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Road safety: Staying out of harm's way

Portrait:
Ph. Busquin and M. Godelier

Environment:
Agriculture and the life sciences: food for thought

Editorial

Double-edged science

The Iraqi conflict has again highlighted the 'effective' contribution of science and technology to military power and is a reminder, if one may sum it up so brutally, that the development of a civilisation is also measured by the sophistication of its weapons.

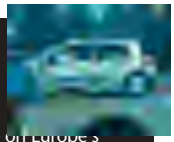
In this context, a recent Eurobarometer survey carried out in the future Member States of the European Union sheds an interesting and topical light on the issue (see page 16). This first opinion poll carried out in Central and Eastern Europe on the subject of science and technology reveals that 60% of the inhabitants of this region, and 69% in the 15 current Member States believe that scientists share responsibility for any use – good or bad – to which their discoveries are put. Almost 45% of all Europeans think that scientists are responsible for the way their discoveries are misused by others. This means that Europeans do not only see scientists as members of a society in which they share responsibility for decisions taken, they also associate them with the negative uses of science. In terms of its impact on the image of researchers, science could also be seen as a victim of the 'collateral damage' of the war in Iraq.

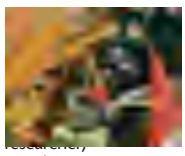
This confusion in the public mind between science itself and the uses to which it is put is, of course, regrettable. Should the scientist who discovered the HCN molecule be held responsible for all the murders committed since by cyanhydric gas? The situation becomes more complicated, however, when scientists themselves take an active part in the applications of their science.

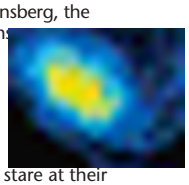
The First World War, for example, sparked a genuine moral crisis in scientific circles when the role of science in the massacres of the conflict was called into question. During the Second World War, and contrary to popular belief, it was not the politicians who commissioned the scientists to develop an atom bomb, but the very opposite: two physicists, Léo Szilard and Enrico Fermi, made strenuous efforts to convince the allies of the need to build such a bomb. Finally, it was after enlisting the support of Einstein that the research was initiated. In 1948, the physicist Robert Oppenheimer, who headed the formidable research effort at Los Alamos, summed up the opinion of many scientists as follows: 'In some sort of crude sense, which no vulgarity, no humour, no overstatement, can quite extinguish, the physicists have known sin, and this is a knowledge which they cannot lose.'

'Equations do not explode,' wrote Bertrand Russell. But at a time of a blurring of the boundaries between fundamental and applied research, one may be excused for doubting whether a dividing line between science and its applications can still be drawn. In an age characterised by the omnipresence of science and the intervention – some would say invasion – of technology in all areas of life, it is no longer possible or desirable to separate science from society. In this respect, we must note – and regret – the silence of scientists at the present time.

DOSSIER







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Technology puts road safety first

The problem of road safety is often discussed but never solved. It has now become a social priotity of top importance for the European Union. The results of technical progress at European level play an essential role on this front.

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European Community responsibility for road safety was originally limited to simply drawing up homogenous standards, with a view to the single market, applicable to vehicle equipment such as seat belts, ABS braking systems and laminated windscreens. With the adoption of the Maastricht Treaty in 1992,(1) the Union acquired extensive powers to submit road safety recommendations to the Member States – in some cases binding ones.

The 1997-2001 action programme was Europe's first attempt to take stock of the road safety issue and to reflect on the priorities for improving it(2). The September 2001 White Paper on a common transport policy for 2010(3) subsequently set the ambitious target of halving the 40 000 or so deaths a year on the Union's roads.

This commitment to combating the scourge of road accidents reflects public opinion, which is increasingly aware of and outraged by the scale of the carnage. Such a strategy includes stricter and more effective implementation of tougher regulations, as well as preventive measures and campaigns to train and educate road users.

The role of technology

Current developments in passenger protection technology – or 'passive' vehicle safety – as well as 'active' safety, are helping to achieve this ambition of a drastic reduction in road deaths. Information and telecommunication systems are enabling 'intelligent' vehicles to interact with other vehicles and the road environment.

It is crucial for these technological innovations to be implemented at European level. Efforts to provide common and compatible passive and active solutions must be coordinated throughout the Union, in terms of the automotive industry and the public authorities responsible for approving standards and managing infrastructure.

Over the past decade, European programmes have provided growing support to the development of cross-border co-operation – both public and private – in research on safe vehicle design and the development of intelligent systems. These two avenues of research will continue to benefit from major EU financing to create networks of excellence and to set up integrated projects within the priorities of the Sixth Framework Programme. These fields are also supported by the European Vehicle Passive Safety Network (EVPSN) and eSafety initiatives, which are designed to bring together all the main players – scientists, manufacturers, and road safety and infrastructure authorities – with the aim of building a European strategy strengthened by R&D and the application of results.

The following pages provide a picture of on-going efforts to ensure that, by 2010, Europe's roads will claim half as many victims as they do today.

(1) Article 71 of the Maastricht Treaty.
(2) To read the conclusions, go to: europa.eu.int/eur-lex/en/com/cnc/2000/com2000_0125en01.pdf
(3) For more information on the White Paper, go to: europa.eu.int/comm/energy_transport/en/lb_en.html

Actively engaged in

Multidisciplinary research into 'passive' vehicle safety studies everything – anatomy, statistics, data processing and material physics – which could help protect road users in the event of an accident. With Union backing, the European automotive industry and public research centres are pooling their expertise to come up with solutions.

'Of course, research is not everything,' admits Jac Wismans, head of R&D at the Dutch research centre, TNO Automotive, and coordinator of the European Vehicle Passive Safety Network (EVPSN). 'Drivers must continue to wear their seatbelts, respect the highway code, and drive with due care and attention. But there is no such thing as a zero accident rate. Progress in passive safety requires studies and very long and costly trials, but these efforts – which often result in only minor vehicle modifications – are paying off. Given the social cost of accidents, the €30 million Europe has invested over the past five years – in addition to the extensive research by motor manufacturers themselves – is fully justified.'

Set up in 1998, the EVPSN consists of 70 European partners (manufacturers, parts suppliers, research bodies, laboratories) who are currently working on some 15 projects. 'Our aim is to bring together researchers and stimulate European co-operation,' explains Jac Wismans. 'But also to disseminate results, help to launch new projects, avoid duplication, and identify research needs.'

Accidentology

There is more to passive safety than driving cars into walls. Several projects have been devoted to the study and analysis of accidents, both statistically and in terms of what actually happens in an accident. 'We are aware, for example, that the population groups involved vary significantly depending on the type of accident,' explains Dominique Césari, head of the INRETS (Institut national de recherche sur les transports et leur sécurité - France) experimental centre. 'Children and pensioners suffer a great deal as pedestrians. It is mainly young men involved in motorcycle accidents. A disproportionate number of elderly people are involved in side impact collisions, due to their reduced field of vision and driving strategy. All these factors clearly affect the kind of protection to be implemented.'

Information of this kind, taken from national studies, is becoming available at European level as a result of the efforts made in recent years to harmonise data. The recently completed *Stairs* project set up a standardised system for recording accidents and injuries. This work is now being pursued further by the *Pendant*

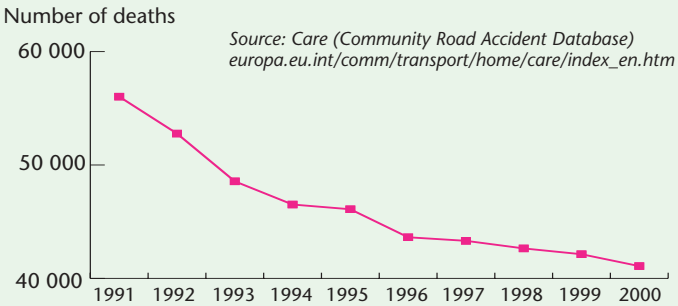
A deadly but declining toll

Every year more than 40 000 people die on Europe's roads, which is the equivalent of a crash killing 100 every day. Over a 10-year period (1991-2000) the death toll on the Union's roads amounted to the population of a town of 500 000 inhabitants. A further 1.7 million are injured, some retaining permanent disabilities. Statistically, one in three people will experience injury at some time in their life from a road accident.

In addition to this terrible human cost, the direct and indirect financial price tag is estimated to be over €200 billion a year, or between 2 and 3% of the Union's GDP.

Yet the fight against this scourge is achieving results. The 1990s saw a fall in the number of deaths on European roads, despite the ever-growing number of vehicles travelling on them. This reduction is due to a variety of factors: increased regulations, improved infrastructure, preventive policies, greater awareness among road users, technological progress, and efforts by manufacturers to increase safety from the vehicle design stage.

Road deaths in the EU



Source: Care (Community Road Accident Database)
europa.eu.int/comm/transport/home/care/index_en.htm

'passive' safety

project, with 14 partners in eight countries, which is expected to produce a genuine European database.

Specific approaches

Most projects, even when dealing with a very specific problem, include a statistical aspect. This is true of the *Child* project, whose aim is to increase knowledge and awareness of road safety issues related to children. Children are not miniature adults, but have specific behavioural and biomechanical characteristics in terms of their distribution of mass and density.

Researchers have pooled existing data from around the world to build up a database of accidents involving children. This has helped them improve the dummies used in crash simulations, which are traditionally just scaled-down copies of the adult version. They have also managed to define risk curves and injury criteria for different age groups with a view to producing better regulations and testing methods for protection systems.

The Enhanced Coach and Bus Occupant Safety (Ecbos) project analyses national accident statistics for group transport vehicles. Such accidents are more frequent than one may imagine – every year, 4% of European buses and coaches are involved in accidents causing injury or death (30 000 victims, 150 of whom die).

Ecbos researchers also analyse vehicle structure and safety criteria. They use mathematical models and computer simulations to study the behaviour of standing passengers. One of the project's aims is to provide manufacturers with digital models to improve vehicle structure for better passenger protection.

Children are not miniature adults but have specific behavioural and biomechanical characteristics. Researchers on the *Child* project are pooling data from around the world on accidents involving children in order to improve the design of the dummies used in simulated accidents. Contact: Françoise Cassan, LAB francoise.cassan@lab-france.com

Other research is focusing on materials. The *Meteor* project is looking at how to lighten structures without reducing resistance, an area in which aluminium and titanium foams are delivering promising results. Energy-absorbing materials, which could help protect pedestrians and cyclists, are also being studied by projects such as *Eamlife*.

Compatible vehicles

Although passive security is a fairly new discipline (crash tests were only included in the legislation in 1998), progress has certainly been made. 'Vehicles have improved greatly over the past decade,' notes Dominique Césari. 'The most significant progress has been in restraining occupants in head-on collisions. Originally a seatbelt was an addition to a car. Now we design total restraining systems with an optimal structure, combining airbags, pre-stressed seatbelts, and vehicle reinforcements.' With rounded bumpers, new materials and sunken windscreen wiper bases, cars have also become less threatening to pedestrians.

To find out more

- EVPSN network
  www.passivesafety.com
- Ecbos Project
  www.dsd.at/ecbos.htm
- Vehicle Safety Research Centre (UK)
  www.lboro.ac.uk/research/esri/vsrc/index-std.htm

Contact

- Patrick Mercier-Handisyde, Research DG
  patrick.mercier-handisyde@cec.eu.int

Different people tend to have different types of accidents. Children and pensioners are often run over, young men are more likely to have motorcycle accidents and elderly people are particularly prone to side impact collisions.
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To find out more

- Care Site (Community Road Accident Database) http://europa.eu.int/comm/transport/home/care/index_en.htm
- OECD site www1.oecd.org/cem/stat/accidents/index.htm

'Of course there is much that can still be done, such as not just looking at the average occupant seated in a typical position, but by simulating all kinds of other possibilities: short and tall people, women, etc.,' admits Dominique Cesari. 'The next stage is to look at the automobile fleet as a whole and work on vehicle compatibility.'

Experts know that differences between the kinds of vehicles involved are aggravating factors in an accident. Major differences in size, weight and rigidity significantly increase damage. Vehicle compatibility implies that manufacturers, especially of cross-country vehicles and pick-up trucks, must not only be concerned about occupants travelling in their products, but also those in other vehicles. Researchers on the *Compatibility I and II* projects are trying to identify the most 'aggressive' models and to define the associated risk factors, such as engine and bumper positions, general structure and materials.

'We are in a field that progresses slowly, but opportunities to innovate will never be exhausted,' concludes Jac Wismans. But even the smallest steps and most modest adjustments can save lives and prevent traumatic disabilities.

Star performers

Co-financed by the Union, certain Member States and consumers' and motorists' associations, EuroNCAP (European New Car Assessment Programme) encourages manufacturers to pay constant attention to passive safety. Its researchers carry out a number of tests on some of the most common new vehicles to come onto the market: front and side impact, pedestrian impact, head protection, etc. These tests go further than the legal requirements imposed on the industry. *EuroNCAP* then awards a score of one to five stars for each test and each vehicle. With the results made available on the Internet and in press releases, this is an effective and transparent method of increasing awareness among car buyers and manufacturers.

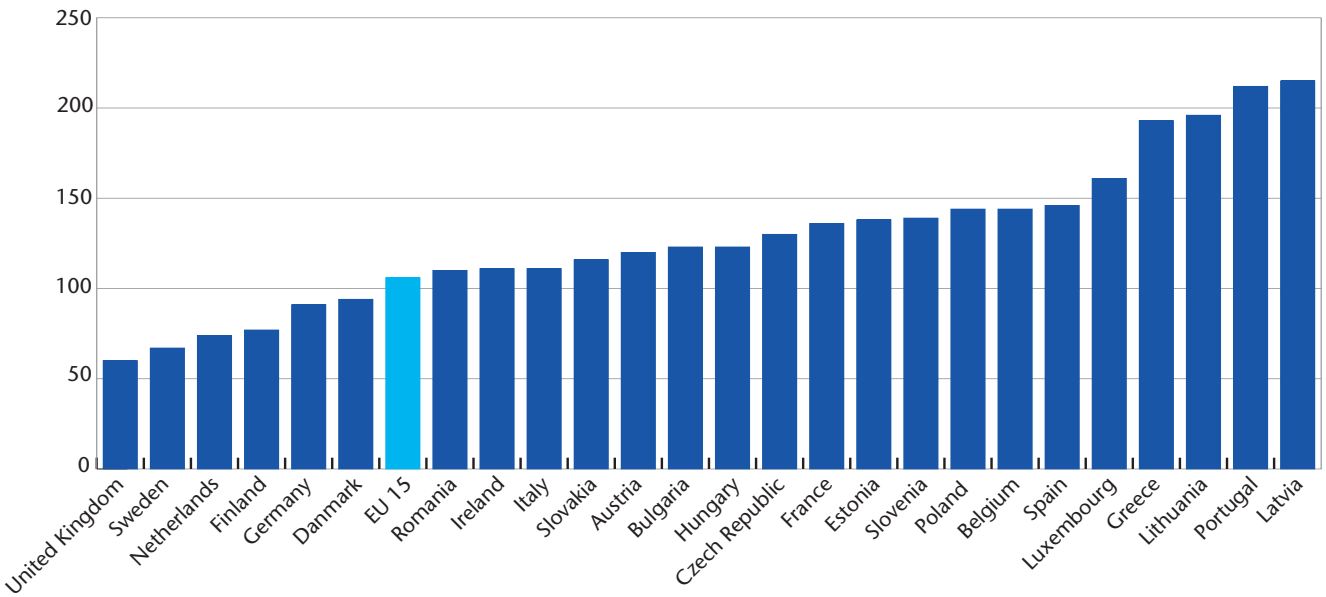
To find out more: www.euroncap.com

The EU road safety imbalance

(Year 2000, per million inhabitants – EU 15: Care and Eurostat data – Candidate countries: OECD data)

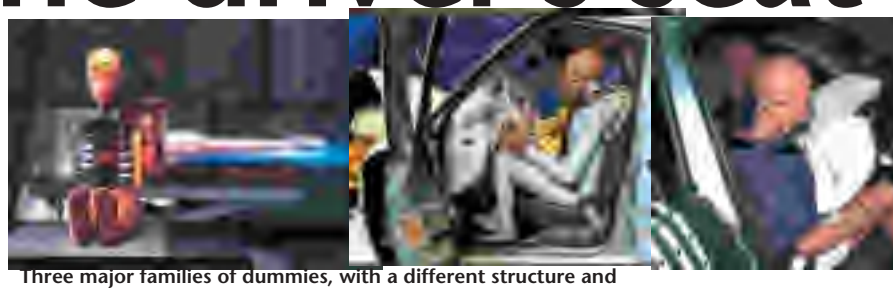
There is nothing inevitable about the level of danger associated with travel by road. In relation to the population, road deaths in the United Kingdom – 60 per million inhabitants – and Northern Europe are three and a half times less than the 'record' held by Portugal.

Road deaths in the candidate countries are quite comparable to levels in several present Member States, but with no country below the 100 mark.



Dummies in the driver's seat

To improve their knowledge of the impact and traumas experienced during road accidents, European researchers are pushing forward on two complementary fronts: crash test dummies and software.



Three major families of dummies, with a different structure and instrumentation depending on the impact to be assessed, are used in various crash tests. Although they have more than 30 sensors and are subject to continuous improvements, they can only be used on existing vehicles, and cannot yet help designers at the model development stage.

Most of them are worth more than €100 000 and have odd-sounding names *(Hybrid III, EuroSID I, Thor)*. They share a common fate: to be seated in a car which is violently rammed into an obstacle while an armada of engineers and researchers look on. A tragic fate, indeed, if these were not dummies designed specifically to simulate, as faithfully as possible, the behaviour of flesh and blood road victims.

It is a difficult role to play. The human body is an impressively complex piece of machinery whose dynamic behavioural patterns are governed by countless factors. The sensors available to researchers generally have a hard time measuring the many forces impacting on a given organ. Forces which, as demonstrated by the special cameras which film the crash tests, vary every thousandth of a second.

Three families

Crash test simulation employ three kinds of dummies, each with a different structure and instrumentation depending on the impact to be measured. *Hybrid III*, usually used for frontal impacts, can represent a whole family: mother, father, child and baby. *EuroSID* is used for side impacts, which pose different problems, with acceleration and damage to the upper body. *RID2* was designed to simulate the neck damage caused by a rear impact, a common and often disabling injury (see box).

All parts of the body can be analysed in this way. The dummies' heads, made of aluminium coated in rubber, indicate the acceleration and deceleration experienced by the brain. The neck, simulated by a kind of steel and rubber spring, analyses the torsion, flexion and tension experienced when the cranium is thrust forwards and then backwards, or vice versa. Although there are no instruments in the arms (to which serious injury is rare), the thorax is packed with them: steel ribs are fitted with sensors which measure both the compression of the rib cage and the speed with which it occurs to ascertain the degree of injury. There is also an analysis of the forces acting on the abdomen and on the pelvic girdle. The legs are particularly vulnerable and are reproduced with the greatest precision, fitted with a whole array of instruments to provide extensive data on injury to the knee, tibia, ankle, femur and hip.

Meticulous adjustments

The number of sensors (often more than 30 per dummy) and their size currently make it impossible to use a single subject for all types of crash tests, but engineers hope that one day this will be possible. However, the immediate aim is to improve the most commonly used dummies. Researchers on the FID project are working on developing the Frontal Impact Dummy, which is an improved version of the ageing *Thor* model developed in the United States.

'Creating a new dummy which integrates all the progress in our knowledge made over the past 30 years was vital,' believes Michiel van Ratingen, FID project coordinator and member of TNO Automotive's Crash Safety Centre (the Netherlands). 'But it is a huge undertaking involving considerable international co-operation as, first, all the available data must be collected from all the countries. About 50 tests are necessary simply to ensure that the dummy behaves the same as a person during the tests. It is only then that the researchers can check sensitivity to a whole range of other properties involving dozens of extra tests. The total cost can be as much as €5 million.'

Comparable programmes, such as *Siber*, are seeking to improve the dummies used in side impact tests, particularly in terms of effects on the shoulder, vertebral column and lower limbs. Here, too, a new prototype, *WorldSID*, should one day take over. Research under the Whiplash II programme should improve *RID2's* ability to simulate rear impacts.

To find out more

- Fid project www.wt.tno.nl/FID
- Siber project www.passivesafety.com/siber/
- Whiplash II project http://www.passivesafety.com/whiplash1/
- INRETS: www.inrets.fr
- TNO: www.automotive.tno.nl

Simulation of a side impact by the INRETS.

Virtual dummies

However much progress is made in developing more sophisticated dummies, their biofidelity will always be limited and they can only be used on real vehicles or at the very best on prototypes. A promising new avenue is being opened up with the development of virtual tests. Computer modelling of the human body reproduces with a superior anatomical fidelity which cannot be matched by traditional dummies. These digitally generated dummies can be transported in virtual vehicles producing every kind of accident condition.

'Vehicle development can take up to four years. In the past, we had to wait 24 months before we could drive a prototype into a wall. If, at that point, we realised that something was not right, we could only correct what had already been developed. With computer simulation, the action becomes preventive rather than curative. The manufacturer installs his virtual passenger in a digital vehicle and simulates crash scenarios,' explains Jean-Yves le Coz, director of the Laboratoire d'Accidentologie et Biomécanique (LAB). This joint research centre, run by Renault and PSA-Peugeot-Citroën, is a partner in the *European Humos* project.

Digital models have many benefits. The size of the dummy can be varied to cover the full range of possible drivers. They can also give reliable indications of organ behaviour, provided there is enough data on the characteristics of the various tissue. In addition to *Humos*, the *Real Man* project is also working on the computerised modelling of human body movement.

Digital anatomy

Are dummies used in crash tests fast becoming obsolete? Today, digital models are permitting much more detailed observations on how various parts of the body react to impacts. A team of surgeons, anatomists and software engineers explain how they are pooling their efforts.

'You will understand the problem right away,' announces Christian Brunet, a surgeon and professor at the Aix-Marseilles Faculty of Medicine, and director of the Laboratory of Applied Biomechanics (LBA). From his bookshelf, between a plastic liver and a heart preserved in resin, he takes down a human skull. 'Look at the fine structure of the bone, the delicacy of the suturae. And look at it against the light. You can see clearly that the opaque, thicker zones alternate with the finer, more fragile and translucent areas. When a skull is hit by an object, the lesions vary a great deal depending on the direction from which it comes and the area it hits. A few millimetres can change everything. Have you ever seen a test dummy? It's huge block of metal and foam. It belongs to the prehistory of road safety.'

The dawn of a digital age

This prehistory is set to give way to a new era: the age of the digital model. A team of researchers at the LBA display a series of legs, shoulders, abdomens, and entire human bodies on their screens. Different colours represent the muscles, organs, bones, tendons and ligaments. They are incorporated in the models with their specific biomechanical properties: elasticity, density and breaking points. Their behaviour when subjected to various types of impact can then be studied.

'Of course, it will never be possible to dispense with real experimentation completely,' stresses Lionel Tholon, a research and development engineer at Mecalog, a software design company which is working closely with the LBA. 'The models have to be compared continuously with reality and adjusted accordingly. That

The importance of consensus

Accurate dummies and computer programmes do not mean that the task is complete – far from it. Defining the best speeds and angles of impact for safety tests is another very complex matter, requiring familiarity with data obtained throughout Europe, which are as diverse as driving habits, and the most common types of accident.

Despite the highly competitive nature of the automobile market, the development of test strategies is a co-operative effort involving manufacturers, research institutes and university laboratories from all over Europe. It is in everyone's interest to have effective and homogenous safety standards, and reaching a consensus over them will mean that they will ultimately pass into law.

Whiplash

Any driver who has ever had the experience of being rammed from behind by another vehicle will need no persuading of the importance of the *Whiplash* project. The resulting lesions are often painful and lasting. Every year 1 million Europeans suffer such injuries, at a cost of between €5 and €10 billion! The first phase of the project (Whiplash 1) produced a special model to study this phenomenon at speeds of 10 km/hr (the most common speed for this type of accident), 15 km/hr (causing most injury) and 30 km/hr (a speed close to the effective limits of the seats). Procedures have also been defined to test seats, headrests and seatbelts.

The second phase, involving 15 partners, began on 1 March 2001. 'Our aim is to reduce the risk and social costs of these accidents by at least 40%,' explains Annemarie Mahieu of TNO Automotive (the Netherlands), *Whiplash 2's* coordinator. 'We are going to improve the results of *Whiplash 1* in a number of respects. We are working on developing digital models for vehicle design and a new model adapted for frontal and side impacts.'

is why we work with experienced anatomists, under the direction of a surgeon who is able to tell us, for example, that a given joint is behaving abnormally, that it should slide and not simply rotate. After basic training in mechanics, I myself took courses in anatomy to improve my work.'

From the real to the virtual

Modellers taking courses in anatomy symbolise the LBA philosophy of creating a place where advanced computing techniques and biological reality are closely linked. At the Faculty of Medicine, the laboratory has practical testing equipment unlike any other in Europe. Accidents are simulated using 'anatomical' subjects – meaning the corpses of people who donated their bodies to science. The vehicles are propelled by means of an adjustable incline to provide the desired speed. The impact can be a collision with an immovable object (a barrier or post), a cyclist or a pedestrian. The car is fitted with sensors, and the accident – illuminated by powerful spotlights – is filmed by several cameras at the rate of 1 000 frames a second.

Next the results must be carefully scrutinised, especially those of the dissection which follows. 'A dummy which has a spring instead of a neck cannot enable us to detect a small fracture of the third vertebra – but this results in tetraplegia. With this method you can,' explains Christian Brunet. 'Take, for example, the height at which bumpers must be fitted to minimise injury in the event of collision with a pedestrian,' continues Lionel Tholon. 'If we lower it, we protect the knee, a very sensitive joint – a broken tibia is far less problematic. But doing this also increases the whiplash effect, which intensifies the impact of the head against the windscreen. Models are invaluable aids in helping us to arrive at the best possible compromise.'

Although the modellers admit that there are still imperfections, their software programmes are improving by the year. With the aid of his computer, Lionel Tholon can simulate a given accident in around 30 minutes. To carry out a similar crash test (with a single impact) takes an entire team three weeks of work at a cost of tens of thousands of euros. Their power, versatility and cost-effectiveness is yet another argument in favour of computer models.

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Automobile intelligence

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Our improving command of Information and Communications Technologies (ICTs) and the growing range of applications are revolutionising road safety concepts. Yet the Union faces a formidable task in perfecting systems, adopting standards and making the necessary infrastructure investments. The *eSafety* initiative, launched in 2002, aims to make major inroads into these issues.

Automobile manufacturers and road safety officials have shared a common vision for almost two decades. They dream of the 'intelligent' vehicle which can communicate with other vehicles, the road infrastructure – also rendered 'intelligent' – and traffic control centres. This dream car will be able to actively assist the driver, by drawing his attention to potential hazards, monitoring his behaviour at the wheel and possibly – in case of a major emergency – taking decisions for him.

Under the *Eureka* initiative, between 1987 and 1995, the *Prometheus* project brought together a vast consortium of some 230 companies, public, private and university research centres. Headed by the German group Daimler-Benz and the French company Sextant Avionique, the project used cutting edge technology to design and develop the very first 'intelligent' vehicle systems. Other Union research programmes, such as *Esprit*, supported a growing number of scientific and industrial partnerships in this field. The launch of the *Telematics* programme in 1994 provided a research platform specifically dedicated to the numerous applications of onboard telecommunications and IT applications. In 1999, the 'Intelligent vehicle' action under the Information Society Technologies programme (IST – Fifth Framework Programme) continued the research. About 40 projects were supported, representing a total budget of €150 million (including €80 million of Community funding), mainly for the development of Advanced Driving Assistance Systems (ADAS).

We are now seeing the widespread application of these systems. Micro-electronic processors, such as those providing ABS braking systems or releasing airbags, are now standard on many models. The same will soon be true of other innovations, including the Electronic Steering Programme to correct steering aberrations.

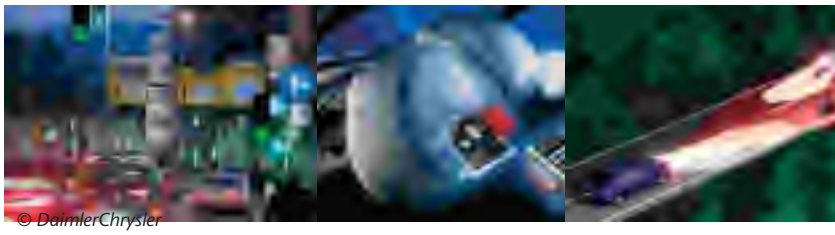
Communicating intelligence

Researchers are now turning their attention to 'communicating intelligence'. The innovations in this field mark a radical change in the concept of active vehicle safety. The aim now is to intervene, whenever possible, before the accident occurs. Sensors, activators, telecommunication systems and associated services are being developed to permit a global approach to every situation that takes into account motorists and factors in the surrounding environment.

At least 75% of road accidents are the result of human factors: errors of judgement, distraction, excessive speed, poor assessment of weather conditions, as well as the effects of alcohol, inexperience and fatigue. ADAS systems offer promising prospects of achieving significant improvements in road safety by reducing the risks associated with driver behaviour.

'Research will continue to progress, but many technologies have already been perfected. Unfortunately, in many cases, there is a huge difference between their development, their real effect on reducing accidents and their dissemination at a reasonable cost and in sufficient quantities. We must, therefore, make a precise evaluation and commit ourselves to certain introduction priorities.'

Erkki Liikanen, Commissioner responsible for information society technologies



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'Progress through conventional methods – vehicle safety, accident prevention campaigns, punishing driving offences – must continue of course, but there is inevitably a limit to what these can achieve,' explains Olivier Mossé, spokesman for *Ertico*, a Europe-wide public/private partnership for the implementation of intelligent transport systems.(1) 'But if we really want to cut road deaths by half, as the Union says, we must act much more on the fatal moment when the accident is about to happen.'

Times of change

Major changes are already in the pipeline. In April 2002, Enterprise Commissioner Erkki Liikanen launched the *eSafety* initiative. This is a partnership between the Union, public authorities in the Member States, the private sector – represented by Ertico – and the European Automobile Manufacturers Association (ACEA). 'Research will continue to progress, but many technologies have already been perfected,' explains Erkki Liikanen. 'Unfortunately, in many cases, there is a big difference between their development, their real effect on reducing accidents and their dissemination at a reasonable cost and in sufficient quantities. We must, therefore, make a precise evaluation and commit ourselves to certain introduction priorities.'

It all comes down to making choices about what to develop first: vehicle speed adjustment in line with traffic density or collision alert; improved vision or pedestrian detection; automatic emergency call or digital road maps. Then there is the importance of knowing more precisely why accidents happen. European databases on the causes of accidents remain insufficient, even if some partners, such as insurance companies or motor manufacturers, have their own information.

As most onboard systems will be controlled by microprocessors and software programmes, languages and protocols must be standardised before telematic services can become widely available. The same applies to vehicle approval. Legislation adopted by Member States also needs to be consistent.

The crux of the matter

A working group of about 40 experts was set up to propose precise actions in four fields: on-board technologies, interactive and co-operative technologies, regulation and standardisation, as well as society and business. They presented their final report at the second eSafety high-level meeting on 14 November 2002 in Brussels. The group set a deadline and named the partners responsible for each of its 28 recommendations,(2) ensuring that they constitute a genuine road map for the future rather than mere good wishes.

The Commission is likely to include some of these conclusions in its next communication to the Council and Parliament on 'Information and communication technologies for intelligent vehicles.' The *eSafety* initiative is now piloting a permanent forum of all the public and private parties involved.

Four study groups – on the emergency call (E-call), the gathering of data on the causes of accidents, the man-machine interface, and economic aspects – drew up reports for the first plenary meeting of the forum, which was held in Brussels in April 2003. Four other subjects (digital road maps, real-time information on traffic and travel, technological research, and the international dimensions) will be explored at a future stage. This will be in Madrid between 16 and 20 November 2003 on the occasion of the 10th World Congress and Exhibition on Intelligent Transport Systems.

(1) Set up in 1991 at the initiative of Filippo Maria Pandolfi, vice-president of the European Commission, and Giovanni Agnelli, president of Italian car-maker Fiat, Ertico now includes some 90 public and private partners committed to promoting 'Intelligent Transport Systems and Services (ITSS). The next major ERTICO event will be the 10th World Congress and Exhibition on Intelligent Transport Systems, which will be held in Madrid from 16 to 20 November.

(2) The working group's report, including its recommendations, is available at: http://europa.eu.int/information_society/programmes/esafety/doc/wg/esafety_wg_final_report_nov02_final.pdf

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eSafety in action

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The latest innovations in this field represent a radical shift in the concept of active vehicle safety. The ambition is to intervene as much as possible before the accident. Sensors, activators, telecommunication systems and associated services all play a part in a global approach to each situation which takes into account the vehicle, the driver and the environment.

Eyes wide open

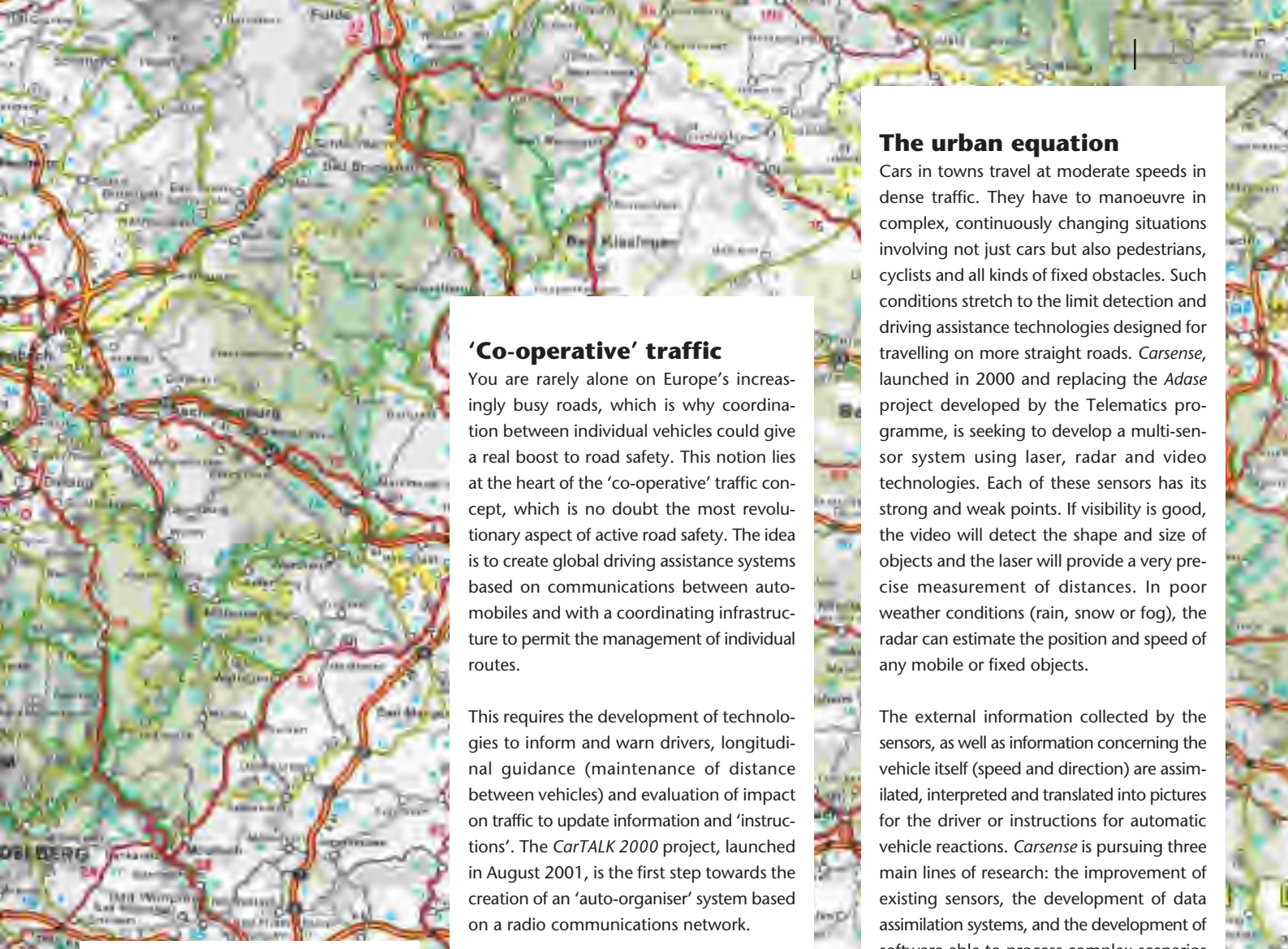
Between 30% and 40% of accidents – often the most serious – are due to exhaustion, drowsiness or lack of vigilance. The *Awake* project, developed by DaimlerChrysler, Fiat, Siemens and the CNRS systems architecture and analysis laboratory in Toulouse, is developing a complete system able to alert drivers when they become drowsy at the wheel. Detectors study eye blinking rates, the way the wheel is held and variations in trajectory. They then warn the motorist with sound and visual signals of increasing intensity. *Awake* will soon be tested in several European countries, particularly on lorry drivers, who are often the victims of accidents due to fatigue.

X-ray vision

A number of projects are using various detection and assisted vision technologies to identify fixed obstacles, as well as vulnerable road users (pedestrians, cyclists and motorcyclists) who make up more than a quarter of road deaths. *Protector* is seeking to create an interactive system to equip these road users with micro signalling devices (reflectors, transponders, etc.) which can be detected by specific sensors (lasers and computer assisted vision) fitted to vehicles. *Save-U* is developing systems which combine the data obtained from various types of cameras and radars. The *Edel* project aims to improve the night vision of drivers by developing a special infrared lighting system.

Keeping balance

The growing number of lorries on Europe's roads are often involved in very serious accidents due to problems such as swaying, overturning, and uncoupling – in other words changes to the dynamic behaviour of the trailer. Nearly three-quarters of these accidents could be avoided by taking corrective action – action which the driver cannot always take in time. DaimlerChrysler (automobiles), Continental (tyres), Diehl (avionics), iQ (batteries), Knorr Bremse (brakes and suspension), EPCOS (electronics) and IVECO (lorries), together with bodies such as the Kraftfahrtbundesamt (certification) and the universities of Budapest, Braunschweig and Karlsruhe, are currently working on the *Peit* (Powertrain Equipped with Intelligent Technologies) project. As its name suggests, it aims to equip the engine, transmission, steering and braking system with sensors and automatic activators which will detect any abnormal behaviour and correct it by acting on the powering, steering or braking of each wheel. This entails putting all these elements under electronic control.



Emergencies

A European emergency call service (E-call) is one of *e-Safety*'s priorities. The AIDER project wants to make it easier for the emergency services to intervene after an accident. The speed with which they can be on the scene with the necessary help is a key factor in saving lives. The system is based on co-operation between emergency centres and the vehicles involved in the collision, which will be fitted with surveillance sensors – including non-invasive medical sensors – to monitor the scene before and after the collision. Emergency services, alerted in real time by means of an automatic link, will not only know where the accident occurred, but also in what circumstances and possibly with what consequences, enabling assistance to arrive quickly and with the right equipment. AIDER will also have software to help with decision-making.

'Co-operative' traffic

You are rarely alone on Europe's increasingly busy roads, which is why coordination between individual vehicles could give a real boost to road safety. This notion lies at the heart of the 'co-operative' traffic concept, which is no doubt the most revolutionary aspect of active road safety. The idea is to create global driving assistance systems based on communications between automobiles and with a coordinating infrastructure to permit the management of individual routes.

This requires the development of technologies to inform and warn drivers, longitudinal guidance (maintenance of distance between vehicles) and evaluation of impact on traffic to update information and 'instructions'. The *CarTALK 2000* project, launched in August 2001, is the first step towards the creation of an 'auto-organiser' system based on a radio communications network.

Coordinated by DaimlerChrysler, the project brings together major manufacturers Fiat, Bosch and Siemens. A number of leading research institutes are partners in the project. These include the universities of Cologne and Stuttgart, and the Dutch Centre for Applied Research (TNO). *CarTALK 2000* aims to develop driving assistance technologies, situation management programmes and network architecture.

The *Chauffeur II project* – following on from *Chauffeur I* under the Fourth Framework Programme – is less complex but also closer to fruition. This is devoted exclusively to 'co-operative' driving between lorries travelling in the same convoy. It is a communications and speed-control system (distance sensors, as well as braking and acceleration activators) which makes it possible to maintain a safe distance between these vehicles automatically.

The urban equation

Cars in towns travel at moderate speeds in dense traffic. They have to manoeuvre in complex, continuously changing situations involving not just cars but also pedestrians, cyclists and all kinds of fixed obstacles. Such conditions stretch to the limit detection and driving assistance technologies designed for travelling on more straight roads. *Carsense*, launched in 2000 and replacing the *Adase* project developed by the Telematics programme, is seeking to develop a multi-sensor system using laser, radar and video technologies. Each of these sensors has its strong and weak points. If visibility is good, the video will detect the shape and size of objects and the laser will provide a very precise measurement of distances. In poor weather conditions (rain, snow or fog), the radar can estimate the position and speed of any mobile or fixed objects.

The external information collected by the sensors, as well as information concerning the vehicle itself (speed and direction) are assimilated, interpreted and translated into pictures for the driver or instructions for automatic vehicle reactions. *Carsense* is pursuing three main lines of research: the improvement of existing sensors, the development of data assimilation systems, and the development of software able to process complex scenarios reflecting real urban driving situations. All these devices are currently being put through their paces on a test track to assess and calibrate the various components.

Twelve partners are working on the project, including car makers BMW and Renault, Ibo parts suppliers (laser sensors), Jena Optronic (optical and electronic systems), TRW (computing and networks), Thomseon-CSF Detexis (radar), an investment fund (CRF) and four French research laboratories. Autocruise, a jointly owned Thomson and TWR subsidiary, is coordinating the project. Carsense will end this year, each partner continuing to develop their own products on the basis of the jointly acquired knowledge.

Ambitions for research

The Sixth Framework Programme is up and running. But that does not mean the debate on common scientific and technological policy has abated. Strengthening the European Research Area and resolute objectives designed to achieve it are a priority on which the Union is placing increasing emphasis, as an interview with Philippe Busquin, head of research policy at the European Commission, reveals.

In his 'spring' declaration – in which he proposed the main items for the Union's agenda in 2003 to European leaders – Commission President Romano Prodi announced an action plan drawn up by yourself and designed to give paramount importance to investment in research and the development of a knowledge-based society. What is the nature of this plan?

Philippe Busquin – The priority given to research is now beyond question. The objective of increasing global investment – public and private – within the Union from the present 1.9% of GDP to 3% by 2010 was adopted by the European Summit in Barcelona. With the exception of a few countries that have already reached this level, such as Sweden and Finland, this will clearly be a very difficult goal to achieve. Scientific and economic indicators are not exactly moving in the right direction and the economic climate is very gloomy. When faced with budgetary difficulties, governments are tempted to put a brake on research expenditure – or research investment as I prefer to call it. Some have already started to do just that.

This attitude is totally counter-productive. Look at the Japanese – recently they have experienced some hard times economically, but that has not stopped them giving their research effort a major boost. The way out of an economic crisis is 'from the top'. Achieving this figure of 3% of GDP by 2010 would mean an additional 500 000 researchers in Europe. They must be trained, there must be more women researchers and, at the same time, we must attract the best researchers from all over the world.

You mention public budgets. But European companies seem very sensitive when it comes to research budgets.

Ph. B.: This is one of the main elements in the action plan we are proposing. Private investment is closely linked to incentives, because research is expensive and constitutes an economic risk which is only going to be taken if the environment is right. There are various mechanisms for this – financial, fiscal, infrastructural, administrative – and these are dependent on many other policies in addition to research policy proper.

Europe needs coherency, consultation and simplification in these fields. Take for example the famous case of the Community patent, for which we have finally obtained an initial consensus. We are also working on what is known as the open method of coordination which means better synergy between national programmes to secure an interesting critical mass. In addition, there are also uncertainties linked to changes in the regulations which could put a brake on certain developments – various reservations about introducing GMOs, for example.

That brings us to the ethical debate…

Ph. B.: This debate is, of course, essential, as is the debate on the precautionary principle. But in taking these into account we must not ignore a fundamental and universal value: freedom of research. The acquisition of knowledge is a universal and timeless principle. For me it is essential.

Towards a European Research Council?

Recently, there has been talk of creating a 'European Research Council' which would be a body recognised by the Member States with the power to initiate and the means to launch cross-border programmes. What are your feelings on this?

Ph. B.: Such a Council could be in keeping with the thinking behind the European Research Area. To date, the Union has had a tool – the Framework Programme – which catalyses co-operation in research and innovation. It is included in the Treaty and has a clear mission of subsidiarity in making the European economy more competitive. Its vocation has therefore been to provide support for 'targeted' research while so-called fundamental research is seen as the responsibility of the Member States.

This divide is becoming rather obsolete. Innovation often comes from fundamental research, which is why more and more com-

On 13 March, Commissioner Philippe Busquin welcomed members of the European Astronaut Corps: 'Man's adventure in space, which symbolises the spirit of exploration and the endeavour to go that one step further, has an extraordinary image value in our societies.'

panies are funding it and it is now being included explicitly in certain priorities of the Framework Programme for RTD.

Therefore, the time is ripe for the concept of a Council which would federate the scientific strategies of Member States in the medium and long term, providing a wider horizon than in the current five-year Programme. But this still requires careful thought on the purpose, missions and structure of such a body. We must not set up another institution hastily, nor call into question the funding currently allocated to the Framework Programmes.

Research and security policy

The present Greek Presidency of the Union initiated another debate last January, that of the relationship between civil and military research. The Commission has also published a document on the problem of European expenditure on arms, which is not entirely unrelated to research.

Ph. B.: Let us speak of security research rather than military research. Europe is peaceful and has no intention of acquiring offensive capabilities. But one must recognise that many civil research projects – in the fields of information and communication technology, satellite systems such as Galileo or GMES, material technologies and even biotechnologies – are of interest to security policy. It would be hypocritical to ignore this aspect and the certain kinds of co-operation that could result.

In the case of the arms industry, things are totally different. This is a matter for the individual Member States. There is talk of perhaps creating a European agency to correct discrepancies in this field, but this relates to common foreign policy, even if it is clear that there is a research element to arms manufacture. We could therefore look at possible bridges that would permit certain transfers between the civil and security fields.

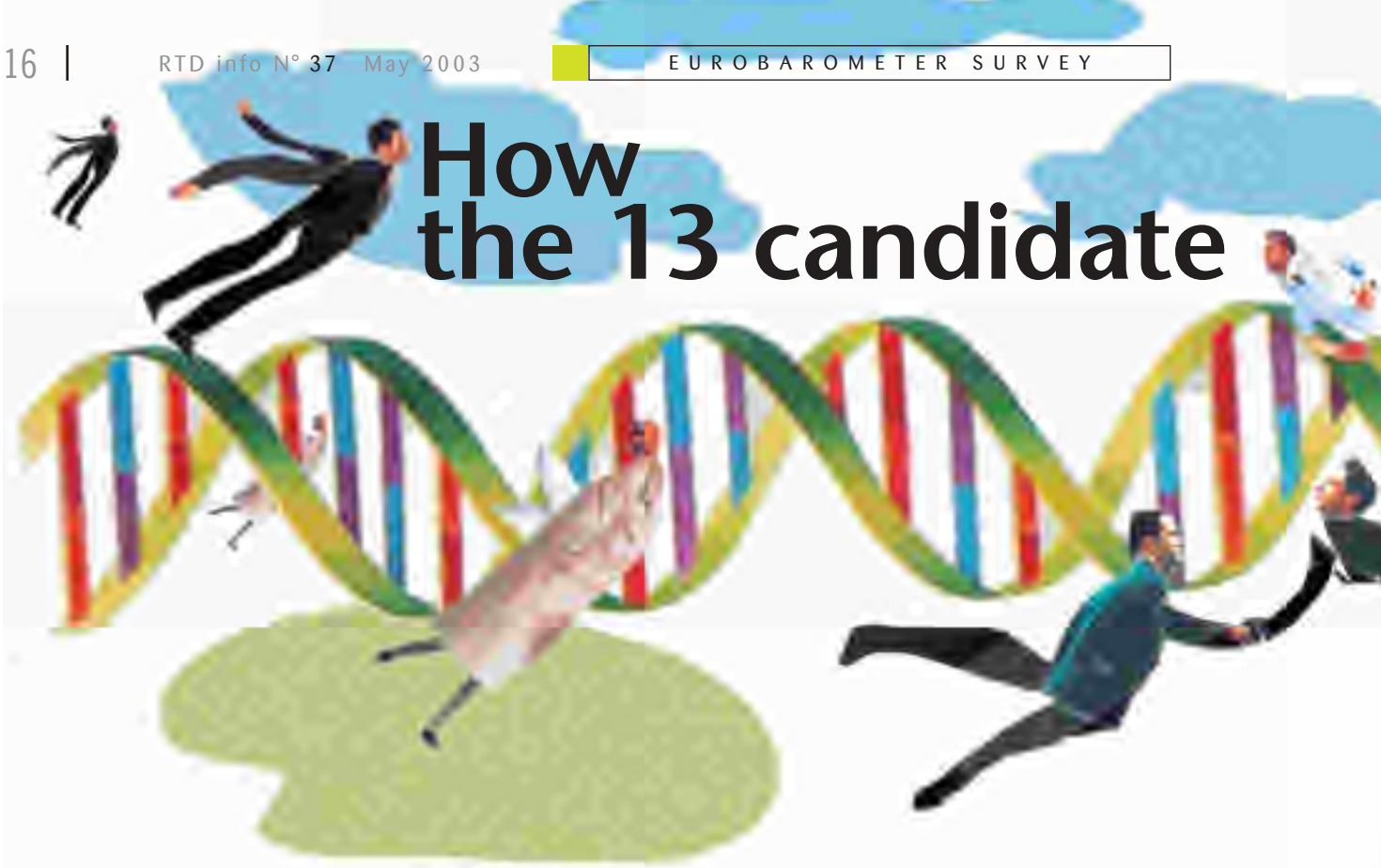
Space

You seem to be very interested in space policy. Europe does not yet have its own manned flight capability. Would you be in favour of one?

Ph. B.: In the medium to long term, personally I would say yes. Of course, it would be a very costly commitment and one must be sure to adopt the right strategy. But Europe has succeeded in acquiring some of the best space expertise in the world within the context of acceptable budgets. We have engineers, astronauts, launchers and we are developing a manned shuttle that will go to the international space station. Manned flights are an essential element of space policy and we must not always be dependent on other powers in this field.

Man's space adventure also has an extraordinary image value in our societies. Astronauts represent the quintessence of the endeavour to go that one step further. They symbolise the spirit of exploration which is also the true motor of science and knowledge.

How the 13 candidate



How do the 'new Europeans' see science? Do they feel they receive enough information about it and are they interested in it? Do they mistrust an increasingly 'technical' world? What do they think of links between research and ethics? These were all subjects of a Eurobarometer survey carried out in the candidate countries late last year. It followed a similar study conducted in the current 15 Member States in June 2001. This latest poll revealed some interesting similarities and differences.

First of all, what exactly do we mean by science? From one end of Europe to the other, whether in the Member States (EU) or the candidate countries (CC), the 'science' label is applied primarily to the so-called 'hard' disciplines and much less to the human sciences, although astrology enjoys surprising credibility (see *Children of the Enlightenment*).

People interviewed in the prospective Member States seem to be less interested in science than their peers in the current Member States (35% compared with 45%). They also feel quite poorly informed on the subject. The picture varies from country to country, however, and some candidate countries are in fact above the EU average: 58% of Cypriots, for example, say they are interested in scientific and technological issues, closely followed by the Hungarians (53%), the Maltese and the Slovenians (50%). But it is also the case that two-thirds of those interviewed admit they are poorly informed on these matters. Their relatively low level of knowledge does not, however, prevent interviewees in the candidate countries from having a more positive attitude to science and technology than those in the Union.

Science and health

When we look at the importance assigned to the principal fields of science and technology which affect our everyday lives,[2] medicine scores highest everywhere (51% in the CC, 60% in the EU). Yet its renown seems to be rather subjective and it is evaluated 'more in terms of satisfaction with health services than its perception as a science'. Bulgaria, for example, 'does not have any particular regard for medicine'.

Generally speaking, women and elderly people exhibit the highest concern for health-related matters and young people for the Internet (52% of 15-24-year-olds compared with 9% of the over-55s). Respondents' range of scientific interests broadens the higher their level of education. Candidate countries are notable for the fairly high score they award to the economic and social sciences (32% compared with 22% for the EU) and the lower regard for life sciences (17% as opposed to 22%).

Whatever the case, science scores well on usefulness 81% of those interviewed in the candidate countries believe it makes our lives healthier, easier and more comfortable; 77% of them think it will succeed in curing illnesses such as cancer or Aids; and 75% hold that it will improve the lives of future generations. But – as in the present Member States – enthusiasm wanes when it comes to evaluating how science and technology could help eradicate poverty (41%) or improve the environment (44%).

countries see science

The rate of technological change

Science changes our lives, but at what rate? Most interviewees (67%), and young men in particular, believe that science alters our lives too quickly. This sentiment varies somewhat depending on country and religious faith. It is felt by 56% of Romanians and Lithuanians, but by just 10% of Cypriots, Slovaks and Slovenians. Furthermore, 69% of those who practice a religion would prefer a more modest rate of change, as opposed to 61% among those who never frequent a place of worship. Interestingly, 52% of citizens in the candidate countries (45% in the EU) also believe that 'we base our lives too much on science and not enough on faith'. This nostalgia for a less materialistic culture is particularly prevalent in Malta and Cyprus (70%).

Science and young people

Nearly 40% of interviewees in the candidate countries think that young people today are less interested in pursuing scientific studies and careers than they were in the past. However, the figures do not bear out this impression, and young people have an above average interest in science and technology. A significant percentage (26%) has no opinion on this subject, although this varies considerably from one country to another: 18% in Cyprus, 40% in Lithuania and 46% in the Czech Republic. The high figure for the latter two countries would suggest that the question is not at the heart of public debate. What is the reason for this – real or presumed – shunning of science? Whereas the main reason cited in the Union is the lack of attractiveness of science courses (60% compared with 52% in the candidate countries), the main reasons given in the future Member States are salaries and career prospects (52% compared with 43% in the EU).

Television

As the leading source of scientific information (71% in the CC 13 and 60% in the EU 15), television does not have a 'bad press' among citizens in the candidate countries, who – irrespective of their education level – do not regard it as an ill-informed or superficial media. Nevertheless, some 'cultural exceptions' are evident, such as the high regard for newspapers and radio in Slovakia and the Czech Republic.

Mad cow disease

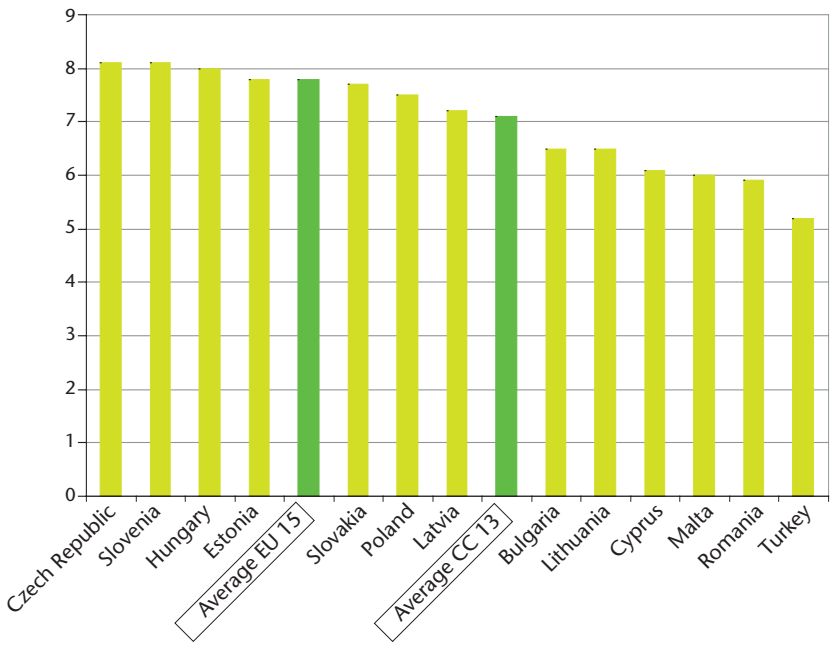
The majority of people in the EU (74%) believe that the main culprit for BSE, or Mad Cow disease, is the food industry, compared with 51% in the candidate countries – while 59% in the Union point to the farmers compared with 41% in the future Member States. Politicians are singled out much more in the EU (69%) than in the candidate countries (40%). What is the lesson to be learned from the crisis? Nearly all interviewees in the Union and in the candidate countries (89%) think that scientists should keep us better informed of the risks involved in scientific and technical developments, and 82% believe that industry should be better regulated.

GMOs

EU countries are slightly more severe in their judgement of GMOs and are more clearly in favour (95% compared with 85%) of having the right to choose and to be better informed (86% as opposed to 80%). They believe that these foods should only be introduced when science has proved they are safe (86% compared with 79%) and fear their effects on the environment (59% as opposed to 51%).

Scientific culture

Average result based on answers to the same questionnaire on fundamental scientific facts presented to survey participants in the candidate countries (CC) and the Member States (EU 15). Four countries – the Czech Republic, Slovenia, Hungary, Estonia – exhibit a general scientific knowledge which places them above the EU 15 average.



European area

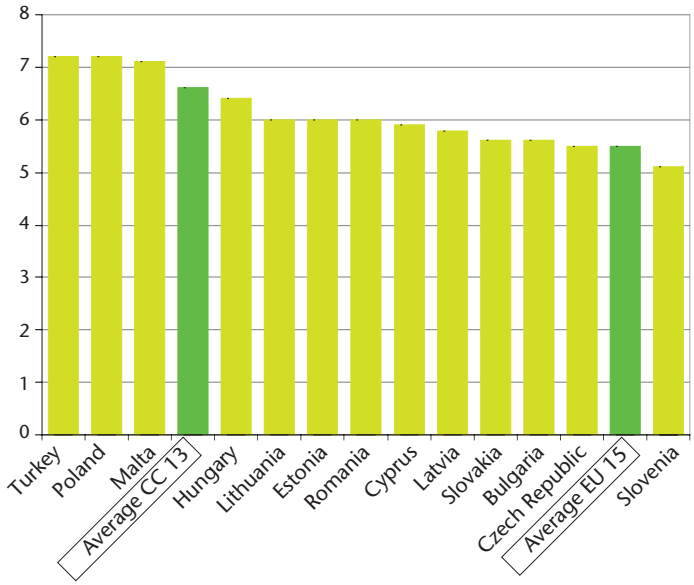
Most interviewees, in present and future Member States, believe that the Union will play an increasingly important role in research. In terms of scientific potential, many citizens in the candidate countries (59%) expect benefits from enlargement for their own countries and for present EU members. Some countries (Bulgaria, Cyprus, Estonia, Romania and Slovenia) expect more benefits for the candidate countries than for the EU 15.

(1) As in the case of the 2001 study in the current Member States (EU 15), the Eurobarometer survey in the candidate countries (CC 13) canvassed an average of 1 000 people per country. In all, 12 247 respondents took part.

(2) Seven fields were proposed: medicine, the environment, the economic and social sciences, astronomy and space, genetics, and nano-technologies.

Optimism regarding science

(average of optimistic responses to a set of 12 questions – by country)



Opinion

Istvan Palugyai, a Hungarian journalist and vice president of the European Union of Scientific Journalists' Associations (EUSJA), gives his reaction to the Eurobarometer survey carried out in the candidate countries.

European culture is one. That, to me, is the message that can be drawn from the Eurobarometer survey of public perceptions of science and technology. In most of the question groups, there are only slight variations from the results of the survey carried out previously in the current EU countries.

There are certainly some discrepancies which originate in their different social development paths over the past 50 years. In Eastern Europe, natural sciences and technology received intensive government support in terms of education and popularisation. This strategy has shaped the thinking of a whole generation, and this is, at times, apparent in the results of the survey.

Thus, the positive perception of science is more pronounced among elderly people who still believe in its omnipotence. Young people, in contrast, do not share this unqualified faith. It is notable that for fields such as culture, sport, politics and the economy, opinions in the candidate countries closely parallel those in the Member States. But when it comes to interest in science and technology the score is 10% below that for the EU 15.

But does this level of interest not depend on the quality of information? This brings us to a certain handicap on the part of some candidate countries. It seems to me that the main reason for this lack of interest is the dearth in scientific information available to the general public in recent decades, coupled with the fact that they are lagging behind in their uptake of new technologies and concepts. Underlying all this is the way in which policy-makers and the media underestimate the importance of popularising science.

Almost half of the interviewees in the candidate countries believe that journalists who report on science lack the required knowledge and expertise. This is not by chance. Unlike in the Member States, there is no training available in scientific journalism or attention paid to scientific communication at university level.

The Eurobarometer data can help to change and improve this situation. The survey could promote the creation of a genuine policy for the evaluation of science in the candidate countries.

Children of the Enlightenment

Grazyna Skapska, professor at the Jagiellonian Institute of Sociology (Krakow, Poland), is a woman familiar with Australia and the United States, as well as Europe. Her present research, based on the experiences of post-communism, is focusing on the moral and cognitive aspects of creating modern citizenship. In this interview, she gives her analysis of the similarities and differences in the way science is perceived in Eastern and Western Europe.

Grazyna Skapska, lawyer and sociologist at Jagiellonian University, Krakow (Poland)

On reading the results of this survey on public perceptions of science in the candidate countries compared to those in the existing EU Member States, were you struck mainly by the similarities or the differences in the opinions expressed?

Grazyna Skapska: What is surprising is the great similarity the two surveys show in terms of the level of information, interest, knowledge and, also, in the way science is regarded. Opinions are comparable on the subject of the interest in and trust of science. Similar, too, in the area of ideologies which deny the benefits of science. Generally speaking, one can conclude that the populations of the Member States and the candidate countries are children of the Europe of the Enlightenment. They see science as good, useful and neutral.

The two surveys do not show much difference either in the way people regard scientists, whether you are talking about the natural sciences or a discipline such as medicine. In both surveys, you also find the highest prestige rating going to doctors, just above scientists and engineers.

You also find the same stereotype in both regions: the image of the scientist who wields considerable power which could be dangerous to society if not used properly. Finally, both see the state as being the most important factor in promoting the development of science and determining scientific policy.

On the other hand, there are differences of opinion. I am thinking in particular of the use of experimentation on animals if it can yield significant results, which is much more widely accepted in the candidate countries. On this point, the prestige of science and the trust it inspires are, in fact, much higher – the difference is 55%!

Let us look now at the reservations expressed about science. Do you again find that opinions are comparable?

G. S.: This anti-science sentiment – which is not without significance – is found in both surveys. The heritage of the Enlightenment and the utilitarian concepts of science developed in the 19th Century have been somewhat undermined by the influence of post-modern, anti-scientific ideologies, as well as by 'superstitions'. In Western and Eastern Europe, astrology enjoys a better reputation than sociology and psychology. Surprisingly, a significant majority who express this view are the young (62% in the candidate countries). The general level of 'superstition' is slightly higher (7%) in the candidate countries than in the Member States. An analysis of the impact of post-modern ideologies on the basis of this inclusion of astrology among the sciences shows that it is particularly evident among non-believers. This could lead us to formulate the implicit hypothesis that secularism is fertile ground for their popularisation.

Finally, do people in the candidate countries really give the impression that all these subjects concern them?

G. S.: People interviewed in the candidate countries are less interested in science and its results than those in the Member States. However, real interest, admitted less frequently but which can be detected in replies to other questions, is quite weak everywhere. In both surveys, it is sport which dominates, followed by culture (preferred in the candidate countries) and economics (more appreciated in the Member States). Overall, Europeans seem to have a very limited knowledge of science, especially when it comes to fundamental research, even if they say they have confidence in science. When you read this survey, you feel it would be a good idea to promote genuine interest in science, in the candidate countries as well as in the Member States.

News in brief...News in brief...

The state of European research

S&T indicators

Europe is the world's biggest 'brain factory' while paradoxically employing, on average, fewer researchers than its principal competitors.

It has the brains but lacks the drive. That just about sums up the current – worrying – state of the European Research Area as revealed by the third report on Europe's science and technology indicators, published in March 2003. In terms of generating knowledge and excellence, Europe certainly remains among the best in the world. In 2000, some 2.14 million science and technology degrees and doctorates were awarded in Europe, which is more than in the United States (2.07 million) or Japan (1.1 million). It also leads its two main rivals in terms of the number of publications in science journals. Yet Europe has far fewer jobs for its researchers (5.4 per 1 000 active workers, compared with 8.7 in the United States and 9.4 in Japan).

This failure to use a remarkable potential in human resources is the real Achilles' heel of the European Research Area. A growing number of scientists and technicians who decide to undertake research in the United States never return. Once in the US, almost 75% of science or technology doctors decide to pursue their careers across the Atlantic.

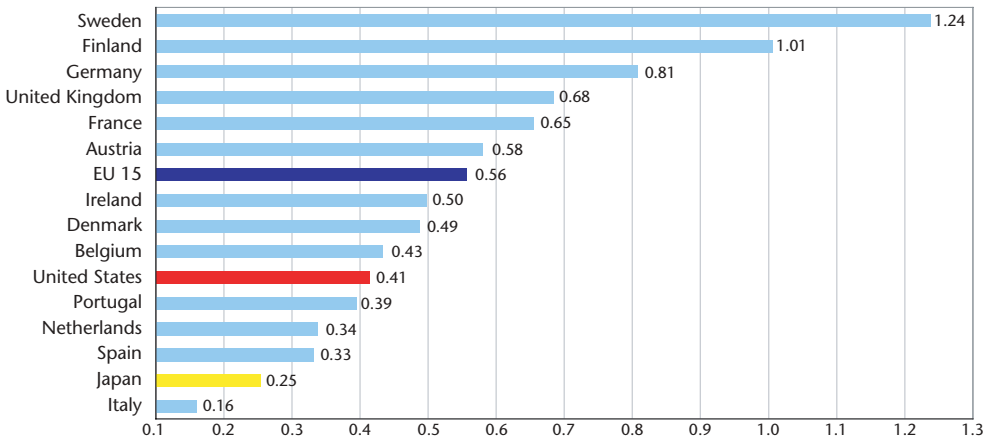
This new diagnosis confirms what we know already – although capable of producing excellence, Europe is finding it increasingly difficult to capitalise on it. Although it shows a creditable performance in some fields (such as medical research, chemistry, aeronautics or telecommunications), it is falling ever further behind in biotechnology and the information technologies. Overall, its performance in terms of trade in high technology is continuing to deteriorate: its trade deficit in this field increased from €9 billion in 1995 to €48 billion in 2000. A clear indicator of this competitive weakness is the falling share of patent registrations of European origin, whether on the European or the US market. But there is one ray of hope: in the nanotechnologies, a sector with a particularly promising future, Europe is level pegging with the United States, in terms of publications and patents.

The remedy is known. The only way to stop the decline is to increase European investment in research. 'This report is not just a study, it is a political tool,' remarked Commissioner Philippe Busquin. These new indicators reinforce the now famous '3% by 2010' target and the need to give real impetus to the European Research Area.

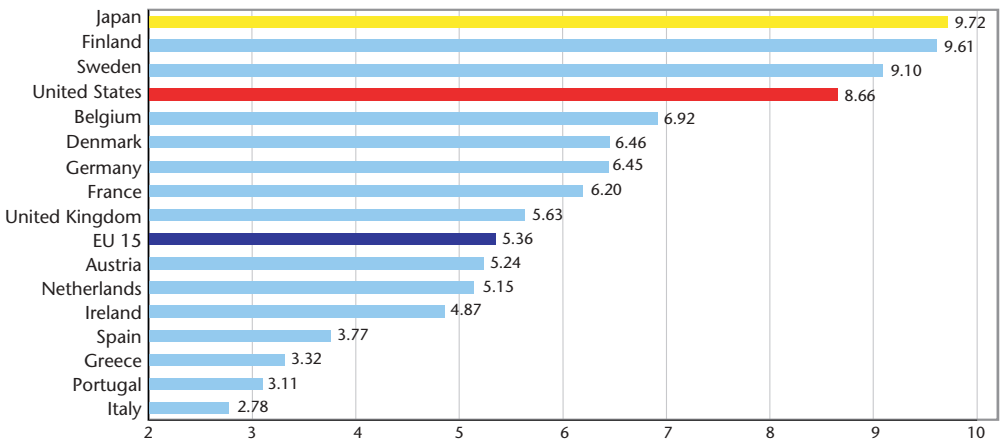
To find out more

www.cordis.lu/rtd2002/indicators/third_report.htm

Number of science and engineering doctors in the 25-34 age group. (‰)



Number of researchers per 1 000 active workers



EUROPEAN RESEARCH AREA

News in brief...News in brief...

2002 research report

The Research Directorate-General has released its annual report for the period from January 2001 to March 2002. This was a period which brought many political innovations, with the implementation of the European Research Area and preparations for the Sixth Framework Programme.

During this period almost 5 000 contracts involving more than 23 000 partners received funding of almost €3.7 billion, 82% of which was allocated to shared cost projects. SMEs were much in evidence, with 4 600 of them receiving funding which exceeded the target of 15% of total funding. Researchers from the candidate countries represented more than 10% of the total.

To find out more

europa.eu.int/comm/research/reports/2002/index_en.html

International co-operation

Important INTAS call

INTAS, the association for the promotion of co-operation with the Newly Independent States (NIS) of the former USSR, has launched its 2003 call for proposals. The total budget is €25.2 million.

The financing applies to any kind of fundamental or applied research project or network creation (€18.2 million), as well as four specific calls of €1 million each for Belarus, and for participation in the activities of the CERN, the GSI (Gesellschaft für Schwerionenforschung, Darmstadt) and the CNES. The closing date for these calls is 13 June 2003.

Fellowships amounting to €2.5 million will also be available for young researchers from the NIS and another €500 000 in the form of innovation grants. The closing date for these two calls is 11 July 2003.

To find out more

www.intas.be

On the public opinion front

Energy: must try harder!

Energy is at the heart of a paradox, highlighted by the publication of a recent Eurobarometer survey carried out among 16 000 European citizens. An overwhelming majority of Europeans are concerned at the threat energy consumption poses to the climate. Most Europeans also say they favour renewable energy and research in this field.

Yet most Europeans do not feel that their own behaviour needs to be called into question. Industry is seen as the main culprit, and, no doubt, to an unfair degree as many companies are very concerned about energy savings and reducing polluting emissions. While many of those interviewed are aware of the importance of saving energy (through insulation and more energy-efficient devices) they underestimate the role of personal transport in the energy equation. In short, Europeans show little inclination to change their habits.

To find out more

europa.eu.int/comm/research/energy/pdf/era_nne_study_report.pdf

Strangely underestimating the role of personal transport in the energy equation, Europeans do not seem much inclined to change their habits.

Biosciences: slow progress?

Closely monitored for the past decade, the uncertain opinions of Europeans on biotechnology were polled, in 2002, for the fifth time. Although overall distrust of the life sciences had increased continuously until 1996 – except when applied to medicine – the latest Eurobarometer results, published in March, show that the situation has tended to stabilise. As in 1999, almost half of all respondents are optimistic that progress in this field will bring improvements to the quality of life. The sticking point remains the use of GMOs in agriculture and the food industry. Any acknowledgement of the benefits continues to be outweighed by the overwhelming sentiment of the risk they pose, even if certain countries such as Spain or Portugal in the South, and Finland and Ireland in the North, are exceptions to the blanket rejection.

'This climate of scepticism is encouraging European biotechnological companies and research centres to set up elsewhere,' commented Commissioner Philippe Busquin. 'If we do not reverse the trend now, we will be unable to enjoy all the benefits from the revolution in the life sciences and will become dependent on technologies developed elsewhere. Now that we finally have strict Community legislation in this field, there is no reason to fuel unjustified fears or prejudices.'

To find out more

europa.eu.int/comm/public_opinion/archives/eb/ebs_177_en.pdf

News in brief...News in brief...

Letters

Science for all...

(...) After looking around the Europa site and, more particularly, the section on research, my attention was caught by a key sentence: 'Europe must invest more in science' (...) Indeed, over the past few years and for various reasons, we have seen young people turning their backs on science, to such a degree that some universities have had to reduce the number of lecturers due to the lack of students. Aware of this worrying trend, some scientific institutions are proposing competitions for primary and secondary school pupils as a means of attracting young people back to science. These competitions are an effective tool in stimulating or sustaining an interest in science among young people. However, not all teachers are experts and they have little scope when the subjects are usually physics and the life sciences.

Many teachers of literary subjects would like to make their contribution to popularisation by adopting a different approach to the scientific fields they know and like, thereby increasing the chances of restoring science to favour among young people, but ... they are not invited to do so. Yet, the more people are involved and the more varied the methods used, the greater the chances of attracting young people to science. Limiting access to these competitions to the experts is, in my opinion, a serious mistake, because many teachers of foreign languages, of French and of philosophy touch upon the sciences in their work, approaching them in different ways, and using different and sometimes very original methods.

By way of example, science fiction is a fantastic point of departure for developing an interest in science in the same way as some researchers draw inspiration from it to launch scientific or space missions. The study of science fiction works alongside popular scientific texts, culminating in writing a science fiction essay in co-operation with the experts, is a way of stimulating the interest of pupils in the sciences (...).

If Europe is to invest more in the sciences, there must be a strong demand on the part of young people. To achieve that it is essential for those who set challenges for schools to facilitate access to all.

Maryse Sari
Head of Languages – Ecole Nationale Supérieure des Ingénieurs en Construction Aéronautique et spatiale – Toulouse (France)
Maryse.Sari@ensica.fr

A little clarification

On the wrong track...

Photo of the German Maglev Transrapid using traditional electromagnets.

In our dossier on superconductivity in issue 36 of RTD info, the photograph with caption on page 8 of a prototype of the Maglev *Transrapid* train, which was used to illustrate the opportunities opened up by magnetic levitation, were likely to cause confusion. The same is true of the mention of the *Transrapid* being inaugurated in Shanghai in December 2002.

In fact, this German technology does not at present use magnetic fields obtained using superconducting materials, but rather uses traditional electromagnets. Only the United States and Japan have to date tested the Maglev train using superconductivity.

To find out more
europa.eu.int/comm/research/news-centre/en/pur/03-02-pur01c.html

Illustration of the US Maglev M-2000 using superconductivity.
http://www.maglev2000.com/

Call for experts

In the previous issue, we mentioned the call for experts launched by the Commission for the evaluation of projects submitted following calls for proposals for implementation of the Sixth Framework Programme. We should point out that when applications from experts are submitted by research organisations and not individuals, these bodies must not present the members of their in-house teams but only external candidates whose expertise they appreciate and who they recommend.

We would also remind you that the Research Directorate-General aims to have women make up 40% of members of evaluation panels and expert committees.

www.cordis.lu/experts/fp6_candidature.htm

News in brief...News in brief...

Humour

The rocket and the safe

At a time when European countries – or, more precisely, their governments – have shown quite deep differences on the war in Iraq, it is reassuring to see major progress on another subject on which they have been at loggerheads for many years. I am speaking of the Community patent. The uninformed, such as myself, failed to understand Europe's repeated failure in a field where it lacked neither expertise nor competence. No doubt that, apart from the legal and technical aspects (language, costs, etc.), the deadlock also had something to do with cultural roots.

In our 'old Europe', industrialists, researchers and politicians perhaps tend to regard the patent from the defensive angle only, rather like a safe in which one stashes away, for fear of burglars, the family jewels. Hence, patent applications are made rarely and reluctantly, lest the effort prove a waste of time and money.

Elsewhere, and fortunately to an increasing extent in Europe too, another more dynamic and pro-active view is growing: the patent seen as a means of guaranteeing earnings from an invention, like a rocket that launches into orbit, out of anyone's reach, the rewards to be reaped in the future.

In fact it is a move from protecting property to projecting profits.

Such images are both beautiful and edifying, and European ministers showed proof of wisdom when they decided, on 3 March, following the Commission's advice, to implement a common policy on the Community patent so as to reduce sharply the cost of registration and litigation.

But making safes less expensive is not enough to transform a Harpagon into an Icarus. It is also necessary to take steps, as did the Council of 3 March, to encourage young Europeans to take chances and create companies.

Candide

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Sixth Framework Programme

Calls for proposals (2003)

On 17 December 2002, the Commission launched an initial batch of 49 calls for proposals with various closing dates in March and April, in particular for the principal calls concerning the major thematic priorities. The table below provides a summary of the closing dates and budgets available for the calls which are still open, as well as some others which have been launched in the meantime.(1)
The reference site to be consulted for all official information is on the CORDIS sever:
fp6.cordis.lu/fp6/calls.cfm

(1) Abbreviations used in the table: IP: Integrated Projects – NoE: Networks of Excellence – STREP: Targeted Research Projects – CA: Coordinated Actions – SSA: Specific Support Actions.

CALL IDENTIFIER	RESEARCH FIELDS OF ACTIONS TARGETED	CLOSING DATE	BUDGET (MILLIONS €)
INTEGRATING AND STRENGTHENING THE EUROPEAN RESEARCH AREA			
	Promotion of co-operation with the associated candidate countries		**rtd-inco@cec.eu.int**
ACC-SSA-General	SSA for the participation of organisations from the associated candidate candidate countries (ACC) in activities in the priority thematic fields.	27.06.03	9
	Information Society technologies		**ist@cec.eu.int**
IST-C	Future and emerging technologies (FET) – Open field (continuous submission)	Open until 31.12.04	60
IST-NMP-1	Manufacturing, products and services engineering in 2010 (1)	16.09. 03(2)	<60(2)
(1) Joint call by the IST and NMP programmes– *(2) The call for the IP/NOE closed on 24.04.03. This closing date therefore only concerns the STREP/CA. The budget of €60M is the total amount for the 2 calls*			
	Nanotechnologies and nanosciences, multifunctional materials and new production processes		**rtd-nmp@cec.eu.int**
ACC-SSA-NMP	SSA targeted at this priority for the participation of organisations from the ACC.	27.06.03	1(1)
(1) Ceiling within the limits of a budget of €4 M for the 4 priorities concerned.			
	Aeronautics and space		**rtd-aerospace@cec.eu.int**
Aero-2	SSA in the field of aeronautics	19.09.03	<7(1)
ACC-SSA-Aero-Space	SSA targeted at this priority for the participation of organisations from the ACC.	27.06.03	1(2)
(1) An initial call closed on 20.03.03. The budget of €7 M is for the total of the 2 calls. *(2) Ceiling within the limits of a budget of €4 M for the 4 priorities concerned.*			
	Food quality and safety		**rtd-food@cec.eu.int**
ACC-SSA-Food	SSA targeted at this priority for the participation of organisations from the ACC.	27.06.03	1(1)
(1) Ceiling within the limits of a budget of €4M for the 4 priorities concerned.			
	Sustainable development, global change and ecosystems	**rtd-energy@cec.eu.int**	**rtd-transport@cec.eu.int**
Transport-2	SSA in the field of sustainable transport systems	19.09.03	<5(1)
ACC-SSA-Energy	SSA targeted at energy for the participation of organisations from the ACC.	27.06.03	1(2)
ACC-SSA-Transport	SSA targeted at transport for the participation of organisations from the ACC.	27.06.03	1(2)
(1) An initial call closed on 20.03.03. The budget of €5 M is the total for the 2 calls. *(2) Ceiling within the limits of a budget of €4 M for the 4 priorities concerned.*			
	Citizens and governance in a knowledge-based society		**rtd-citizens@cec.eu.int**
Citizens-3	In particular: dynamic of the knowledge-based society and its economic and social impact, social cohesion, changes in working methods, enlargement and governance	10.12.03	48(1)
(1) for IP/NoE.			
	Anticipation of scientific and technological needs/New and emerging sciences and technologies		**rtd-nest@cec.eu.int**
NEST-A	*ADVENTURE* projects (emerging fields of knowledge and technologies of the future) *INSIGHT* projects (evaluation of new discoveries and phenomena) – SSA	• 14.05.03 • 22.10.03	28
	Horizontal research activities of interest to SMEs		**rtd-sme@cec.eu.int**
SME-1	Specific call for SMEs: co-operative research (CRAFT)	• 29.04.03 • 27.11.03	95 60
	Specific measures to support international co-operation		**rtd-inco@cec.eu.int**
INCO-DEV-1	Developing countries (DEV): projects in the field of health, resource management and food safety	11.09.03	50

CALL IDENTIFIER	RESEARCH FIELDS OF ACTIONS TARGETED	CLOSING DATE	BUDGET (MILLIONS €)
INCO-MPC-1	Mediterranean partner countries (MPC): projects in the field of the environment, cultural heritage and health	07.05.03	25
INCO-WBC-1	West Balkan countries (WBC): projects in the field of environment and health	07.05.03	13.5
INCO-DEV/SSA-1	SSA (DEV)(1)	04.09.03	1
INCO-MPC/SSA-2	SSA (MPC)(1)	04.09.03	0.6
INCO-WBC/SSA-3	SSA (WBC)(1)	04.09.03	0.6
INCO-Russia+NIS/SSA-4	SSA for Russia and other countries of the former USSR(1)	04.09.03	0.6
INCO-COMultilat RTD/SSA-5	SSA for the multilateral coordination of RTD policies and activities(1)	04.09.03	0.6

(1) Calls open until 2006. The indicated budget applies for 2003 (a first call closed on 11.03.03).

	Support for the coordination of activities		**rtd-coordination@cec.eu.int**
ERA-NET/1/CA-SSA	Supporting the co-operation and coordination of research activities at national and regional level (ERA-NET)(1)	03.06.03	24

(1) Call open until 2005.

STRUCTURING THE EUROPEAN RESEARCH AREA

	Research and Innovation		**rtd-innovation@cec.eu.int**
Innov-2	Innovation Relay Centre	02.07.03	74(1)

(1) Budget for 4 years.

	Human resources and mobility (Marie Curie Actions)		**rtd-mariecurie-actions@cec.eu.int**
Mobility-1	Research training networks(1)	19.11.03	115
Mobility-2	Host fellowships for early stage research training(1)	11.02.04	70
Mobility-3	Host fellowships for the transfer of knowledge(1)	• 22.05.03 • 19.05.04	40 45
Mobility-4	Support for conferences and training courses	20.04.04	10
Mobility-5	Intra-European fellowships(2)	18.02.04	55
Mobility-6	Outgoing international fellowships(2)	• 21.05.03 • 12.02.04	10 18
Mobility-7	Incoming international fellowships(2)	• 21.05.03 • 12.02.04	9 11
Mobility-8	Excellence grants(2)	• 20.05.03 • 18.05.04	25 30
Mobility-9	Excellence awards (in the framework of mobility)(2)	• 20.05.03 • 18.05.04	0.25 0.25
Mobility-10	Marie Curie chairs	• 20.05.03 • 20.01.04	5 5
Mobility-11	European reintegration grants (in the framework of European mobility)(2)	Open until 31.10.04	39
Mobility-12	International reintegration grants (for researchers based outside Europe)(2)	Open until 31.10.04	17

(1) Allocation to host bodies
(2) Allocation to researchers

	Research infrastructures		**rtd-infrastructures@cec.eu.int**
Infrastructures-2	Development of communication infrastructures	06.05.03	50

	Science and Society		**rtd-sciencesociety@cec.eu.int**
Science and society-1	Support and networking for the Science and Society approach	Open until 09.12.03	4
Science and Society-EoI-1	Call for expression of interest 'Science and Society'	02.06.03	-
Science and Society-2	Support for European Science Week (2004)	13.05.03	3
Science and Society-3	'Descartes' Prize (2004)	13.05.03	1
Science and Society-4	Deepening the understanding of ethnic problems	05.06.03	5
Science and Society-5	Science and education European initiative	08.10.03	7

RESEARCH AND TRAINING IN THE NUCLEAR FIELD

	Euratom		**rtd-euratom@cec.eu.int**
Euratom Call 03 – Fixed deadline	Research on the management of nuclear waste, protection against radiation, security of installations, and training aspects	06.05.03	67
Euratom Call Open	SSA, especially in the fields of training, mobility and access to infrastructures	• 06.05.03 • 14.10.03	 2

Diary

Meetings under the Greek Presidency

www.cordis.lu/greece/events.htm
www.cordis.lu/greece/rd_events.htm

- **Foresight in the Enlarged European Research & Innovation Area** – 16-18/05/03 – Ioannina (Epirus Technological Park)
- **Sustainable Development Indicators in the Mineral Industries** – 21-23/05/03 – Milos
- **European Platform for Biodiversity Research Strategy** – 22-27/05/03 – Lesbos
- **Sustainable Development of the Mediterranean Sea and of the Black Sea** - 28-31/05/03 – Thessaloniki
- **International Conference "Tales of the Disappearing Computer"** – 1-4/06/03 – Santorin
- **Scientific and Technological Development cooperation between the European Union and the Balkan Countries** – Ministerial Meeting – 26-27/06/03 – Thessaloniki

European notebook

- **2003 ESARDA Symposium –** European Safeguards R&D Association – 13-15/05/03 –Stockholm (SE) web.jrc.cec.eu.int/esarda/events/esarda_meetings/stockholm/index.html
- **eHEALTH 2003: ICT for Health** – 22-23/05/03 – Brussels (BE) europa.eu.int/information_society/eeurope/ehealth/conference/2003/index_en.htm
- **Green Week** – Conference, exhibition and competition for schools – 2-6/06/03 – Brussels (BE) europa.eu.int/comm/environment/greenweek/index.htm
- **8th European Conference on Traumatic Stress 2003** – 22-25/05/03 – Berlin (DE) www.trauma-conference-berlin.de/
- **European Association of Geoscientists and Engineers 65th Annual Conference and Exhibition** – 2-5/06/03 – Stavanger (NO) www.eage.nl/conferences/index2.phtml?confid=9
- **CESURA 2003 – International Conference on Clean, Efficient & Safe Transport** – 4-6/06/03 – Gdansk (PL) aandy@ely.pg.gda.p
- **Towards the Sustainable Use of Europe's Forests** – 25-27/06/03 – Tours (FR) www.efi.fi/events/2003/Forest_ecosystem/
- **First FEMS Congress of European Microbiologists** – 29/06-3/07/03 – Ljubljana (SL) www.fems-microbiology.org/congress2003.htm

What's new on the Web?

Ploteus Portal www.ploteus.net/ploteus/portal/home.jsp

Proposed by Euroguidance with the support of the Commission, this new site presents education and training opportunities throughout the European area.

Greenfacts www.greenfacts.org/

An independent and pluralist site publishing clear and in-depth studies on environmental and health issues. The first study is on climate change.

Science-Generation www.science-generation.com

A multilingual site offering an attractive presentation of all the issues raised by the biosciences.

The Sixth Framework Programme on the Internet

The Europa>Research site is currently launching a series of new pages to disseminate information on the Sixth Framework Programme.

- **Principal access site** europa.eu.int/comm/research/fp6/index_en.html

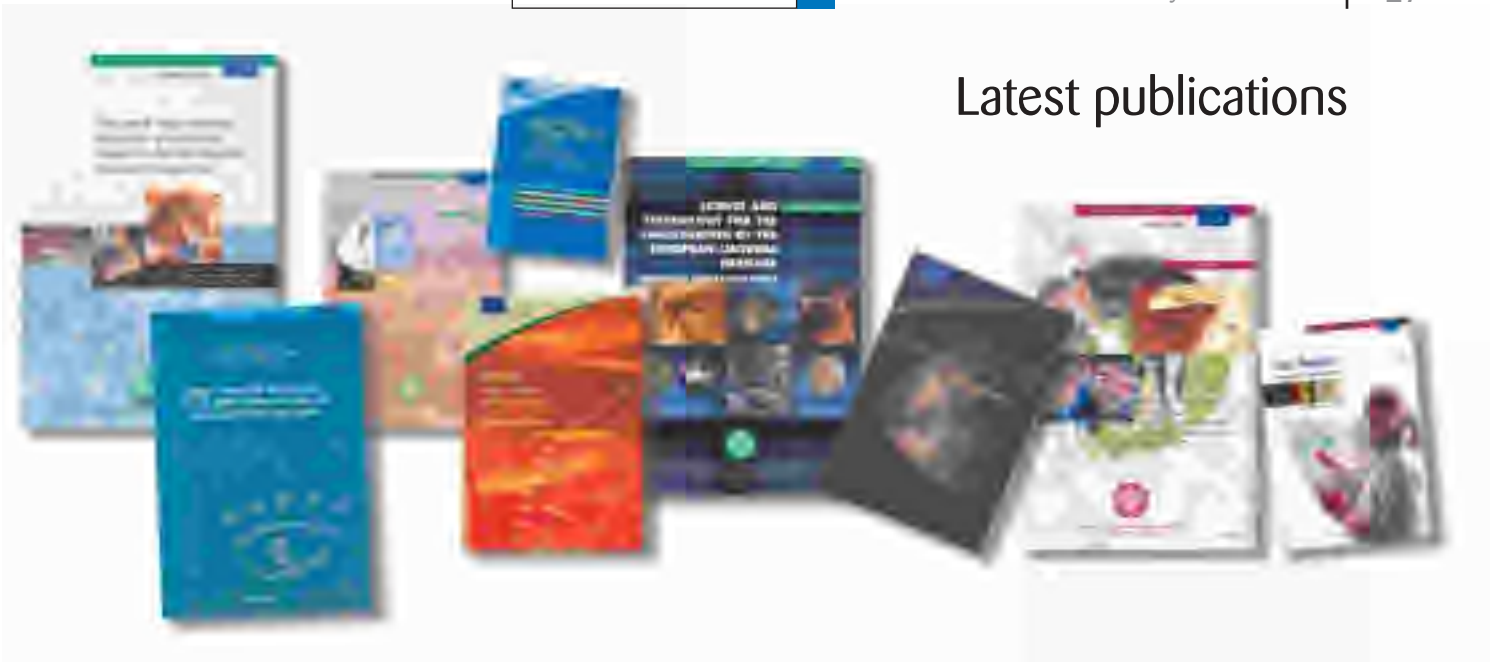
Several pages devoted specifically to various themes and 'horizontal' aspects of the programme are to be launched. Here are some to be going on with:

- **Agriculture (EU Agri-Net initiative):** europa.eu.int/comm/research/agriculture/index_en.html
- **Research on energy:** europa.eu.int/comm/research/energy/index_en.html
- **Marie Curie actions:** europa.eu.int/comm/research/fp6/mariecurie-actions/home_en.html
- **The information society:** europa.eu.int/information_society/programmes/research/index_en.htm
- **Co-operation and coordination of research activities carried out at national and regional levels (ERA-Net initiative):** europa.eu.int/comm/research/fp6/era-net.html
- **International co-operation:** europa.eu.int/comm/research/iscp/index_en.html
- **Innovation:** europa.eu.int/comm/enterprise/innovation/cordis.htm
- **Intellectual property:** europa.eu.int/comm/research/era/ipr_en.html
- **Science and society:** europa.eu.int/comm/research/science-society/index_en.html
- **The EU's space policy:** europa.eu.int/comm/space/index_en.html

The *Cordis* server is also a very complete portal, designed especially to help research organisations to participate in the new Framework Programme. Among other things, the site has full details of calls for proposals. It also has many thematic pages.

- **Principal access site:** www.cordis.lu
- **Site of the Sixth Framework Programme:** www.cordis.lu/fp6

Latest publications



Policy document

- **Green Paper – European Space Policy – 31pp**
  space-policy@cec.eu.int

Brochure

- **The international dimension of the European Research Area – 8pp**
  inco@cec.eu.int

Project profiles

- **Research and results for SMEs – III – 26pp**
  rtd-sme@cec.eu.int

Reports

- **Women and research – A wake up call for European industry – 64pp**
  helga.ebeling@cec.eu.int
- **The overall socio-economic dimension of Community research in the Fifth European Framework Programme – 105pp**
  research@cec.eu.int
- **Benchmarking National Research Policies – 79pp (with a CD)**
  erika.szendrak@cec.eu.int
- **Higher education and research for the ERA: Current trends and challenges for the near future – 80pp**
  elie.farcult@cec.eu.int
- **Regional Foresight in Austria – 200pp**
- **Regional Foresight in France – 201pp**
- **Regional Foresight in Germany – 189pp**
- **Regional Foresight in Ireland – 190pp**
- **Regional Foresight in the United Kingdom – 196pp**
  guenter.clar@cec.eu.int
- **Wind Erosion on agricultural land in Europe – 76pp**
  denis.peter@cec.eu.int
- **Quality enhancement of plant production through tissue culture – 27pp**
  joachim.bollmann@cec.eu.int
- **Science and Technology for the Conservation of the European Cultural Heritage - Research Infrastructures project – 32pp**
  anna-maria.johansson@cec.eu.int
- **Energy: Issues, Options and Technologies – 124pp**
  martin.huemer@cec.eu.int
- **Fusion Energy – Moving Forward – Spin-off benefits from fusion R&D – 26pp**
  OPOCE
- **EU co-sponsored research on reactor safety/ severe accidents (Final – 'INV' cluster projects) – 445pp**
  hans.forsstroem@cec.eu.int
- **EU co-sponsored research on reactor safety/ severe accidents (Final – 'EXV' cluster projects) – 172pp**
  hans.forsstroem@cec.eu.int
- **Testing of safety and performance indicators (SPIN) – 94pp**
  research@cec.eu.int
- **Building confidence in deep disposal: The borehole injection sites at Krasnoyarsk and Tomsk-7 (BORIS) – 26pp and 132pp**
  research@cec.eu.int

Studies

- **World energy: technology and climate policy outlook - WETO 2030 – 137pp**
  domenico.rossetti-di-valdalbero@cec.eu.int
- **Genetic testing – Patients' rights, insurance and employment. A survey of regulations in the EU – 154pp**
  elisabetta.balzi@cec.eu.int
- **Radio-epidemiology – 55pp**
  ernst-hermann.schulte@cec.eu.int

Conference reports

- **EO-Workshops European Earth Observation Research and Applications on the Environment (Brussels 11-13/09/01) – 192pp**
  michel.schouppe@cec.eu.int
- **Mixing height and inversions in urban areas (Toulouse (F), 3-4/10/01) – 113pp**
  pavol.nevediik@cec.eu.int

Project catalogue

- **Cell factory Community funded projects – vol. 2 – 241pp**
  alfredo.aguilar@cec.eu.int

Printed publications accompanied by the mention of an e-mail address are free and can be obtained by sending a message to the address given. EUR-OP (Office for Official Publications of the European Communities) means that the printed versions must be purchased. To order copies please visit the website at: eur-op.eu.int/general/en/s-ad.htm

The publications mentioned are a selection. 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

Agriculture and the

In developed countries, particularly in Europe, the development of genetically modified organisms (GMOs) and biotechnologies in the agricultural sector has been greeted with controversy. But is this regional confrontation failing to take into account the situation at the global level? This was the central question at an international forum organised by the Research Directorate-General in January, at the instigation of the European Group on Life Sciences.

Selected European projects

- Development of advanced sweet potato genotypes resistant to the complex of polyviruses infecting sweet potato in China. www.wisard.org/wisard/shared/asp/
- Genetic improvement of maize to enhance food safety by introducing resistance to fusarium monilliforme. www.up.ac.za/academic/botany/safemaiz.html
- Pest management: Picking a safer path for cotton production. www.delchn.cec.eu.int/en/Co-operation/Pest_Management.htm
- Exploiting the biodiversity of rhizobia for the sustainable improvement of common bean crops in South America. ferdinand.kaser@cec.eu.int
- Giving rice an added edge. Caritene plus. www.europa.eu.int/comm/research/agriculture/project_showcase/yellow_rice.html
- Characterization of immune effectors in penaeid: application to disease prophylaxis and selection of resistant shrimps. http://www.ifremer.fr/incodc/

Within the next 25 years, the world's population is likely to have stabilised at 8 billion, 90% of whom will be living in one of today's developing countries. Although global agricultural output is, at present, considered sufficient to feed everybody on the planet, there is no denying the profound imbalances in the nutritional situation. The food available worldwide is equivalent to approximately 2 700 calories per person per day, but average daily rations in sub-Saharan Africa are below 2 000 calories, compared with more than 3 500 in rich countries. In addition, 800 million people suffer from chronic malnutrition and consume an insufficient quantity of food to meet their body's requirements in terms of energy and nutrients (proteins, lipids, carbohydrates, vitamins and minerals).

The lessons and limitations of the first 'green revolution'

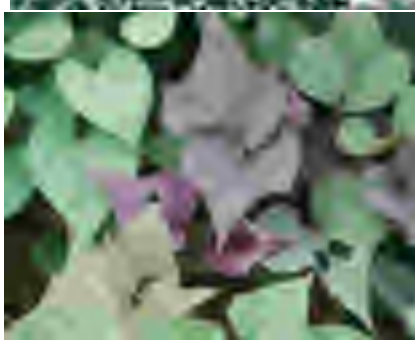
Conceived in the 1960s, the first 'green revolution' aimed, not without success, to boost agricultural productivity in developing countries. Under the guidance of the United Nations' Food and Agriculture Organisation (FAO), the programme received substantial public aid and the support of Western agricultural experts. It achieved some spectacular results – at least in certain southern regions, especially in Asia – by applying methods such as the selection and use of high yield wheat and rice varieties, the intensive use of chemical fertilisers and phyosanitary products, and ambitious programmes to develop irrigation and mechanised farming.

In a quarter of a century, this 'Western-style' modernisation has certainly helped to combat malnutrition and counter the effects of population growth on the demand for food.

Field tests in Guangdong (China) compared sweet potato clones of potential interest for their virus resistance. These plants are placed in the natural conditions under which they can become infected. Symptoms and yields are then observed.

View of experimental field: symptoms observed under natural conditions.

This variety shows high tolerance to viruses and is used as a parent to study the transmissibility of this characteristic.



Close-up: symptoms exhibited by an infected plant.

life sciences: food for thought

However, the FAO admits that the first 'green revolution' has pretty much run its course. The systematic use of fertilisers and pesticides is causing major environmental problems and the expansion of cultivated land has now reached its limit – often to the detriment of forest cover. Moreover, intensive irrigation is a threat to water resources, over-farmed land has lost its fertility, while high-yield plants have reduced biodiversity and diseases have become increasingly resistant to treatment. New plant varieties generally last just three or four years – the time it takes for the insects which devour them to adapt and for diseases to overcome their natural resistance.

Xuzhou laboratory: in vitro culture of tissue in which sweet potato is purified before being transferred to a field to measure the impact of viral diseases and assess sensitivity.

At the socio-economic level, this drive for modernisation has resulted in two-speed agriculture, which has hit many traditional farmers hard and excluded those rural zones unable to participate. In many developing regions, subsistence farming, with its meagre harvests, exists alongside large modern crop or livestock farms, with their focus on urban and export markets.

The promise of bioscience

Solutions to these agricultural challenges need to be found at the very source of the imbalance. The FAO has launched the concept of the *alternative green revolution*. While not closing the door on intensive agricultural production, where it is feasible, this new strategy focuses more on respect for the environment, fairness and democracy, and is applied where there is a problem of undernourishment.

'This new approach, which is better suited to the majority of populations in southern countries, is based on better technologies, better farming practices and better seeds. The biotechnologies – which are more than just modifying genes – offer amazing opportunities in this respect. But we are only at the very beginning,' believes Professor Michel Petit, former governor of the World Bank. 'In any event, to prevent developing countries from benefiting from them would be to do them a flagrant injustice.'

Biosciences, in fact, offer new opportunities across a wide range of fields. In crop farming, in addition to alternatives to conventional phytosanitary practices, research is focusing on drawing attention to existing plants which are not yet being farmed.(1) These include sweet sorghum as cattle feed or new varieties of manioc, part of the staple diet in Africa, and one of the continent's most widely grown crops. Developing crops resilient to difficult soil and climatic conditions (wheat for arid regions, rice for saline or infertile soil, and so on) offer particularly promising prospects.

The quality of tropical soils is a key factor in agricultural productivity, but they are fragile and much more sensitive than other soils to over-exploitation, erosion, deforestation and pollution, sometimes resulting in irreversible degradation. Agricultural production is also largely dependent on the micro and macro fauna (earthworms, termites, insects, bacteria, etc.) the soils support. These play a vital role in airing and restructuring the soil and transporting the mineral elements necessary for plant growth. It is, therefore, important to preserve this biodiversity, and the increasingly precise knowledge provided by the life sciences can be crucial to this.

Setting aside all the hype surrounding cloning, research can help improve the resistance of livestock to diseases and parasites. It can also lead to the use of previously undomesticated breeds. The same applies to fish farming.

The biosciences may also benefit non-edible agricultural produce – such as decorative plants, plants for textiles and biofuels – and become an integral part of a vision for sustainable agriculture in southern regions.

To find out more

- United Nations Food and Agriculture Organisation (FAO) www.fao.org/biotec/index.asp
- Technical centre for agricultural and rural co-operation www.agricta.org/index.htm
- European initiative on agricultural research for development www.eiard-infosys.org
- OECD report (Nov. 2001) www.oecd.org
- US biotechnology industry www.bio.org
- Biomass Research and Development Board www.bioproducts-bioenergy.gov
- Biotechnologies in Africa www.bio-earn.org and www.africabio.com
- Biotechnologies in developing countries www.futureharvest.org
- International Service for the Acquisition of Agrobiotechnology Applications (ISAAA) www.isaaa.org
- EuropaBio www.europabio.org

Should we fear GMOs?

Developments in biosciences – and in GMOs in particular – for the benefit of agriculture in southern regions is a controversial subject. First, there is the fundamental question – posed more energetically in the North than in developing countries – of the danger posed by genetic modification.

Yet, since the dawn of crop and livestock farming, humankind has been applying some form of 'genetic engineering' through the selective breeding of plants, animals and micro-organisms (bacteria or yeast).

Contemporary genetic engineering, nevertheless, differs from these traditional techniques in that the transferred gene can come from species that are altogether different to the host.

For the plant world, it is the risks to the environment that are the most apparent and the most numerous. Ecologists fear that new characteristics will be transmitted from genetically modified crops to wild plant species (see box 'The challenge of co-existence'). As for humans, years of research by the world's leading laboratories have failed to uncover a single proven case of toxicity in humans caused by GMOs.

Not all convinced

A second subject of discussion relates to the take up of biosciences in the South. Not all countries are equally well placed to benefit from these technologies. In South America, the Argentinean government, in co-operation with leading industrialists, has planted millions of hectares of GMO crops, while Brazil is hesitant to take such a step (at least officially) as it plans to continue to sell to Europe.

In Asia, India and China are also taking different roads. Whereas in India GMOs are the subject of heated debate fuelled and much influenced by the North, China is committed to genetically modified organisms and, today, claims to have developed 141 of them, 65 of which have been approved for commercial production. China spends almost 10 times as much as India or Brazil in this field, initially with the aim of feeding a growing population, but it could ultimately become a major exporter of these technologies to the South.

The thorny issue of patents

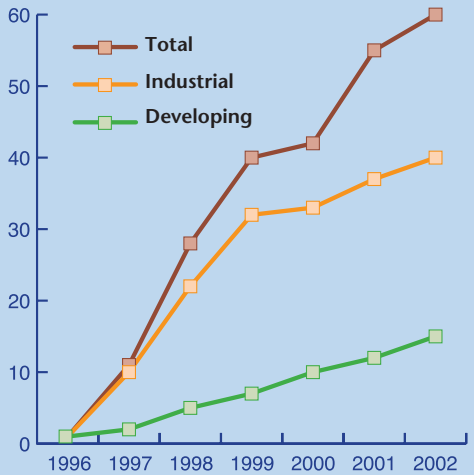
It remains to be seen how farmers in the poorest countries will benefit from these costly technologies. Even if some private firms are on occasion very generous, it is hard to imagine the giants of the agro-chemicals industry suddenly becoming charity organisations. GMOs are a natural focus of debates on the ethics of fair trade between the North and South.

The challenges of co-existence

The risk of 'transgenic flows' between GMOs and other plants is part of the wider issue of 'co-existence', which is the focus of a debate organised by the European Commission on the acceptance of GMOs in the North and the South. The Commission's message is that there should be total freedom for producers and consumers to choose between conventional, biological or genetically modified farming. Taking into account the biological risks, this co-existence must be respected at every level of the production chain to ensure that there is no mixing of the seeds and products of the three sectors, whether during storage, transport, or marketing. A round table, which brought together the various stakeholders, was held for the first time in Brussels at the end of April.

europa.eu.int/comm/research/press_en.html

Global Area of Transgenic Crops, 1996 to 2002: Industrial and Developing Countries (Million Hectares)



Source:International Service for Acquisition of Agro-Biotech Applications www/isaaa/org

Experts remain divided in their opinions on this thorny issue. The new intellectual property laws for transgenic seeds give reason to fear that the poorest countries will never gain access to them. Opponents insist that only the technical process used to develop a gene should be patented and not the gene itself. Seed producers counter that without royalties their laboratories may as well shut up shop. Critics also accuse biotechnology firms of tying their customers' hands by producing sterile seeds that oblige farmers who use them to purchase more for each sowing. Proponents contest this accusation by arguing that hybrid grains may have these characteristics naturally and not by design.

The free transfer of patents is not, however, worth very much without having the means to develop the technology – and that is an issue which developing countries need to address. To assist them, universities and laboratories

The involvement of the population in implementing a project in the field of biosciences for food: enzymatic breakdown of the natural toxins present in maize- and sorghum-based products.

in industrialised countries should help train their researchers and provide logistical support. There is a very real risk of seeing developing countries become dependent on GMOs, especially given the dynamic of vertical concentration at work within the industry due to considerations linked to intellectual property. But the alternative of denying them access to genetically modified foods is not necessarily any more desirable.

(1) Just a dozen plants – including wheat, rice, manioc and maize – provide more than 50% of human food requirements.

Progress in South Africa

In Makhatani, a disadvantaged region in South Africa, 600 farmers have been growing, for the past three years, a genetically modified variety of cotton which is resistant to insect attacks. The project has resulted in a fourfold reduction in the quantity of insecticides used, time saved on routine menial tasks, substantial increase in yields and more revenue per hectare.

The crop planted was the transgenic variety *Bollgard*, named after the gene introduced into a cotton variety marketed in South Africa since 1998. Developed from the bacteria *Bacillus thuringensis (Bt)*, it enables the plant to secrete an insecticide protein which protects it against more than 20 parasites, and caterpillars in particular. South Africa is the only country in Africa to have authorised, in 1998, the commercial cultivation of transgenic plants.

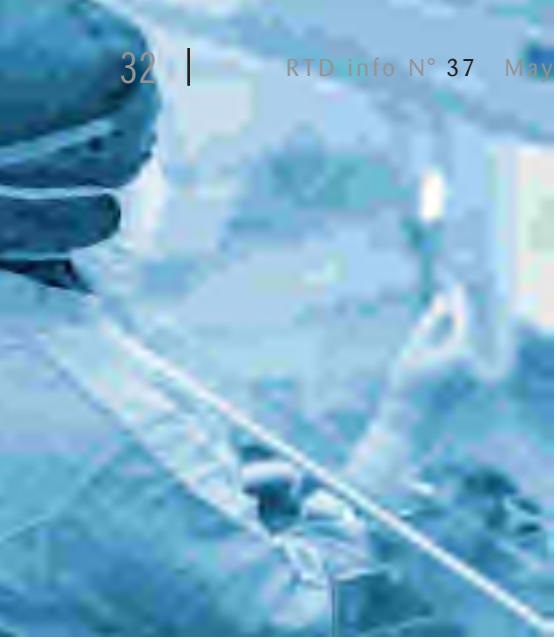
Professor Jennifer A. Thomson of Cape Town University explains that, at present, two varieties have official authorisation for marketing: Bollgard cotton (12 000 hectares in 2001) and Yieldgard maize (75 000 hectares in 2001), both of which are resistant to insects. Others are being studied or awaiting registration, in particular strawberries, maize and sorghum which are resistant to certain parasitic fungi, virus-resistant apples and a kind of sugar cane which can withstand the *Eldana*, an insect with a particularly voracious appetite.

Threats to the banana

Most people in the West are only familiar with dessert bananas (10% of global output), but in many developing countries consumption of the *plantain* variety almost rivals that of rice, wheat and maize. This crop is now under serious threat from the recent appearance of a fungus which attacks its leaves (*cercosporiosis*, or black spot disease) causing the trees to wither and the yield to collapse.(1) The only solution currently available is to apply vast quantities of fungicides. Fortunately, they do not penetrate to the pulp which is protected by the banana's thick skin. On the other hand, there is a significant impact on the environment, and every year doctors report serious cases of poisoning among workers handling these products.

To save this essential fruit, experts recommend research on more resistant strains of the plantain banana, either by hybridisation (fertilising cultivated varieties with wild plants – a highly expensive and unreliable solution), or by transgenesis (GM bananas).

(1) Source: The New Scientist, 18/01/2003.



Fighting

Long seen as providing a miracle treatment, antibiotics are beginning to show worrying signs of weakness. A major European research effort is now under way to combat the growing resistance to antibiotic action by infectious agents. In recent years, new molecules, new medical practices and new diagnostic tools have all been developed to try to solve this problem.

Seventy per cent of the germs responsible for lung infections are today resistant to at least one of the principal molecules available to combat them. Tuberculosis, long regarded as having been marginalised, is now back with a vengeance with deaths running at 1.5 million a year worldwide and the appearance of new multi-resistant strains. Pneumococcus, the agent which causes pneumonia – the world's most deadly infectious disease resulting in 3.5 million deaths a year – is also proving increasingly resistant to current treatment.

Increasing resistance

The problem is widespread and, despite the very wide range of antibiotics available to them, developed countries are far from being risk free. In fact, it is their over-consumption which is one of the main causes of the problem. So-called nosocomial diseases found in a hospital environment regularly make headline news – and 60% of these are caused by resistant microbes. During a recent outbreak in the United Kingdom of infections caused by *Staphylococcus aureus*, the usually effective methicillin proved ineffective in four out of ten cases. However, bacteria are not the only culprits – the same problem is being encountered in many microbial illnesses, whether viral (such as Aids), fungal, or parasitic (such as malaria).

What is the reason for these mutations? Strangely enough, we still know very little about the exact way in which many common antibiotics work, and thus even less about the precise mechanisms behind the resistance shown by pathogens. The European Molmechmac (Molecular Mechanisms of Macrolides) project has been trying to shed light on these grey areas since December 2000. Researchers are concentrating on the (very widespread) family of macrolide antibiotics in an attempt to improve their understanding of the emergence of resistance and to avoid the problem by modifying the therapeutic molecule.

Genetic transfers

Another problem arises from the fact that when a resistant gene appears, it spreads immediately. 'Given certain conditions, bacteria are able to exchange genetic material, although we do not know exactly how important these flows are, what stimulates them or what reduces them,' explains Anne-Marie Collignon of the Université de Paris-Sud, coordinator of the Artradi project which was launched in September 2002 with the help of European Union funding. 'The digestive tract is a favourable environment for the transfer of resistant genes. It contains several thousand billion bacteria of every kind, concentrated in a restricted space which is ideal for the exchange of genetic material. We chose to focus on *in vitro* and *in vivo* studies.'

Many farm animals are also given regular doses of antibi-

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To find out more

http://www.cordis.lu/lifescihealth/major/drugs.htm

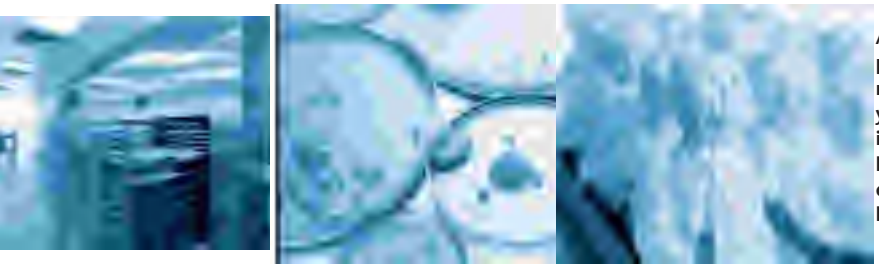
European actions

The European Union adopted an initial resolution *(Strategies to combat the microbial threat)* in 1999, followed by recommendations in November 2002 *(For a prudent use of antimicrobial agents in human medicine).*

More than 80 research projects, supported by the Union to the tune of some €100 million, have been carried out over recent years.

The *Genomics and biotechnology for human health* priority action under the Sixth Framework Programme is concentrating explicitly on support for networks of excellence and integrated projects engaged in research on new molecules; the mechanisms which explain resistance; the development of alternative treatment and preventive strategies; the development of diagnosis and susceptibility tests; and approaches to epidemiology.

microbial resistance



A partner in various European research projects, LEO Pharma (DK) has developed many major treatments over the past 90 years. It aims to discover and develop two innovative medicines every decade, knowing that it takes about a decade to develop a pharmaceutical product of this kind.

otics, often for long periods, to reduce the risk of infection and to stimulate growth. Their intestinal fauna could therefore also acquire resistant genes and then transmit them to man. 'If we could understand how these transfers occur we may then be able to advise on how to avoid the occurrence of resistance and gain better insight into the exchange of genes in procaryotes,' adds Anne-Marie Collignon.

Uses and abuses

Scientists also want to define a better use of antibiotics. 'There are many ways of reducing the risk of resistance appearing,' explains Anna Lönnroth, scientific manager responsible for microbial resistance at the Research Directorate-General. 'You can combine different molecules and change the combination from time to time, or use certain additives. Common sense also plays a part, for example by only using certain treatment when it is really necessary. Above all, there is the duration of administration and dosage. The worst option is to give low doses over a long period – a sure way of encouraging the emergence of resistance.'

With this in mind, researchers on the Arpac project are analysing and evaluating the practices of many doctors at European hospitals with a view to optimising their methods and harmonising anti-resistance practices. They also want to gather data on the scale of the phenomena in Europe and the pathogens involved.

Developing new antibiotics

Obviously, this growing resistance also brings with it a need for research into new antibiotics. Discovering such molecules is a long, difficult and costly process (about €500 million per molecule) and the market is highly competitive. These difficulties tend to deter pharmaceutical companies – in fact, it has been several years since a new and important antibiotic was launched. The European Union is therefore helping to finance projects aimed at developing antimicrobial agents, some of them in close co-operation with industry.

The Antistaph project, for example, is exploring the totally new avenue of protease inhibitors. 'Proteases are enzymes directed against the host proteins and which play a key role in the growth and virulence of pathogens,' explains project coordinator Magnus Abrahamson of Lund University. 'Substances which inhibit these proteases have achieved some remarkable successes in the fight against the Aids virus. We now want to draw on these successes to develop antibiotics with a radically different action to that of traditional molecules. A German SME, one of the project partners, aims to patent one or more molecules which prove genuinely effective.'

The Ribosome inhibitors project is also seeking to develop new antibiotics. Its strategy is to use the mechanisms of protein manufacture as a target for the development of innovative and effective antimicrobial agents. 'We are starting with a molecule, fuscidic acid, the antibiotic effects of which we have long been familiar with,' explains coordinator Frederik Bjorkling of the Danish Foundation Leo Pharmaceutical Products Ltd. 'We want to understand how it works and use this knowledge to find new

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Supporting our neighbours

The Armed project (Antibiotic resistance surveillance and control in the Mediterranean region) reflects the Union's desire to take into account the global aspect of the antimicrobial resistance phenomenon. The project was launched on 1 January 2003 for a period of four years, with the aim of extending EU efforts to monitor the problem and disseminate good practices to the south and east of the Mediterranean Basin.

Dr Michael Angelo Borg, of St Luke's Hospital in Malta, is coordinator of the project which includes Northern European institutions (British, Belgian and Dutch) as well as hospitals and universities in Cairo, Tunisia, Ankara, Casablanca, Jordan and Cyprus. The network of experts on antibiotic resistance, which was created as a result of this initiative, will be looking at subjects including antibiotic consumption patterns and practices to control infections, and will also try to identify any cultural factors specific to this region. Similar projects are running in other parts of the world.

On the viral front

We know that viruses do not respond to antibiotics. These formidable pathogens, which are much smaller than bacteria, reproduce by using the replication system of the cells on which they feed. Apart from vaccination, on which research is continuing, there is virtually no treatment to combat them, as is clear from the annual ravages of influenza germs. Nevertheless, a few treatment molecules have, nevertheless, been developed over recent years, most of them against the HIV virus. The first instances of resistance were not long in coming, however, and today nearly 20% of new infections are caused by viruses which are resistant to at least one of the available treatments.

To study this worrying phenomenon, the 16 partners on the European Spread project are collecting data on the spread of HIV resistance. Other projects are trying to understand the appearance of resistance, especially to protease inhibitors. These researchers all share the same goal – to produce new molecules able to eradicate resistant strains of the virus.

molecules.' This research is particularly interesting as it is also seeking to develop new agents against mycoses, a field where there is very widespread resistance and where the treatment options are more limited.

'Developing new antibiotics will also benefit recent progress in genomics,' adds Anna Lönnroth. 'Several microbial genomes have been sequenced recently, increasing the amount of genetic information available and thereby reducing the cost of developing new molecules. This genome revolution will also help us in the key field of diagnostics.'

'Real-time' diagnoses

Diagnostics is a strategic element in the campaign against the over-consumption of antibiotics being observed in the industrialised countries – a practice which is partly to blame for the development of resistance. If doctors had inexpensive and fast – ideally instant – methods for identifying the antibiotics best suited for a given infection, treatment would be improved considerably, in the case of benign and more serious infections. For example, the Dissarm project, coordinated by the National Microelectronics Research Centre (NMRC) in Ireland, is trying to develop a kit able to identify the presence of multi-resistant TB agents from a biological sample.

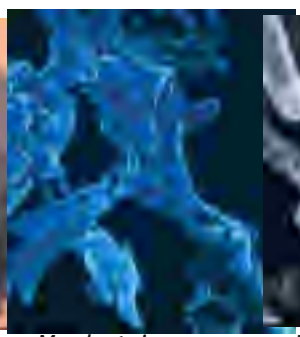
However, research alone is not enough to reduce the incidence of resistance. Radical changes in our social practices are also necessary, and a drastic reduction in our consumption of antibiotics will probably be required. At present, almost 50% of antibiotics are being used either by industry to treat foods against pathogens, or for farm animals, often to promote growth. In human medicine, some 60% of antibiotics are used for complaints of the upper respiratory system, most of which are viral in origin and consequently do not respond to this treatment. A recent study showed that in the United States – and the same probably applies to Europe – half of all antibiotics prescribed by GPs are superfluous and many people are unaware that they are ineffective against viruses.(1) The battle against microbial resistance is therefore far from over.

(1) 40% of people interviewed in the EU during the last Eurobarometer survey on the attitude of Europeans to science and technology.

Staphylococci: **these bacteria, first isolated by Louis Pasteur in 1829, are the agents of many infections (boils, septicaemia, etc.).**
© Institut Pasteur.

Serratia marcescens: **this bacteria is the source of nosocomial infections which are resistant to many antibiotics.**
© Institut Pasteur.

Mycoplasma pulmonis: **this is the smallest micro-organism living in a free state, without walls, which is also able to multiply inside cells, causing pneumonia in particular.**
© Institut Pasteur.



Mycobacterium tuberculosis, **or Koch's bacilli: the tuberculosis agent.**
© Institut Pasteur.

Pseudomonas pyocyanea, **at the origin of many nosocomial infections (pneumonia, bronchopneumonia, pleurisy, dysentery): not a very pathogenic bacteria, except in individuals with a depressed immune system.**
© Institut Pasteur.

An anthropologist takes stock

Maurice Godelier: 'The global clashes we are seeing today show the ever greater need to look to the social sciences to understand their origin and their nature.'

A philosopher by training, an expert on the societies of Oceania, and director of research at the Ecole des Hautes Etudes en Sciences Sociales, Maurice Godelier is a man of many talents. In particular, he is passionately interested in all questions of scientific policy, both national and European

It is usual to speak of the human sciences or the social sciences. You prefer the more inclusive 'sciences of man and society'. Why is this?

Maurice Godelier: You have to put things in their historical context. The Humanities – philosophy, law and even history – appeared in the West during the Greco-Roman era. The social sciences – economics, sociology, anthropology, linguistics, demography, etc. – originated from the late 18th Century onwards. Then, in the 20th Century, other disciplines found favour, such as political science or management science. Many universities continue to keep these two fields apart. But in terms of methods and ideas, each influenced the other from the very beginning. Alongside traditional political history – the history of dynasties and empires – we saw the development of economic history, the history of mentalities, and so on. The point of departure of the analyses is not the isolated individual in his specificity, but individuals and groups defined by their social relationships. The humanities try to define the nature of these relationships which make up what is particular about a given society and a given period in all their complexity. In the 20th Century, the idea took hold that the specificity of social relationships are determined by their structure. Research moved towards the discovery of these structures and attempts to reconstitute their inherent logic to understand their appearance, evolution or disappearance.

This complex approach also takes into account what people think of their relationships and the place they occupy within their society. It also includes the representations people make of their own body, as well as the shared or rejected values and symbols within their community. One of the difficulties of the social sciences is the need to also take into account the imaginary realities or symbolic practices associated with the exercise of power and the reproduction of societies.

Is it possible to dispense with a multidisciplinary approach when dealing with such complex questions?

M. G.: No, social reality is, in fact, accessible through a single approach. An anthropologist who knows nothing about the history of civilisations will see just a part of the reality. It is becoming increasingly necessary for research to adopt a multidisciplinary and interdisciplinary approach. In short, to my mind the former separation, even opposition, between the human and social sciences must disappear and be replaced by the field of the sciences of man and society. The global clashes we are seeing at present show the ever-greater need to look to the social sciences to understand their origin and their nature. It is impossible, for example, to analyse what is happening in Iraq without approaching it from various angles. There is history and philosophy, which tell us about the sources of Islamic fundamentalism, including Wahhabism. Anthropology and sociology tell us about what is happening in the lives of these people, while economics gives us the context of globalisation and shows the strategic importance of certain resources and certain regions of the world. Finally, there are the political sciences which analyse the regimes in the West and the East which co-exist in mutual opposition.

European Union enlargement can also be seen as a complex change, one which the analyses of the social sciences could shed light on …

M. G.: The entry of new countries into the EU, with their cultural diversity, their unequal development, and their religious differences, is going to pose problems which are more than mathematical equations or ideological formulae. Their history and their identity oblige us to invent specific routes for their integration into the Union – an integration at two levels: the development of a market economy which could be tempted by unbridled economic liberalism, and the development of plural and democratic political regimes. The response to these changes will be social, cultural and political, and not just technological or economic.

“One of the difficulties of the social sciences is the need to also take into account the imaginary realities or symbolic practices associated with the exercise of power and the reproduction of societies.”

Opposite, the Baruya society, studied by Maurice Godelier. A tribal leader in charge of initiating boys into manhood wields the *Kwaimatnié*, a sacred object with which he beats the breasts of the initiated – decorated with feathers from the casoar and birds of paradise – so that they will be penetrated with the strength of the Sun.

Priority for the ‘soft’ sciences

A European Research Area in the field of human and social sciences. That is the new objective as stated clearly in the Sixth Framework Programme. With a budget of €225 million, the seventh thematic priority (Citizens and governance in a knowledge-based society’) is devoted exclusively to achieving this goal.

At the same time, this desire for the ‘soft’ sciences to support the ‘hard’ sciences in many multidisciplinary projects (bringing the total budget to €355 million) is evident in all areas of the Framework Programme. ‘The pace of scientific progress is such that the social changes brought in its wake are difficult to gauge. Research in the social and human sciences can help us evaluate the consequences of this progress, and at the same time remain master of it,’ believes Jean-François Marchipont, director of the ‘knowledge-based society and economy’ unit at the Research DG.

The research fields of the seventh priority can be the subject of proposals for networks of excellence, integrated projects, specific targeted research or coordinated actions. These fields of study are as follows:

- Improving the production, transmission and use of knowledge and its effect on economic and social development.
- Options and choices for the development of a knowledge-based society.
- Variety of paths towards a knowledge-based society.
- Implications of European integration and enlargement for governance and citizens.
- Relationship between areas of responsibility and new forms of governance
- Issues connected with the resolution of conflicts and the restoration of peace and justice.
- New forms of citizenship and cultural identities.

To find out more:
www.cordis.lu/rtd2002/fp-activities/citizens_governance.htm

Enlargement also means enlargement of European co-operation.

M. G.: Of course, and in future this is going to be a genuine ‘plus’ for the Europeans. As you know, in nearly all disciplines the main partners of European researchers are increasingly the Americans. Bilateral and sometimes multilateral partnerships between European research centres exist of course, but they rank second in importance. Through their commitment to promoting the creation of European networks, the Union programmes represent major progress. They are permitting the pooling of intellectual and other resources of which each of the partners was often unaware.

The stress placed on the quest for excellence will also enable Europe to give new impetus to research in the individual Member States. The constantly repeated message is that we must attain the ‘critical masses’ of human and

material resources required for ambitious research programmes which would place us on an equal footing with the Americans. These two points will now constantly weigh upon the way research is organised within the various Member States. In many of these countries, the essential national evaluation to judge the scientific quality of researchers, teams, programmes and institutions is still not rigorous enough and this is going to have to change under pressure from Europe.

Also, the development of the European Research Area implies research organised on a bigger scale, with stronger teams and international visibility. This will bring demands for the financing and management of research which are totally new and different to what is usually found at national level.

The Sixth Framework Programme strengthens considerably the opportunity for research into the human and social sciences, in particular through the seventh thematic priority, 'Citizens and governance in the knowledge-based society'. Presumably, you see this as a good initiative?

M. G.: 'Considerably' is perhaps going too far. It is true that, for the first time, European funds are earmarked exclusively for the social sciences. But the global amount is still very low and must be increased sharply to meet the knowledge needs linked to European integration – political integration but also scientific integration with the European Research Area. Beyond knowledge and governance, other areas of the Framework Programme also include research themes which could incorporate a social science dimension. But they must learn to identify them and to respond to them.

Take the example of the nanotechnologies. These are set to bring about a radical change in production systems and, thus, in the economic organisation of modern societies. We therefore need forward studies to prepare and support this change. The development of biosciences raises ethical and deontological issues to which lawyers and philosophers must provide a response. The social sciences can also shed essential light in fields such as the environment and sustainable development. For example, they can study the way in which European policy in this field will be perceived and possibly accepted or contested by the public. But for all these forms of co-operation between the human sciences and other sciences, we must also increase the means of communication between these disciplines – and these points of contact are much too rare.

There has been a lot of talk about the information society. Today there is a lot of talk about the knowledge society. What does this mean in concrete terms for an anthropologist?

M. G.: It means building a Europe in which knowledge is disseminated more widely and influences the lives of individuals, as change in society is a fundamental objective. But a growing volume of information does not necessarily mean the development of knowledge.

I would cite the European ECHO (European Cultural Heritage On Line) programme as an example of the progress which the information and communication technologies can bring to many sections of society. This project aims to make available, for free, access on the Internet to whole areas of European heritage in fields such as the history of science, the history of art and the history of philosophy, while also presenting the heritage of other parts of the world. This is the patrimony of ethnographic museums and major collections of works from non-European societies in Africa, Asia, Oceania and the Americas. This heritage can be found in London, Berlin, Budapest, Paris and Rome, for example, and consists of masks, statues and objects from the ritual or everyday life of hundreds of non-European societies. Stimulating this systematic census of European collections and providing access to a part of these resources together with the necessary documentation is a major responsibility for researchers and museum curators. But also, what an opportunity for them for exchange and dialogue with all these non-European societies that have a part of their heritage in Europe. That is both a goal and a challenge.

"The entry of new countries to Europe, with their cultural diversity, unequal development and religious differences, will pose problems which cannot be reduced to terms of mathematical equations or ideological formulae."

Jorge Wagensberg: 'Interesting people in discoveries which they often knew nothing at all about'.

Never afraid of a little controversy or to try something different, Jorge Wagensberg, curator of the *Museu de la Ciència* in Barcelona, has a very personal view of how to interest all kinds of people in the realities of science. Rather than the traditional educational approach, he prefers what he calls 'emotional interactivity' in which curiosity, as the motor for acquiring knowledge, plays the key role.

Science, senses and sentiments

More than anything else, Jorge Wagensberg wants to provide a space that addresses all the senses. Touch, sight and sound are the rule. A visit to the permanent exhibition rooms at the *Museu de la Ciència* in Barcelona is like walking around a zoo where objects and phenomena have replaced the animals. Various installations combine interactivity and experimentation to enable visitors to discover for themselves the mechanisms and paradoxes of the perception of the real world around them.

The snail and the stair

Original presentations, such as the use of a magnifying mirror, show the similarities between a snail and a Gaudi staircase, for example, and between fields such as biology and architecture. At first sight, a large vivarium, known as *Invisible Silence*, seems to contain nothing but dead leaves, earth and roots. It is only after reading the notice – '30 insects live here' – that careful observation will reveal a small colony of *Extetosoma tiaratum*, tiny stick-like insects lost among the mass of inert vegetation. 'In the real world, things are diffuse and we do not notice them. A science museum must present this reality in a condensed form, in such a way that it catches the attention of the visitor who then goes on to ask questions and discover the answers that reality itself can provide. You will not find that in books, at school or in a video.'

A top level physicist – a role he combines with university lecturing and his commitment to his museum – Jorge Wagensberg concentrates his scientific work on the interdisciplinary borders of biophysics, a field which brings him face to face with the complexity of matter, living organisms and their evolution. When, 15 years ago, the *Museu de la Ciència* asked him to become involved in its activities his first reaction was to say: 'No thank you, I am too busy with research and teaching.'

Stimuli and suggestions

Yet the art of communicating science is a subject which has always interested him, as indicated by the titles of two books he published back in the 1980s: *Science and Us* and *Ideas on the complexity of the world*. After a trip to the United States (organised by the Barcelona museum as a means of tempting him), where he visited several science museums, Jorge Wagensberg became increasingly fascinated by the scope for innovation in this field. He subsequently agreed to take up the offer. In 1991, the non-profit La Caixa Foundation, which finances the museum, offered him the job of curator.

This gave Jorge Wagensberg full powers to develop *his* concept of a science museum which is anything but conventional. 'The primary task of a museum is neither to teach, nor to protect a heritage, nor even to inform or educate. Of course these aspects can be present but I believe that, much more fundamentally, one must seek to 'stimulate' the visitor – especially through sensory stimuli and experimentation – causing surprise, provoking a questioning reaction, and providing food for thought rather than ready-made answers. The aim is to draw on the public's curiosity about the world, nature and knowledge, the result being that people do not leave the museum exactly the same as they went in.'

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To find out more

- **Museum of Science *(Museu de la Ciència)***
  www3.lacaixa.es/fundacio/eng/equips/museu.htm
- **New Museum of Science**
  www.noumuseudelaciencia.com/home.php
- **La Caixa Foundation *(Fundacio la Caixa)***
  www.fundacio.lacaixa.es

And after the visit?

The ambition to act as a 'trigger' that will spark the *lasting* interest of the visitor is something that, as a good scientist, Jorge Wagensberg is keen to test for its presence and effectiveness. The golden rule for the team at the Barcelona Museu is to monitor and evaluate the impact produced by the thematic presentations they organise. 'We walk around the exhibition rooms and we look and listen. How is the public reacting? Where do they stop most frequently? What do they say to each other? We also interview visitors when they leave. Surveys are carried out among some visitors during the months following their visit to establish whether or not they have continued to show interest in the subject we presented, perhaps by buying books for themselves or their children, surfing on the Internet or watching television.'

All kinds of people

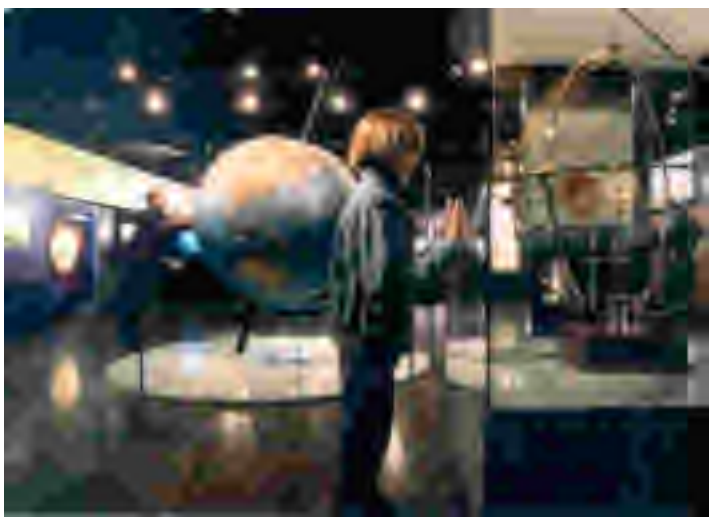
This desire to be sensitive to public reaction does not mean that the *Museu* is seeking to choose popular subjects guaranteed to draw the crowds. 'We do not go for fashionable topics designed to please. Our criterion is not "audience figures". What counts is interesting people in discoveries which they often knew nothing at all about.'

This does not prevent the *Museu* from setting itself the primary task of being a meeting place where people can come together to discuss the ongoing evolution of knowledge. In addition to its museographical vocation, it also seeks to be a platform for exchanges between scientists, students, children, the general public and politicians. Jorge Wagensberg sees the communication of science as an inherent part of democracy. 'The parallel activities we organise – seminars and debates – are designed to permit the expression of opinions and to "take the temperature" of various opinions in society.'

This commitment to a museum as a place where all kinds of people can meet and interrelate is a fundamental principle for Jorge Wagensberg. 'Whether you are a scientist, doctor, philosopher or writer, adult or teenager, when you take a walk in the forest you may have different perceptions, but you share a common space. A visit to a science museum must permit a similar communion. I believe it is a mistake to approach the job of communication by reasoning solely in terms of a *target public*. A good exhibition is one that is able to adopt a creative approach which addresses all kinds of people.'

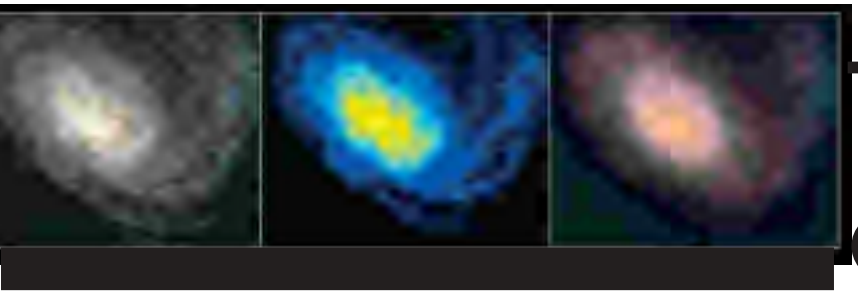
So what does Jorge Wagensberg think of the much bemoaned loss of interest in science among young people? 'In a world where the model presented to young people is the businessman, it is not really surprising. But this disastrous trend can and must be countered by stimulating the motor for knowledge: curiosity. In terms of human development and the organ that is most specific to man, namely his brain, curiosity is a stimulus which plays a role comparable to that which hunger represents biologically as a motor for nutrition in the living world. It is particularly active during childhood but, as with hunger, it should not stop with progress to adulthood. Curiosity is the reason science exists at all…'

A museum which does not have a 'target public' but has exhibitions which can be of interest to all kinds of people, at different levels.



A model patronage

Barcelona's *Museu de la Ciència* is housed in an industrial building typical of the late XIXth century Catalan style. It was founded in 1981 by the *Fundacio la Caixa*, an important non-profit organisation active in the educational and social field and set up by the prestigious bank of the same name. The growing reputation of the *Museu* – which, besides exporting its temporary exhibitions throughout Spain and abroad, also organises numerous conferences, workshops and courses –means that today it is possible to fund a new architectural infrastructure. 'We have opted for a vast project on several floors built at below ground level. A cathedral of science must not tower above its inhabitants robbing them of light,' says Jorge Wagensberg.



The digital cosmos

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Since the arrival of new generations of terrestrial and satellite telescopes, observation of the Universe has moved away from the 'age of the eye' to that of the detection of its many invisible rays. This technological change is giving rise to such a mass of digital data that it requires a new tool – the Astrophysical Virtual Observatory (AVO) – to manage it.

Three images of the same galaxy are the result of different telescopic approaches using the spectrum of visible waves, radio wavelengths and X-rays. Each one gives rise to interpretations which increase our knowledge. © ESO

The Universe has never come in for such scrutiny – from satellites such as the Hubble, the Infrared Space Observatory (ISO) and the XMM-Newton X-Ray Telescope, as well as such high-tech terrestrial installations as the Very Large Telescope (VLT) at the European Southern Observatory's Chile site. The sophisticated sensors fitted to the telescopes continuously record billions of observations of invisible rays which are stored in huge databases. New equipment already being prepared at the international level – such as the Next Generation Space Telescope or the Atacama Large Millimetre Array (ALMA), a complex of 64 dishes measuring 100 metres in diameter being planned for Chile – will further increase this explosion in astrophysical data.

The sky on screen

Astronomers no longer look at the sky, but at computer screens, as they face an increasingly daunting task. 'The performances of astronomical instruments and detectors double every year, those of computers every 18 months, and of data transmission networks every 20 months,' stresses Lars Christensen of the ESA (SC-ECF). 'The telescopes we will be using 10 years from now will provide us with such a mass of images in a single night that it would take us more than a month to transfer them using the present Internet configuration.'

How do you manage and use this growing flow of data effectively? This is a question, first and foremost, for the information and communication technologies – and one posed not only by astrophysics but by disciplines such as particle physics and genomics too. The answer lies in using the Grid. This new concept is a kind of 'super-Internet' designed to share the archiving and processing of vast quantities of data between host computers at different locations, thereby pooling power and capacity.

Customised data mining and archiving

It is against this background that the Astrophysical Virtual Observatory (AVO) is being set up. Launched at the end of 2001, the initiative has a budget of approximately €5 million, including a Union contribution of €2 million. It is a partnership of six of Europe's best astronomy centres under the management of the ESO.

This interactive structure will enable researchers to identify, for example, in which galaxies black holes can be identified which correspond to specific characteristics. The system will explore the data available in all the interconnected databases before making a summary of their processing using, in parallel, the capacities of the networked computers.

The researcher will then receive an analysis of the results without having to undertake the long and laborious task of decoding and listing. At the same time, another scientist working on different questions but drawing on data used for the first request will, in turn, receive a reply customised to his own needs.

Note: the AVO is being developed in close co-operation with two sister initiatives, Astrogrid in the United Kingdom and the National Virtual Observatory (NVO) in the United States.

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To find out more

- www.euro-vo.org/

Partners in the AVO project:

- ESO (coordinator)
- Institute for Astronomy (University of Edinburgh) and Jordell Bank Observatory (Victoria University of Manchester – UK)
- Institut d'astrophysique de Paris and the Observatoire astronomique de Strasbourg (CNRS and Université Louis Pasteur – FR)
- Space Telescope European Coordination Facility (ESA/ST-ECF).

Humour

The rocket and the safe

At a time when European countries – or, more precisely, their governments – have shown quite deep differences on the war in Iraq, it is reassuring to see major progress on another subject on which they have been at loggerheads for many years. I am speaking of the Community patent. The uninformed, such as myself, failed to understand Europe's repeated failure in a field where it lacked neither expertise nor competence. No doubt that, apart from the legal and technical aspects (language, costs, etc.), the deadlock also had something to do with cultural roots.

In our 'old Europe', industrialists, researchers and politicians perhaps tend to regard the patent from the defensive angle only, rather like a safe in which one stashes away, for fear of burglars, the family jewels. Hence, patent applications are made rarely and reluctantly, lest the effort prove a waste of time and money.

Elsewhere, and fortunately to an increasing extent in Europe too, another more dynamic and pro-active view is growing: the patent seen as a means of guaranteeing earnings from an invention, like a rocket that launches into orbit, out of anyone's reach, the rewards to be reaped in the future.

In fact it is a move from protecting property to projecting profits.

Such images are both beautiful and edifying, and European ministers showed proof of wisdom when they decided, on 3 March, following the Commission's advice, to implement a common policy on the Community patent so as to reduce sharply the cost of registration and litigation.

But making safes less expensive is not enough to transform a Harpagon into an Icarus. It is also necessary to take steps, as did the Council of 3 March, to encourage young Europeans to take chances and create companies.

Candide