherent and accessible infrastructure.



Cereus Napoleonis – Plate from Endlicher's *paradisus vindobonensis*, a work by Anton Hartinger describing specimens from the Botanical Gardens in Vienna.



Anthias anthias – a fish discovered during the first voyage of Captain Cook (1768-1771).



Agate – Sectioned mineral, showing the pattern of concentric circles around different points - Origin: Uruguay.

© The Natural History Museum, London

* *Taxonomy: science of the laws of the classification of living creatures, established by the Swedish botanist Carolus Linnaeus (1707-1778).*

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THE HOME of taxonomy*, Europe houses almost three-fifths of all 'type specimens' – those used to identify a plant or animal for the first time – in the history of the natural sciences. Its museums, botanical and zoological gardens, and universities possess collections of an incredible variety, in part enriched by its colonial past. 'Because they contain unique information on the distribution of species in both space and time, these collections represent a source of fundamental knowledge for research, especially in the framework of the international undertakings of the Convention on Biological Diversity,' explains Malcolm Scoble of The Natural History Museum in London (NHM). This agreement⁽¹⁾, signed in 1992 in Rio de Janeiro by more than 180 countries, seeks to 'conserve biological diversity, the sustainable use of its elements and the fair and equitable sharing of the benefits stemming from the use of genetic resources.'

'The collections are a source of essential references in this respect,' explains Simon Tillier, of the Muséum National d'Histoire Naturelle in Paris. 'If, for example, we discover a natural substance with potentially useful applications, we then need the means to compare it with reliable references so that we can share the

fruits of the exploitation of this biological resource with the countries it comes from.' Natural science collections can also prove very interesting tools for economic prospecting. 'The analysis of micro-fossils is a very valuable tool in the search for oil deposits,' continues Antony Weir of the NHM. 'And many museums have key collections of these specimens, which can be used as models and compared to samples obtained from experimental drillings.'

Due to the geographical dispersion of the collections and the variety of information support systems used to classify them, gaining access to this knowledge remains something of an adventure. Despite some progress in facilitating the consultation of general data on Europe's various museological collections (see box), there is still no structure enabling information recorded on a given specimen to be obtained directly. 'At present, a researcher who wants to record the number of species of mosquito present in European collections has no alternative but to write individually to each of the bodies likely to have some,' regrets Simon Tillier.

of natural history collections



© MNHN, Paris

Interconnecting

With the aim of rectifying this situation, a three-year project called ENHSIN (European Natural History Specimen Information Network) was launched in January 2000. Co-ordinated by The Natural History Museum in London, it aims to create an interactive system facilitating access to these valuable data. Among the most important are the place and date of discovery of each specimen, as well as the exact scientific name attributed to it. 'The idea is to create a permanent tool which allows for interconnection of the databases of the institutions housing the museum collections so as ultimately to build up a genuine European network,' says project coordinator Malcolm Scoble.

Seven institutions have already teamed up to work on developing this pilot network. The task is a considerable one in a field scarcely touched by information and communication technologies. 'Of the tens of millions of specimens housed at the Muséum National d'Histoire Naturelle in Paris, there is a computer file on just a small percentage of them,' explains Nicolas Bailly. 'And when databases do exist, they are not necessarily structured in the same way and the ways in which information is stored digitally can vary greatly from one institution to another.' The first step in creating a European network is therefore to harmonise, organise and structure the information on the specimens conserved in the museum collections.

Standardising

A number of groups have been set up. Apart from computerising its own collections, each of the partners is responsible, alone or in cooperation with others, for part of the general harmonisation work. One of the teams is identifying the needs and expectations of potential users of the ENHSIN network by circulating questionnaires, while another is studying any problems of intellectual ownership which could arise. Others are defining the overall structure of the database or its technical construction, namely a program which can consult the databases on the various institutions' servers via the Internet so as to retrieve the pertinent information on each specimen. Finally, one working group is looking at how such a project should be managed. Although access to the network must in principle be free, this does not rule out charging certain users, such as companies.

The work of the new ENHSIN network should progress rapidly over the coming months thanks to the survey results. At the annual meeting of the Taxonomic Database Working Group (TDWG), attended by the project partners last November in Frankfurt, there was even talk of using the initial results as a basis for creating a worldwide network. ▀

(1) See also Carbon sinks to combat the greenhouse effect, p.27

Biodiversity:

the network web

The ENHSIN project is specific in that it seeks to network an inventory of data on the many and varied collections of specimens in the care of Europe's natural history museums. It is also part of a major international effort consisting of many networking initiatives aimed at safeguarding biodiversity, a goal set by the UN Convention on Biological Diversity in 1992 at a conference in Rio de Janeiro.

Launched in 1997, the European BioCISE initiative aims to publish a catalogue on the Internet systematically classifying biological collections. On a global scale, the Species 2000 network, set up in 1994 by the International Union of Biological Sciences (IUBS), also has the objective of classifying all known species of plants, animals, fungi and other micro-organisms on Earth. To coordinate and ensure the coherence of these many efforts, a new global structure has been set up at the initiative of the OECD's Megascience Forum: the Global Biodiversity Information Facility (GBIF) which will help organise the networks. By joining forces with the international community in this effort, the European Union will provide crucial logistical support.

www.bgbm.fu-berlin.de/biocise/

www.gbif.org/

www.sp2000.org/



Is it true to speak of a European identity? How did the sense of belonging to Europe evolve during the 20th century? What are the factors which shape it? For the past decade more than a 100 historians have been networking, in small groups, on these complex issues which underlie the contemporary political debate. Their research won them a place among the finalists for the Descartes Prize. (*)

To be or not

Rooted in a common culture shared throughout a long history, the sense of belonging to the same area lies at the basis of the European identity. More recently, a European consciousness has been added to a moral and political consciousness.

IDENTITY is not the same as consciousness. Consciousness is not sentiment. The first task of the *European identities network* of researchers was to define these three concepts, and then to study their variations in time and space, and in different socio-economic contexts. 'Identity, that is the sense of belonging to Europe or the consciousness of being European, is linked to a socio-cultural dimension,' they explain in their presentation. Going back a long time, this identity is based on a shared civilisation and a common destiny. On the other hand, European consciousness is more recent - it emerged after the horrors of 1914-18 - and adds a moral and political dimension to identity: 'It is already a consciousness of the need to build Europe.' Finally, under the influence of consciousness and sentiment, European identity develops towards a sense of belonging to the European Union, even if this is still fragmentary. These different 'states' do not, however, develop linearly.

Identification and behaviour

After the first phase involving 120 researchers working from 1989 to 1994, a network of 180 historians continued the exploration in two directions (1995-1999). On the one hand, they investigated the processes by which European identities are formed and the resistance they meet and, on the other, the behaviour, alliances and action which help give birth to consciousness and sentiment, the mortar of European integration.

'We first wanted to focus on relationships between European identity and national identity, or European identity and *Western identity*,' explains Robert Frank, a professor at the Université de Paris I (Sorbonne) and the network's co-ordinator. 'We wanted to gauge to what extent national diversities are an obstacle to this process or, on the contrary, if they are perhaps a component of it.'

Some groups studied cultural transfers - 'influences' in terms of lifestyle or ways of thinking - between countries and the part they may have played in creating the concept of identity. Others studied the same phenomenon with reference to regions, social classes, religious beliefs, the media, etc.

A sense of belonging

Two components of European society were the subject of more precise research: the economic players and intellectuals (see box). The sentiments of the former seem to be marked by a constant desire to 'build' Europe. The motivations of the latter are more complex and less constant.

It was in the 1920s that business managers first became aware of the importance of external competition - mainly from the United States - and of the benefits of joining forces. They thought in terms of the 'European area' and the Franco-German axis, the latter becoming one of the cornerstones of European

Fortunous intellectuals

Intellectuals, especially German and French, played an important role in the formation of a European consciousness in the period between the wars. Based on pacifism and linked to Europeanism, this movement was partially interrupted by the Second World War. The Cold War and decolonisation brought a long period of indifference on the part of intellectuals, most of whom took up positions in favour of either the East or the West, against colonialism, for the Third World, or supported Marxist theories and structuralism. 'Paradoxically, the intellectuals were

interested in European unity as long as it was not becoming a reality. When Europe actually began to integrate, they turned away from it, finding it too economic and technological,' points out Robert Frank. Since the decline of the major ideologies and the fall of the Berlin Wall with its symbolic value, there has been a new confidence among intellectuals in the democracy embodied by Europe, as opposed to that of the United States. 'Europe is becoming an area which can provide shared values and propose a certain kind of globalisation which is not the US model.'

to be European

integration and already an important 'sub-area', that was soon to be destroyed by the Second World War.

'Monetary Europe and social Europe are more rooted in history than is generally believed. These two areas are two very important elements in the sense of belonging.' (1) Professor Frank believes that social Europe is of fundamental importance in strengthening a common identity. 'Europe will become a reality when its citizens have the real sense that it helps them progress in their day-to-day lives. For decades the nation state had a monopoly on welfare, and the welfare state has continued to exist in our countries, despite the onslaughts of neo-liberalism. Europe could now shoulder part of the burden and become welfare-Europe.'

The sense of belonging therefore needs to have its roots in the concrete. In this respect the euro is a valuable tool. Pragmatic and symbolic - while also providing a political instrument - the euro could make up for the deficiencies and strengthen the sense of identity. 'The general public is aware of the poor distribution of powers in Europe. Many Europeans no doubt want more from Europe, while remaining dissatisfied with the way Europe is being created. They have the feeling it interferes in questions of no importance because it is incapable of resolving major issues. Institutional changes, both real and symbolic, could boost motivation for Europe and thus act as a catalyst. Recent progress towards European defence and a rapid reaction force for the EU is encouraging in this respect.'

Elusive Europe

But what Europe are we talking about here? Where should we set the limits to this Europe in the making? Is it enough to experience a sense of belonging in relation to a political area to integrate into and become a part of it? 'Although the Russians have a European cultural identity, is it true to speak of their European political identity when most of them believe that Russia is a political entity in itself? Can we deny Turkey's European cultural identity on the grounds that it is a Muslim country? No, because Islam is also part of Europe. In this case, too, it is Turkey's political identity which will be the determining factor.'

The notion of the European area is one of the research network's future projects - a network now enlarged to include Polish, Hungarian and Russian historians, and seeking to include a range of disciplines. In addition to the palpable and concrete notion of area - northern, southern and central Europe, etc. - they will also be looking at the 'abstract' area. 'Is there a European democratic area, symbolic areas, a European-opinion area? These are all complex questions. Take just one example. There is often the feeling that there are national opinions on the one hand, and international opinion on the other, in the form of major global emotions. But the intermediate area - European opinion - is much more difficult to detect.'

(1) All quotations are from Robert Frank.

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Publications

The first stage of the research is reported in seven publications, summarised in the single volume entitled *Identités et conscience européennes au XXe siècle*, published by René Girault, Paris, Hachette, 1994. Ten publications present the second stage of the research, for which a summarising volume is about to be published.

(* Awarded for the first time in November 2000, this prize rewards excellence in European research conducted through networks. see RTD info, special edition, January 2001 (<http://europa.eu.int/comm/research/rtdinfo/en/january01/>) and www.cordis.lu/improving/src/hp_awa.html.)

The mathematician came in

Winner of the 1998 Fields Medal - the mathematics 'Nobel' - Maxim Kontsevich is a member of the brilliant Russian school of mathematics which was scattered across the West following the collapse of the Soviet Union. We retrace the route of one of 'greater Europe's' masterminds who decided to stay.

BURES-SUR-YVETTE, south of Paris. This leafy suburb is home to one of the major centres of mathematics and theoretical physics, the Institut des Hautes Etudes Scientifiques (IHES). Maxim Kontsevich has taught here since 1995.

This quiet mathematician was born in Khimki, near Moscow, in 1964. Born into a cultured family - his father was an expert on Korean language and history, his mother an engineer, and his older brother a researcher in computer imaging - during his last three years at secondary school in Moscow, Kontsevich took special advanced courses in maths and physics, admission to which was by competition only. These subjects have fascinated him since he was an adolescent ('thanks to my brother and some very good books').

His talents were first displayed in the mathematics Olympiads, a high-level competition in which he was ranked second nationally. This success - at the age of 16 - won him a place at Moscow University. His high ranking in the Olympiads allowed him to bypass the rather subjective entrance examinations at a time when university policy had a clearly anti-Semitic slant (Kontsevich is pronounced in a way which resembles a Polish Jewish name, a fact which has caused his brother a lot of problems).

After completing his studies, Maxim Kontsevich set to work on his doctoral thesis. He opted for a subject in the field of mathematical physics. At this same time he joined the Institute for Problems of Information Processing, a Moscow laboratory attached to the Academy of Sciences, where he undertook research in mathematical theory.

Witten's conjecture

His career took an international turn in 1990 when he was invited to spend three months at the Max Planck Institute in Bonn (DE). The visit culminated in a conference and seminar at which the guest speakers included Sir Michael Atiyah, 'an eminent British mathematician who spoke of wonderful things, most

Fields, strings and knots

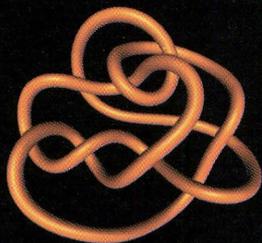
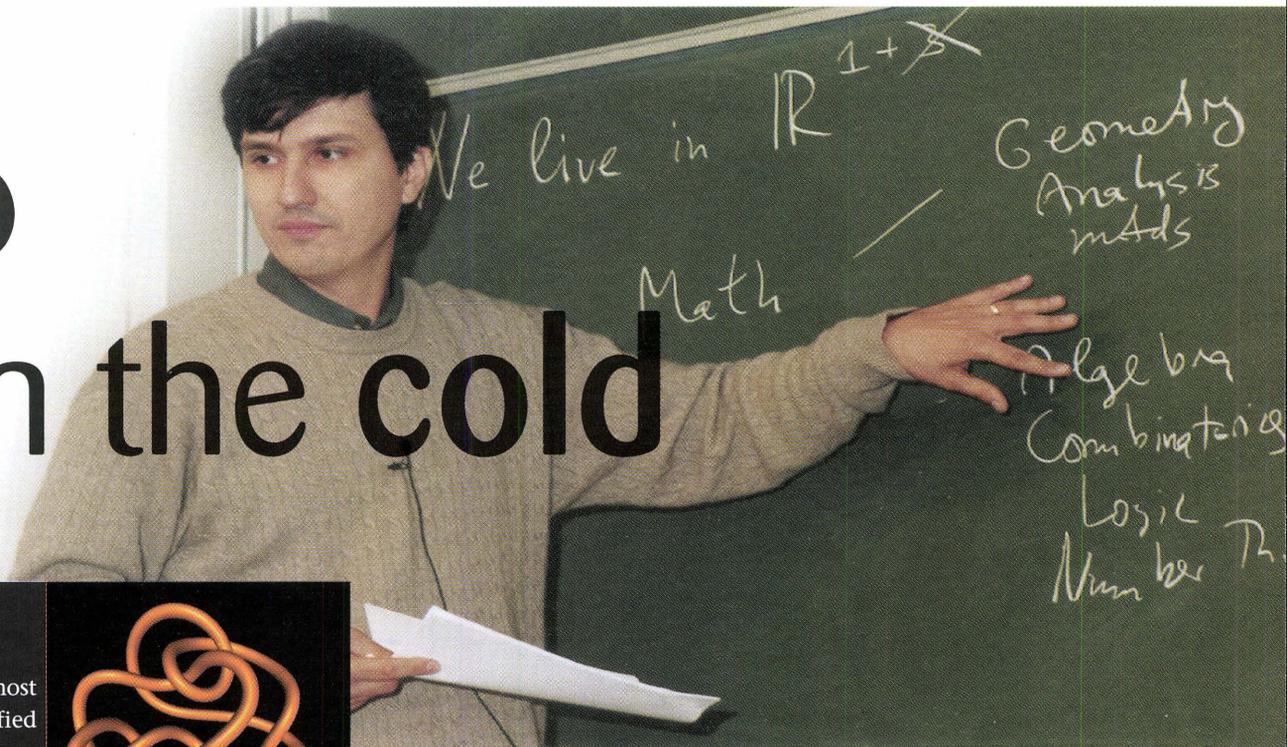
Maxim Kontsevich's research cuts across many fields of pure mathematics, mixing algebra, geometry, analysis, topology, combinatorics, etc. Some of his work is inspired by theoretical physics, in particular string theory and quantum field theory, which applies quantum theory to the interaction between elementary particles. Among other things, this theory helps us understand the interactions between electrons and photons, which are the 'energy packets' of an electromagnetic field. One of physics' main unresolved problems is that we still do not have a coherent theory of this kind which can be applied to gravity, even if preliminary models of quantum gravitation have been proposed and studied. One of Kontsevich's contributions has been to demonstrate the mathematical equivalence of two of the models.

importantly Witten's conjecture.' This was a major conceptual development based on certain geometrical aspects of string theory. Developed in the late 1980s, this complex approach takes the view that the fundamental particles of physics are not point-like objects but minute, one-dimensional strings existing in a multi-dimensional 'spacetime' (current theory puts the number at 11).

Kontsevich was 'obsessed' by what he had heard and the next day, during a final boat trip on the Rhine for conference participants, he explained to his colleagues how he intended to prove Witten's conjecture. The project sounded so impressive that he was invited there and then to return to the Max Planck Institute as a visitor for a full year.

The young Russian mathematician was to spend a number of periods at the institute and it was in Bonn that he obtained his doctorate in 1992. His German 'visit' in fact lasted until 1994, interrupted by stays of several months in the United States at the invitation of Harvard University,

who from the cold



ring theories seem the most likely to lead to a unified quantum description of gravitation and the other three fundamental forces. Witten's conjecture, which Kontsevich was able to prove and help bring to wider attention, concerns one of their mathematical aspects. Kontsevich has also worked on the mathematics of knots, a field which, though it seems to be further from physics, is not without its applications. The big question here is to find the criteria making it possible to state that two complex knots of string are equivalent (meaning that one can be transformed into the other without cutting the string). Kontsevich has found new knot 'invariants' - an invariant being a mathematical object (a number, function or other) which characterises all equivalent knots.

the collapse of the Soviet Union the famous Russian school found itself scattered across the globe, '...especially in the United States, but also in Europe, where France is the principal host country. At the IHES alone, with Mikhael Gromov and Nikita Nekrassov, the Russians make up half the resident professors...'

What Maxim Kontsevich likes about mathematics is what he calls its 'beauty'. And more specifically the beauty of the structures he discovers in it.

Kontsevich is also visiting professor at Rutgers University in the United States, now home to his former teacher Israil Gelfand. Together with his fellow countrymen, he is therefore helping to keep alive, in the diaspora, something of the tradition which brought such renown to the Russian school of mathematics. 'The style is difficult to define, but it can be described as very open, universal and intuitive. You find it more in Europe than in the United States where researchers tend to be very specialised.' This Russian eclecticism is apparent in Kontsevich's own work which covers virtually the whole spectrum of mathematics: 'I have worked on almost 20 different subjects, in many fields.' In 1998, his research won him the Fields Medal, a leading, international prize awarded every four years to four mathematicians under the age of 40.

Often linked to questions originating in string theory and quantum field theory (the theoretical and mathematical field which describes the world of elementary particles), the work of Maxim Kontsevich deals with general mathematical structures that appear in fields which do not seem at first to have a great deal in common. But it is not the possible applications of a particular field of physics or technology which interests him, nor the rigour of mathematical demonstrations. What Maxim Kontsevich likes in mathematics is what he calls its 'beauty'. And especially the beauty of the structures he discovers in it.

Princeton's famous Institute for Advanced Studies, and the University of California at Berkeley, where he was a professor from 1993 to 1996.

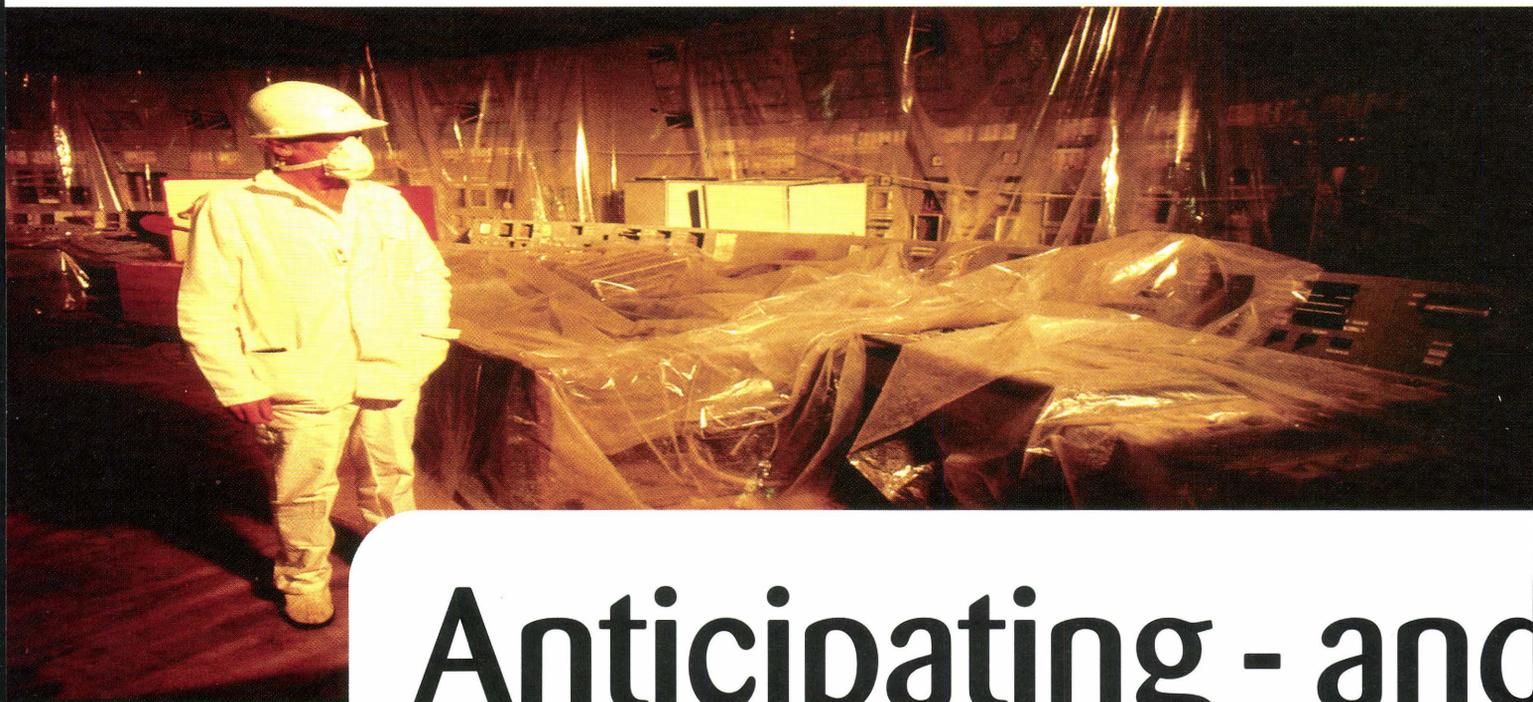
Like many of his compatriots condemned to exile, Kontsevich could have settled permanently in the United States. He had a post at Berkeley, not far from San Francisco where his brother was living. He was in fact on the point of buying a home there when the IHES offered him the post of resident professor. He knew the institute's reputation, having spent a few days there in 1988 during a short working visit to France.

Russian eclecticism

So why did he decide to head back across the Atlantic to Europe? 'This institute offers total freedom in research, with no hierarchy and virtually no bureaucracy. What is more, the Paris region is the world's leading mathematics centre.' That used to be true of Moscow and Leningrad, but with

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<http://www.ams.org/new-in-math/cover/kontsevich.html>
<http://www-groups.dcs.st-and.ac.uk/~history/Societies/FieldsMedal.html>



Anticipating - and - the worst



At Cadarache, in the south of France, the Phébus reactor is being used to simulate nuclear accidents. Conducted as part of an ambitious international programme, these experiments aim to anticipate the effects of such incidents, hopefully to prevent them from happening in the first place, and to avoid the worst if they do.

One of the aspects studied by the Phébus FP programme is the degradation experienced by a cluster of fuel rods subjected to intense heat. This involves characterising the deformation and displacement of the materials which make up the rods, following their partial liquefaction.

These tests are carried out using tomographic techniques (transmission tomography, γ -ray emission tomography, etc.) which make it possible to reconstitute the internal and three-dimensional structure of the fuel cluster.

Above: 3-D tomography of the fuel cluster degraded during the FPT-1 test.

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12 OCTOBER 2000: the staff at the Institut de protection et de sûreté nucléaire (IPSN) are busy in the control room of the Phébus experimental reactor. After long months of preparation, the time has come for the 'FPT-2 test'. At 09.23, the operators start up the reactor, progressively increasing the power. The flow of neutrons heats up the main 'guinea pig' in the experiment: a 'bundle' of 20 nuclear-fuel rods – containing uranium oxide pellets – placed at the centre of the reactor, where the temperature starts to climb to over 2 500°C. This simulation causes a degradation in the materials tested similar to that caused by the very worst nuclear accidents. The process ends at 14.52 when, having consulted the many instruments placed in the device, it is decided that the fuel degradation and related emissions of dangerous materials have reached the expected levels.

The drama of the experiment was followed by a variety of operations and physico-chemical examinations of the aerosols emitted and the chemistry of the radioactive products. Throughout the test, samples were taken - at regular intervals and at different locations inside the circuits and the container shell - of the elements released as a result of the intense heat and the melting of part of the test fuel bundle. These operations continued until 17 October. The researchers then started to collect the samples taken for analysis and to examine the cluster and its components. The post-experimental phase is still continuing. It will be another two or three years before the final conclusions of the FPT-2 are available, when all the experimental results have been acquired, analysed and interpreted.

Phébus, technical specifications

Phébus is a small experimental reactor (40 megawatts), able to hold a zircaloy-clad test bundle of 20 one-metre fuel rods in a centralised watertight cell and to heat it by neutronic irradiation. An absorbent rod in a silver-indium-cadmium alloy lies at the centre. This represents the control rods which are inserted to various depths into the heart of a nuclear reactor to absorb the neutrons and thereby regulate or stop the fission reactions.

The test bundle is contained in a sealed cylindrical envelope, cooled by circulating water, and irrigated by steam

which collects the products formed and carries them to a section of the cooling circuit. This represents the principal elements of the primary cooling circuit of a pressurised water reactor. The steam carries the fission products and other materials which escape from the fuel cluster to a containment system measuring 10 m³, which represents the container building in a nuclear reactor. This is a way of reproducing a rupture in a reactor's primary circuit resulting in the steam and the substances it is carrying being released into the container building. In Phébus, the fission products are deposited on painted surfaces (making it possible to study the action of the paint which reacts to the iodine) or in the sump at the bottom of the container.

The circuit, the container and the sampling devices are placed in a watertight housing known as a 'caisson' measuring 350 m³, which isolates them from the exterior and prevents any emissions into the environment. The caisson itself is situated in an experimentation hall protected by concrete one metre thick. The experiment installation is also equipped with approximately 250 measuring and sampling instruments: several dozen thermometers distributed throughout the fuel cluster and enveloping structures (to monitor the state of degradation of the test cluster), gamma ray spectrometry devices (to monitor the length of the circuit, and in the container changes to the fission products carried by the steam), and devices measuring the aerosols and the composition of the gaseous and liquid phases in the container.

avoiding

Six global experiments

This simulation was carried out under the European Phébus FP programme,⁽¹⁾ the most important international research project in the field of nuclear safety. The aim? To study as closely as possible what happens to fission products - the substances created by the fission reactions of the atomic fuel core - in a situation that simulates a serious accident in which the reactor fuel melts, in full or in part. In other words, it is a question of evaluating what quantity of extremely harmful radioactive products are likely to be emitted into the environment and in what form - gas or dust.

Phébus FP is distinctive in that it carries out research on safety by means of global experiments at an installation (see box) which reproduces on a reduced scale, in the region of 1/5000, the principal configurations of a pressurised water reactor (the most common type in the West). Phébus FP therefore complements experimental studies that focus on specific effects but are incomplete and on a smaller scale.

FPT-2 is the fourth in a series of six simulation exercises, the first of which was carried out in 1993. The main differences between them lie in the fuel tested and the flow rate of the steam. The irradiated fuel (i.e., fuel which has already been used in a reactor) employed in last October's



View of the interior of the caisson used in the Phébus FP programme, which contains elements simulating the cooling circuit of a damaged nuclear reactor.

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FPT-2 simulation is equivalent to that found in operational nuclear power stations, and produces greater quantities of fission products. The variation in the steam-flow rate determines the degree to which the fuel and its zircaloy (an alloy of zirconium) cladding is oxidised. The oxidation of zircaloy is an exothermal reaction which emits hydrogen and thus poses two major threats in a damaged reactor where the core is excessively hot: the physical degradation of the fuel, and the production of hydrogen which can lead to the build-up of excess pressure in the container building.

Confirmations and surprises

The results obtained to date by the Phébus FP programme confirm much of what was already known, but also indicate a number of important effects which were not expected and had not been taken into account by the modelling and computing codes used to study serious accidents: the hydrogen produced by the oxidation of the cladding had been underestimated; the melting at the core, that is the liquefaction of the fuel rods, occurred at temperatures several hundred degrees lower than anticipated; and a small part of the radioactive iodine - one of the principal products of highly

radioactive fission - penetrated the container shell in the form of a gas (bringing an increased risk of emissions in the environment) when it was believed that it would be in the form of solid caesium iodide particles. On the other hand, the silver produced by the melting of the control rod proved to have a positive effect as it trapped the rest of the iodine in solution in the sump water, thereby reducing the quantities released in gaseous form.

These results demonstrate the benefits of the research. They are already being included in the accident computing codes used throughout the world, such as the ICARE 2 core deterioration code developed and used in France by the IPSN, or the ASTEC global code which the IPSN developed in cooperation with its German partner the GRS (Gesellschaft für Anlagen und Reaktorsicherheit).

The next experiment (FPT-3) is scheduled for 2003. It will be similar to the test which has just been carried out, but with a control rod made of boron carbide (B_4C) - as used by many reactors - rather than Ag-In-Cd alloy. The aim is to study the deterioration of the fuel in the presence of boron carbide as well as changes to the chemistry of the fission products, particularly the iodine. Scheduled for 2006, the final test is still being defined. It should simulate an

accident scenario in which the air penetrates the interior of the reactor core (following an accident when recharging the core or rupture of the vat by the melted core, for example). Once all six Phébus FP experiments have been carried out, analysed and interpreted, the world community will have the knowledge necessary to significantly improve the prevention, evaluation and management of serious nuclear accidents. But Phébus FP will not have the last word. The Phébus-2000 programme, currently being developed, will continue the work. ▀

(1) FP - 'fission products';
FPT - 'fission product test'.

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A programme of global interest

The Phébus FP programme, launched in 1988, is being implemented by the IPSN in cooperation with the European Commission's Joint Research Centre (JRC). It brings together 35 bodies representing most of the countries which operate nuclear power stations. About 100 engineers and technicians are permanently employed on the project at the CEA (Commissariat à l'énergie atomique) in Cadarache (FR), with a dozen radiochemistry laboratories worldwide involved in the analysis phase.

Phébus FP's total budget is in the region of 150 million euros spread over 15 years, most of it provided by the IPSN, with the European Commission contributing about 25%. Of the 12.8 million euros devoted to research on

nuclear safety, 4.5 million euros goes to Phébus FP under the Fifth Framework Programme (1999-2002).

There are also several specific projects related to the prevention and mitigation of severe accident consequences, co-sponsored by the EU under the Fourth and Fifth Framework Programmes⁽¹⁾. Some of them are directly linked by Phébus issues and are aimed at supporting it, for example, by contributing to pre- and post-test analyses, and by applying validated numerical models to reactor assessment studies.

(1) Proceedings of 'FISA 99 - EU Research in Reactor Safety' - EUR 19532 EN