Innovation & Technology Transfer

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Innovation: *How to* Spin Straw *into* Gold

European Healthcare Research

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INNOVATION/SMEs PROGRAMME • SEPTEMBER 1999

CONTENTS

Medical and Health Research

All four thematic programmes of the Fifth Research Framework Programme (FP5) address topics relevant to medicine and health, while the European Commission's Joint Research Centre also contributes to medical knowledge and health promotion both through its institutional activities – including those of the new Institute for Health and Consumer Protection – and through participation in framework programme projects.

Research under the precursor programmes of FP4, notably Biomed and Biotech, has led to advances which bring closer effective treatments for diseases including cancer and Alzheimer's, as well as enhancing understanding of new subjects of concern such as transmissible spongiform encephalopathies (TSEs) and the use of genetically modified organisms (GMOs) in food.

The value of such work for long-term health protection is beyond doubt. But EU funding also supports medical innovation – the intense collaborative effort needed to bring new drugs, new devices and new communication technologies to the point at which they can start to be manufactured and used.

The case studies in this edition's Dossier article highlight three demonstration projects – two from FP4's Biomed programme, and one from its Telematics Applications programme – and a transnational joint development project supported by the Innovation and SMEs programme's Innovation Relay Centre network.

All four offer fine examples of the direct benefits produced by EU research activities, both for European citizens and for European industry.

Innovation & Technology Transfer

Innovation

Innovation & Technology Transfer is published six times a year in English, French, German, Italian and Spanish simultaneously by the Innovation and SMEs programme. The Programme promotes innovation and encourages the participation of small and medium-sized enterprises (SMEs) in the framework programme.

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The Challenge of Change

It is not just ignorance or cost which makes markets slow to adopt technological innovation. Frequently, institutions and individuals are simply resistant to change. Technical success itself often depends on the ability to address and overcome such non-technical barriers.

In the Fifth Research Framework Programme (FP5), Innovation projects will not only support the industrial take-up of specific new technologies, but will develop and test tools and strategies for tackling generic, non-technical barriers to innovation(1). The first FP5 Innovation projects, selected in July, will be launched at the start of next year(2). But two recent initiatives illustrate the kind of result which the Commission expects to emerge from them.

Innovex(3) examined five earlier Innovation projects, all dealing with technologies to support improved regional water management, and has produced a guide to good practice for those attempting to introduce technological innovation in public sector markets. Proinno(4) addressed the difficulties of communication and project management arising between transnational technology transfer partners, working with four projects to refine and update a series of training workshops and a computer-based manual.

It is not only the participating projects that will benefit from the new insights and approaches gained from these measures, and from the concrete products based on them. Increasingly, European Union research and development as a whole is being oriented to the needs of the market. These products – and others like them generated by future groups of Innovation projects – will be welcomed by academic and industrial innovators engaged in transnational collaboration in all FP5 programmes.

Venice's city administration was unusually open to new technology. But many public authorities overlook opportunities for innovation which could bring both economic and environmental benefits.

Market pull

Traditionally, innovation has been driven by new technologies emerging from academic research. But there is now widespread recognition that take-up is more likely when research itself is designed to meet market needs. Involving end-users in research and demonstration projects from the outset ensures that work remains focused on real technology requirements. It also provides a credible reference for other potential purchasers, speeding the subsequent replication of results.

"Public administrations in particular tend to be distrustful of technology suppliers," says Rainer Behnke of InnoTec, the German consultancy which examined non-technical aspects of the five water projects. "They rarely adopt a new technology until its value has been demonstrated in a public sector application comparable to their own."

In fact, says Behnke, private and public sectors see innovation itself from radically different perspectives. "For technology providers, change is their business. Innovation enables them to explore new markets, and so survive and grow. Administrators, by contrast, value stability, and are naturally averse to the risks of innovation."

Tuned in

So how can a technology-based company gain the committed participation of a pilot end-user in the public sector? WAMM(5), one of the five projects

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(1) See 'Dismantling Barriers to Innovation', edition 4/99.

(2) See this edition, page 5.

(3) Project INNO121 – Study and analysis of five Innovation projects dealing with the management of water in urban and rural regions.

(4) Project INAMI0606 – Promoting European innovation culture.

(5) See 'Damage Limitation', edition 3/99.

Innovation

The Innovation/ SMEs Programme In Brief

Part of the EU's Fifth Research Framework Programme, the 'Innovation and participation of SMEs' programme promotes innovation and encourages the participation of small and medium-sized enterprises (SMEs) in the framework programme. The Programme Director is Mr G.C. Grata.

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Proinno brought together the partners from four Innovation projects to discuss team-building strategies for cross-border technology transfer work.

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InnoTec studied, is applying a new satellite-based technology to improve flood forecasting in the Venice lagoon. Here, a forward-looking administration identified a need, and went looking for a supplier capable of providing the necessary technology. But public authorities are rarely so well attuned to innovation, says Behnke.

"In this case, there was an established relationship of trust between the city authorities and a reliable private partner," he recalls. "Most authorities do not have such relationships. Lack of communication between administrations and technology brokers – consultants, and neutral agencies such as the Innovation Relay Centres and OPETs[6] – is a major barrier to innovation in the public sector."

What is needed is a European channel for disseminating to public authorities news of relevant technological innovations. "The IRC network has an important role to play, which in many regions is still underdeveloped," he says. "In Germany, the IRC North Rhine-Westphalia (ZENIT) has built strong contacts with all the administrations in the region. But in many places, public officials remain unaware of their region's own IRC."

Different style

Differences in approach, leading to misunderstandings and the breakdown in communication between partners, can seriously compromise a project's technical results, according to Lothar Lissner, who co-ordinates the Proinno initiative.

Problems normally stem from differences in the partners' organisational cultures, he says. "Different working styles produce incompatible expectations of how things should be done. Often, this has nothing to do with nationality. To a small, innovative company, for example, the highly structured meetings and reporting procedures expected by partners from a traditional university or corporate background may seem completely inappropriate."

In a classical research project, this may not matter – each partner can complete its own work package in isolation. But in an Innovation project, partners have to deal with the uncertainties of market application, and internal cohesion is much more important. "In future," Lissner points out, "the technology implementation plans required under FP5 will make similar demands on all EU research projects."

Team spirit

To establish the mutual trust necessary for successful collaboration, the team must acknowledge, understand and resolve cultural differences – but this takes time.

"The people involved are skilled professionals. They assume that communication difficulties will be easy to straighten out, and focus on technical aspects," says Lissner. But the failure to set aside sufficient time for initial team-building can be very costly, he believes. "If there is no team spirit, pretty soon no one will contribute more than the minimum required to fulfil their contractual obligations."

Proinno has developed simple self-assessment tools which produce practical recommendations for strengthening a project partnership. After testing the tools on four 'live' Innovation projects, the team has developed complementary workshops designed to improve the capacity for transnational collaborative work by sensitising those involved to cultural issues.

One such workshop is designed for research programme administrators, and one for technology intermediaries such as IRCs. The other two are aimed at project co-ordinators and project participants, and have already been successfully piloted by IRC South Germany (Steinbeis), and by the French Association Nationale de la Recherche Technique (ANRT), an associate member of the IRC network.

"The IRCs' technology transfer work is often frustrated by communication problems between partners with which their staff are not equipped to deal," says Lissner. "Both Steinbeis and ANRT have asked us to run further workshops, and we hope that other IRCs will also start to use the Proinno method." ●

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The written outputs of both projects will be available on-line in early 2000 from the homepage of the Innovation and SMEs programme: http://www.cordis.lu/innovation-smes/home.html

(6) Organisations for the Promotion of Energy Technology.

Quality, Not Quantity

The evaluation of proposals submitted in response to the first call for Innovation projects has been completed. To assemble coherent clusters of projects, the evaluation experts employed a novel procedure which may in future be applied by other research programmes.

Following the call published on 23 March, 44 proposals were received, involving a total of 253 partners – just under half of them small and medium-sized enterprises. Of these, 15 Innovation projects(1) were selected, together with five clustering and one promotional accompanying measure, with likely expenditure by the programme of €15-17 million, against an anticipated budget of €30 million.

"We think the relatively small number of proposals was due to the tight timescale and the complexity of the call," says Guido Haesen of the Innovation Projects and Methodologies Unit. "But we were pleasantly surprised by the very high quality of many of them." He expects to invite the selected consortiums for negotiations during September, and to draw up project contracts in November.

Two dimensions

The innovative evaluation and selection methodology, designed to provide the basis for the creation of meaningful project clusters grouped around shared concerns, emphasised not only the transfer of technical know-how planned by each project but also the non-technical barriers to innovation which it expected to encounter. Both aspects will be defined in detail during the negotiation phase in order to build cohesive clusters.

Haesen hopes that the methodology will provide a model that can be taken up in other parts of the Fifth Research Framework Programme. "Certainly, the evaluation experts have given us very positive feedback on the clustering exercise," he says. ●

(1) For a full explanation of the new Innovation projects, see 'Dismantling Barriers to Innovation', edition 4/99.

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Rapid Evaluation

The commitment to extend and simplify the participation of small and medium-sized enterprises in European research under the Fifth Framework Programme is being fulfilled(1). By mid-May, the first evaluation of 328 Exploratory Award proposals had been completed.

According to Directorate-General XII (research), there is already clear evidence that the new network of SME National Contact Points (NCPs), and the streamlined application and evaluation procedures, are having their intended impact.

"The awareness-raising activities of the NCPs, and the new one-stop-shop approach which allows SMEs to submit proposals for any research topic to a single entry point, meant that we received 328 proposals, involving 695 SMEs, in the first two weeks of the open call," says the SME and Innovation Unit. "That is five times more than at the same stage in FP4."

Compared with FP4, the proportion of ineligible applications was halved to just 9%, while the spread of proposals, both geographically and in terms of research topic, was greatly improved.

The evaluation exercise, coordinated by the Unit, involved all four thematic programmes, using common evaluation guidelines. This made the reallocation of proposals – required in 15% of cases – much easier than in the past. Streamlined procedures also made it possible to begin negotiation of 150 contracts less than six weeks after the proposals had been submitted, in parallel with formal selection. This will greatly reduce delays, allowing the projects to be launched in September. ●

(1) For further information on the SME specific measures under FP5, see 'Opportunities for SMEs', edition 3/99.

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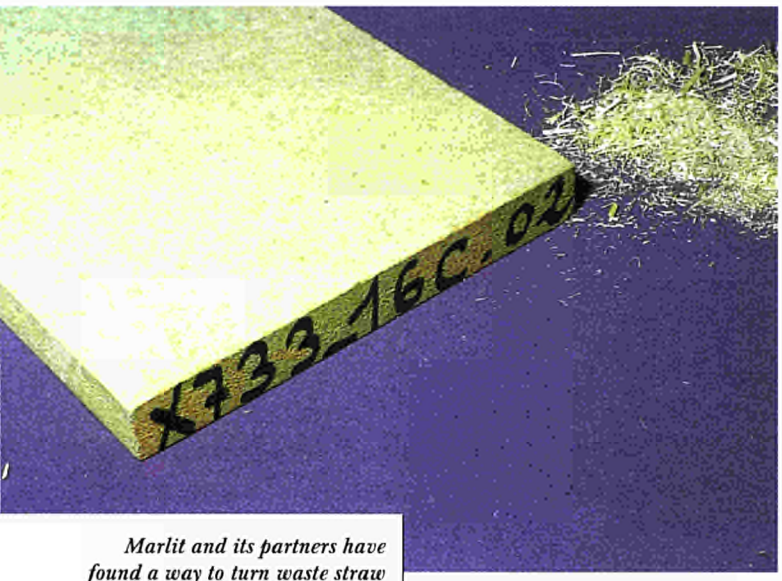
How to Spin Straw into Gold

An innovative technology which allows a valuable building material to be produced from agricultural waste promises to solve two serious environmental problems – and has massive economic potential both in southern Europe and in the developing world.

Since the 1980s, depletion of the world's forests has steadily forced up the price of wood and wood-based materials such as medium-density fibreboard (MDF), now widely used in the construction and furniture-making industries. Today, legislation designed to mitigate the ecological consequences of deforestation is being introduced in many countries. When this starts to bite, the price of wood will skyrocket.



Marlit and its partners have found a way to turn waste straw into competitively priced, high-quality board.

At the same time, the burning of straw and other agricultural by-products is also a serious environmental hazard. In some countries, straw-burning has already been banned.

Completed at the end of 1996, a CRAFT co-operative research project[1], led by the small Greek company Marlit, successfully developed a laboratory prototype of a new production technology which enables board to be made entirely from straw. Marlit is now engaged in a follow-up Innovation project[2], in which the new process will be scaled up for industrial production.

With the price of strawboard likely to be 20% lower than that of conventional MDF, and world-wide sales of chipboard and fibreboard worth over €7 billion each year, the potential of the technology is huge.

Patented process

"In straw, the fibrous cells are surrounded by a waxy layer," explains Marlit's Panagiotis Nakos. "Until now, this has prevented the cheap, water-based urea formaldehyde (UF) resins used to make normal fibreboards from forming a sufficiently strong bond between the fibres."

But with the help of university research teams in France, Germany and the United Kingdom, Marlit and six other small and medium-sized enterprises found a way of removing this wax layer. The technology, now patented in 40 countries, employs mechanical shear forces, boiling water and chemical treatment to break open the straw, allowing ordinary UF resin to penetrate and bind to individual fibres.

Strawboards which match conventional MDF in appearance, surface smoothness and strength are not only cheaper to produce, but also emit much less formaldehyde – well within the limits imposed by European Union regulations.

Rice straw

The transition to the current Innovation project was smooth, thanks to an extended implementation phase, Nakos says. "It took us some time to find the new partners we wanted," he recalls. "A couple simply did not believe that we could make strawboard with UF resin, and only agreed to take part after they had seen the process for themselves."

The project involves process plant and chemicals suppliers, the Greek board manufacturer Acretas and one of its largest customers, and the Agro-Industrial laboratory at the Ecole Nationale Supérieure de Chimie de Toulouse (ENSCT), one of the research performers in the earlier project.

By mid-2001, the partners will install and commission the first full-scale production line at the Acretas factory, demonstrating both the technical and the commercial performance of the technology. "We expect to show that a board manufacturer can recover its investment in a modified production facility in under three years, thanks to strawboard's improved cost-quality profile," says Nakos.

The technology will be licensed world-wide, and the partners anticipate interest from southern Europe and north Africa, as well

as China and India – where there are large populations and very little wood, but straw is plentiful.

Additive-free

The tight focus maintained by Marlit and its partners on the practical obstacles to industrial scale-up will not prevent them from continuing to develop the underlying technology. "The chemicals and the treatment process have been progressively refined," Nakos confirms. "Now we want to replace UF with a resin binder made from straw itself. That would make the process completely self-contained – from straw to fibreboard with no other ingredients." ●

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(1) CR-1638-91 – Advanced environmentally friendly composite materials for the furniture and construction industries.

(2) IN20551D – Innovative technology for panel manufacture from fiberised agriwaste.

CERAMIC GLAZES

A Polished Performance

The only factor holding back growth in the popularity of glossy, white ceramic floor tiles is their limited durability. Now, a consortium of tile and glaze manufacturers and merchants has employed advanced research facilities to perfect a new glaze which meets the requirements of the market in full.

Attractive and easy to keep clean, tiles provide an ideal floor surface for a wide range of commercial and domestic applications. The variety of colours and designs available, as well as their strength and resistance to staining, have made them increasingly popular as a cost-effective flooring material, especially in shops and restaurants.

Demand for glossy white tiles has grown particularly fast in recent years, and this type now constitutes around 10% of the total market. But to date, customers have too often been disappointed by their long-term performance. "Light-coloured, high-gloss glazes have a comparatively low resistance to abrasion," explains Dr Agustin Escardino Benlloch of Spain's Instituto de Tecnología Cerámica (ITC). "In heavily trafficked areas, the surface gets scratched and quickly picks up dirt, impairing its appearance."

Manufacturability

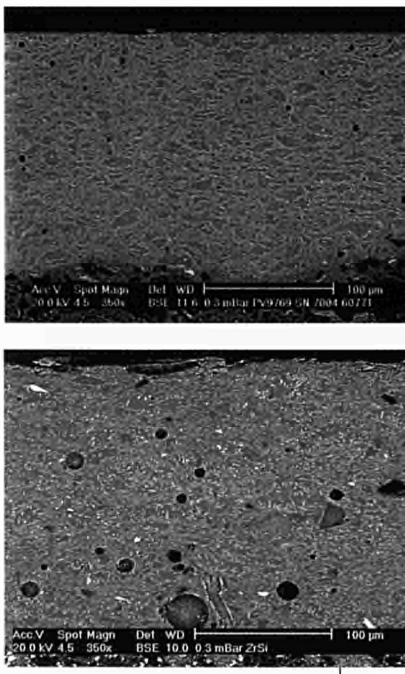
In 1993, two Spanish tile-makers, Keraben and Gres de Nules, together with Italian glaze manufacturer Esmalglass, approached ITC with a request for help in the development of a new glaze that would overcome this problem.

Eventually, the three companies formed a consortium with tile merchants in Ireland, Germany and the United Kingdom to undertake a CRAFT co-operative research project(1), in which the laboratories of ITC and the Centre Recherche de l'Industrie Belge de Ceramique (CRIBC) acted as specialist research performers.

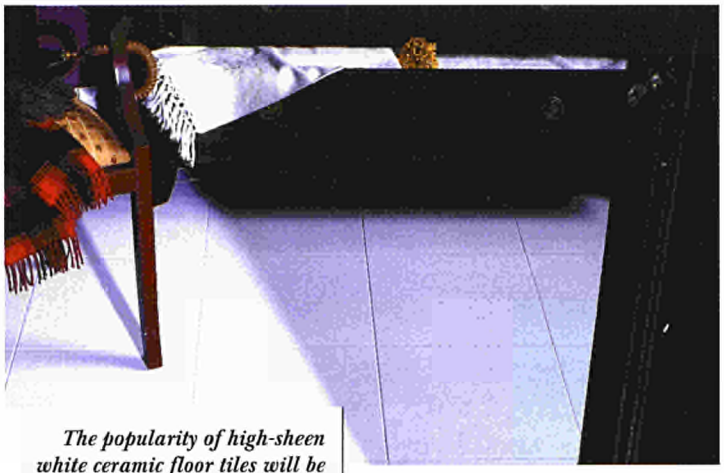
"The involvement of the tile merchants provided market intelligence of the most direct kind," Escardino recalls. "The brief the partners gave us was to develop a glaze with improved hardness and abrasion resistance, which could nevertheless be applied to existing tile bodies using traditional manufacturing processes." ●

Tile glazes are aqueous suspensions of glass particles – known as 'frit' – and crystalline materials. After a layer of glaze has been applied, the clay is sintered in successive firings at temperatures of up to 1,160°C, to achieve the desired mechanical strength and hardness. Firing bonds the glaze to the tile body, producing both internal crystalline phases and a smooth, glassy surface. ●●●

(1) CR-1001 – Obtaining smooth ceramic glazes with improved wear resistance and hardness.



Cross-sections of (top) a gahnite glaze developed in the CRAFT project, and a conventional white zirconium glaze. The low porosity (darker regions) of the new glaze greatly reduces dirt retention.



The popularity of high-sheen white ceramic floor tiles will be increased by the new abrasion-resistant glazes developed in the CRAFT project.

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Scale-up

"We needed to develop an entirely new composition in which small, very hard crystals would be uniformly distributed in a glassy phase whose expansion under firing closely matched that of the tile body," says Escardino. "We chose the oxide system SiO_2-Al_2O_3-ZnO, and tested a range of formulations in the laboratory to optimise whiteness and gloss as well as hardness and scratch resistance."

Esmalglass applied the new glaze on an experimental scale, and testing methods specially developed by ITC demonstrated much greater abrasion resistance than that of conventional zircon glazes. Scaling-up the production process presented some difficulties, with pin-holing of the glaze surface and 'curling' of the tiles during firing. But after overcoming these initial problems, Gres de Nules and Keraben were able to produce tiles first in a pilot plant and finally in full industrial production.

EEIG

The eight industrial and commercial partners, all small and medium-sized enterprises, formed a European Economic Interest Grouping, Esmalgres EEIG, to formalise under EEC law their shared commitment to the co-operative research project – and they are delighted with the results.

"Our Alaska range, produced with the new glazes from Esmalglass, outperforms any other product of its type on the market," says Laura Gargallo of Keraben. "It is now one of our best-selling tiles, and we forecast annual sales growth of 10-20% over the next five years."

There have been benefits for ITC and CRIBC, too. A considerable amount of theoretical and practical knowledge was gained concerning the relationship of crystalline structure to the mechanical and optical properties of glaze surfaces. Escardino is confident that this will prove valuable to the European tile industry as a whole, making possible the development of further new glazes. ●

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SECURITY AND SURVEILLANCE

I Know That Face

Access to modern office buildings and industrial sites often needs to be tightly controlled, but should not slow down the entry of authorised personnel. Only card-based systems currently meet these security requirements, but they are vulnerable to theft or misuse of the cards.

Biometric devices can now identify people by their hands, fingerprints or eyes – which, unlike cards, cannot be lost, stolen or shared. But such devices rely on close contact between the subject and a sensor. Even state-of-the-art face recognition systems require users to stand for a moment in front of a camera.

"In a large bank, where thousands of employees enter in a ten-minute period every morning, those delays are unacceptable," says Anton Kuip of Dutch identification system specialist Nedap. Kuip co-ordinates an Innovation project[1] which will integrate face-spotting and face recognition technologies into the company's existing card-based access control system. "What the market wants is high security at high speed. Convenience is critical," he says.

Hands-free

Nedap's 'walk-by' access control system employs radio-frequency (RF) identification cards which are read from a distance of up to one metre by an interrogator at the doorway. If a person without a valid card is detected, the door is instantly locked. At Amsterdam's Schiphol Airport, for example, hundreds of doorways are linked within a single security system with 50,000 cardholders.

But the system could be fooled by a valid card which fell into the hands of an unauthorised individual. "We think some customers will be interested in adding an extra level of security for particularly sensitive areas," says Kuip. "Face recognition is the only biometric technology with the potential to verify a person's identification on the move."

The WABY system will be as convenient for users as the current one, but will employ face recognition to make the unauthorised use of valid cards impossible. The technical feasibility of integrating three existing technologies in order to achieve this has already been demonstrated in a definition phase, completed at the end of 1998.

"Facesnap, produced by the German company C-VIS, provides real-time face spotting for video surveillance applications," Kuip explains. "It can automatically raise an alarm if a face appears in a video image, capturing a snapshot for identification by a human operator."

WABY will use such images – gathered as people approach a doorway, without requiring them to stop – as input to the face recognition software of a second German partner, ZN. Currently used in access control applications, this compares the face of a person wishing to enter with images of registered personnel, contained in a database.

Greater than the sum

But searching a large database of authorised users takes several seconds, and may produce false matches. By contrast, WABY will first read a user's card, comparing his/her face only with the stored image of its registered holder. "One-to-one verification is both faster and more accurate," says Kuip. "Combining face-spotting and face recognition technologies with our RF card system will give very high reliability at high throughput rates."

Schiphol Airport and the Dutch bank Rabobank, both existing Nedap customers, will evaluate pilot systems which Kuip expects to be installed in the second half of 2000. "It is very hard to estimate the market potential of a really innovative product like WABY until you have practical experience of working systems," he says. "The ability to optimise and demonstrate the technology in day-to-day operation is essential, so the participation of two very different end-users which already run large access control applications is especially valuable."

Face in the crowd

The partners are currently defining the protocols which will allow rapid, error-free communication between the three component technologies, enabling them to function as an integrated security system. But identifying and checking more than one face at a time presents real technical challenges. "Capturing facial images of sufficiently high quality from a moving crowd is not easy," says Kuip. "But the availability of more powerful processors is helping us to achieve the necessary speed."

The three companies will share the intellectual property rights to the combination of their existing systems, and to any new technology developed within the project. But WABY itself will be marketed by Nedap, and Kuip anticipates interest not only from banks and airports, but also from commercial and government offices, and from sports and leisure facilities.

In time, the partners also hope to develop a cardless system for surveillance in public areas such as shopping centres. Here, the WABY technology will continuously capture faces and compare them with a database of people whom the owners wish to exclude. It could, for example, be used to raise an alarm if it identifies a possible match with the face of a convicted shoplifter. ●

(1) IN30910D – A walk-by biometric identification system based on face recognition (WABY).

Face-spotting technology captures images from live video and stores them in a database.

To the user, the WABY system will be transparent. The ID card is read from a distance, and a snapshot is taken of the face. Provided face and card match, the door turns.

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Taking Root in the Regions

For enterprises of every size, and in every industrial sector, competitiveness today requires proactive management of technological change. A recent evaluation found that the Innovation programme has stimulated the widespread application of new management tools and techniques.

During the Fourth Research Framework Programme, the Innovation programme's Innovation Management Techniques (IMT) action line(1) supported 23 two-year projects promoting the application of IMTs in small and medium-sized enterprises (SMEs). The action was designed to build national and regional capacity to deliver innovation management support through subsidised pilot schemes. It also supported six projects aimed at stimulating the transnational exchange of good practice between innovation agencies and consultants in different regions.

New developments

Ninety such organisations were directly involved in the delivery of innovation support, in which adapted or newly developed tools were piloted, to nearly 900 SMEs, each of which received up to ten days of consultancy to help it define, plan and carry out an innovation project.

But, according to an independent evaluation carried out by Erdyn Consultants, Paris-Malakoff, the 90 contractors involved twice that number of national or regional SME support organisations and private consultants in the delivery of the schemes – in particular, in conducting innovation audits within the client companies.

The final conclusions of the evaluation will be delivered to the Commission in the autumn, but it is already clear that considerable progress has been achieved. The attitudes of the contractors themselves towards the promotion of innovation management techniques has matured and, crucially, appears to have taken root in their regions. Almost all are now engaged in new schemes or programmes which will build on the results obtained at Community level and will continue their action. "The impulse given by the Innovation programme has thus opened the way to new developments to support innovation management in SMEs," the evaluators find.

Network

The horizontal activities supported by the action line, designed to facilitate the transnational exchange of good practice, are also seen as a success. Newsletters, a website, a series of thematic seminars and methodological conferences, and a number of studies (see box) were very much appreciated by the majority of the participating contractors, and have helped to establish a viable platform for the continuation of their work. ●

(1) See 'Managing to Fulfil Europe's Technological Potential', edition 1/99.

Innovation Management Techniques in Operation: Building Competitive Skills in SMEs

FP4's Innovation Management Techniques action line provided a platform of good practice for improving the management of change at company level throughout Europe. *Building Competitive Skills in SMEs*(1) contains an overview of ten practical tools for SMEs wishing to improve their competitiveness through innovation.

Describing techniques such as value analysis, benchmarking and technology watch, selected from among those tested by the IMT projects, the study also includes examples of their application in actual SMEs. Detailed references are provided for each technique, enabling users to obtain more detailed information on those which may be most useful.

(1) CD-17-98-160-EN-C;
ISBN 92-828-4650-4;
€16

Details of all the publications produced by the IMT action line can be found at: http://www.cordis.lu/imt/src/p-study.htm

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I Can See Clearly Now

Advanced research carried out on behalf of the European Community frequently produces spin-off results with significant market potential. A recent project has brought one such technology to the brink of commercial success as an investigative tool for manufacturing industry.

The rights to intellectual property produced during projects funded by the Community under its Research Framework Programmes belong to those projects' partners. But the Community retains intellectual property rights resulting from research undertaken for itself, either by the European Commission's own Joint Research Centre (JRC) or by other institutions.

The Community Patent Portfolio is managed by the Directorate for Innovation, DG XIII/D(1), which is responsible for patenting and licensing technologies with immediate potential for commercial exploitation. But in many cases, spin-off results need further development before such exploitation becomes viable (see box).

The recent 12-month prototyping project, CamRecord(2), undertaken by the German company Photonetics, was designed to perfect and demonstrate a high-speed, high-resolution video camera system. This was based on a technology developed in the course of research conducted for the Commission by the Applied Optics Group of France's Centre National de la Recherche Scientifique (GOA-CNRS) based in Strasbourg.

In the frame

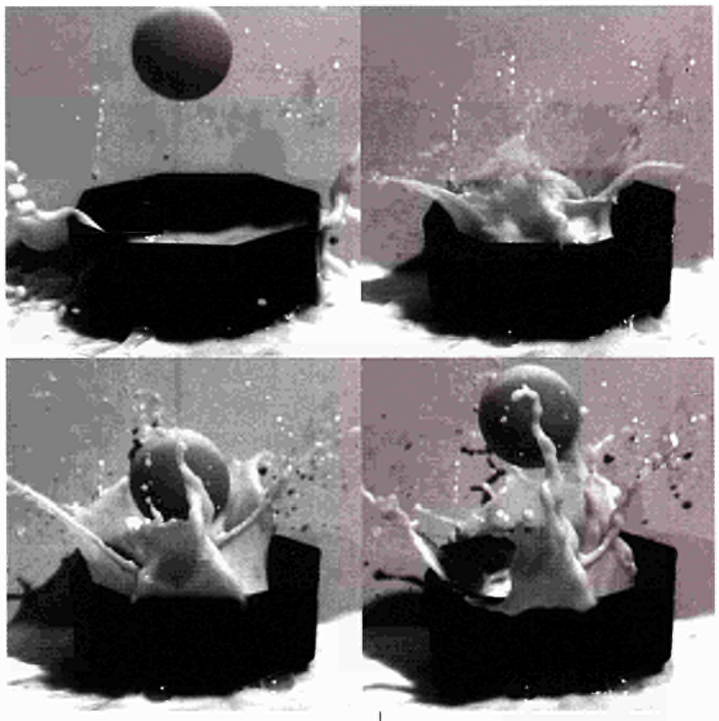
The ability to observe and analyse very brief events is an essential part of many scientific and industrial studies involving explosions, impacts, interactions between fast-moving parts, or flows of liquids, gases or particles. High-speed cameras, able to record an extremely rapid sequence of images, have for some time been an important aid to the understanding of such processes, allowing researchers to view such processes in slow motion or frame by frame.

Until recently, high-speed cinematography, in which images are captured on film, was the only available technology – and is still the only one suitable for scientific applications requiring ultra-high resolution or colour images.

"Many laboratory tasks, and a wide range of industrial studies, deal with the relatively slow millisecond to microsecond range," explains François Tomasini of Photonetics. "Here, high resolution is needed at speeds of 250 to 2,500 frames per second. In the last few years, the availability of powerful charge coupled device (CCD) chips has, for the first time, made it possible to build video cameras capable of meeting these requirements."

Film cameras are large and heavy, and film itself is expensive. But for industrial researchers in particular, whether they are studying the design of a valve exposed to turbulent gas flows or the deployment of air bags in a new model of car, the key advantage of video is that it simplifies accurate analysis. Today's powerful PCs allow image sequences to be processed almost in real time.

"In industry, the length of the development cycle is critical," says Tomasini. "Using film, it takes 24 hours before you even know what images you have got. Their chief value is as the basis for calculating velocity, acceleration, or other parameters. But before you can extract such data the images must be digitised, loaded into a special computer program, and calibrated. Video allows you to feed digital images directly into the computer, producing the same information outputs in just a few seconds."



CamRecord offers 1,000 frames per second at full 512 by 512 resolution (illustrated) or faster recording speeds in reduced formats.

High resolution

Until the CamRecord project, however, the best available video performance was around 100 frames per second, at a spatial resolution of only 256 by 256 pixels – neither fast enough nor sharp enough for general use. ●●●

(1) See 'Leading by Example', edition 4/99.

(2) Project CSA97123.

High-speed links from the CamRecord to a standard PC, and proprietary software, allow the user to view and analyse images immediately.

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"During 1997, GOA demonstrated the technical feasibility of a camera which used specially designed multiple output registers to achieve a resolution of 512 by 512 pixels at 1,000 frames per second," Tomasini recalls. "Photonetics has been active in the field of high-speed optical events since 1986, producing ultra-high-speed film electronic cameras for the scientific community. But this is a small niche. We were keen to use the technology as the basis for a product which could reach a much bigger industrial market."

The development of a commercial prototype involved four essential tasks. To make the system less cumbersome, Photonetics separated the camera head from the processing, control and storage unit. It built in operational flexibility, allowing the user to choose from a range of image formats and speeds, up to 2,500 frames per second at 512 by 128 pixels. It developed a high-speed interface for the transfer of data to a PC, and a user-friendly software package for controlling the camera from the computer, and for viewing the images produced. Finally, it subcontracted to the Ecole Nationale Supérieure de Physique de Strasbourg (ENSPS) the development of a high-speed memory card with the capacity to store 2,000 images at full 512 by 512 resolution.

On the market

The system's flexibility extends not only to the compactness of the camera head, and the variety of possible frame rates, but to the wide range of options for synchronisation. The recording sequence can be triggered internally as well as externally, thanks to a feature which monitors changes in the light intensity of the image, and CamRecord can also produce an output trigger signal synchronised with image capture.

By the end of 1998, a prototype had been built and tested, and has since been sold to a customer. Now, as a direct consequence of the EC-funded development work, Photonetics will be manufacturing the system as fast as orders come in. "We have been promoting CamRecord since the start of the year," says Tomasini, "and are in discussion with several prospective customers. We are confident that sales will grow steadily." ●

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Competitive Support Actions

The Commission's Competitive Support Activities (CSAs) were launched in 1995. They finance scientific and technical work needed to bring technologies whose underlying knowledge is owned by the European Community – normally, spin-offs from research conducted by the JRC – to the stage at which they can be applied by European industry.

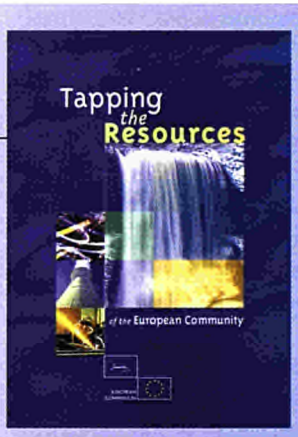
An annual selection of projects is made from proposals by JRC scientific staff and other Community inventors, with most of the development work contracted to companies which are themselves potential licensees.

Under the Fourth Research Framework Programme, €24 million was spent on 132 separate projects. These included technology assessments, market studies, and searches for licensees. But 85% of the total budget was devoted to prototyping, validation and demonstration projects.

The transfer to industry of a number of innovative technologies has already taken place(1), with a corresponding flow of licence fees to the Community. More important, the CSAs have stimulated a dramatic increase in the number of patent applications made by the JRC's eight institutes, and promoted the growth of an entrepreneurial culture among its staff.

Twenty-seven new two- or three-year projects have been launched recently.

(1) See main story, and 'From Laboratory to Industry', edition 2/99.



Tapping the Resources of the European Community (CD-21-99-117-EN-C; ISBN 92-828-6354-9) gives an overview of the CSA, and describes some current technology transfer projects.

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Technology Transfer – the American Dream?

The transfer of technology from the research environment to industry is a major source of jobs. Recent US legislation has greatly accelerated the exploitation of federally funded research. The $22-billion 1997 research budget alone led to over 300 new start-up companies and 250,000 new jobs.

A recent two-day workshop on science and technology transfer, jointly organised in Amsterdam by the US Association of University Technology Managers (AUTM) and the European Science Alliance, highlighted examples of best practice and set out to demonstrate the relevance of the US approach to the European Union's Fifth Research Framework Programme (FP5). Both American and European universities, as well as European companies and public authorities, took part.

Uncle Sam

Federal funding has a strong influence on research in the US. The 1980 Bayh-Dole patent and trademark act created a uniform policy for federal research agencies, enabling small businesses and non-profit organisations to retain the rights to innovations resulting from federal funding. It also encourages universities to collaborate with industry to promote the application of their inventions.

Results have been overwhelming, with a marked increase in disclosures, patent applications and patents. Since 1980, more than 2,200 academic start-up companies have been formed, and by 1997 gross university income from licences had risen to $700 million. Most American universities now have their own technology transfer and licensing offices to co-ordinate the exploitation of intellectual property rights (IPR). Their functions include filing patent applications, marketing patents to industry and finding partners to develop new technologies into marketable products.

In Europe, the legal situation is not the same – and is fragmented. Universities have different traditions, and employees' rights as inventors vary widely. German university professors, for example, retain the rights to any invention, irrespective of external funding.

False modesty

These difference do not mean that Europe is not inventive, according to Manfred Schmiemann who manages several IPR-related actions lines within the Innovation and SMEs programme.

"We underplay our successes," he insists. "The Max Planck Institute in Germany has earned €500 million from patents over the past 20 years. And the Catholic University of Leuven (KUL) in Belgium is making €4.5 million per year from a single drug. We may be different, but we are no less successful.

"But instead of national patents, what we need are Community patents, providing immediate coverage for the whole EU," Schmiemann adds. "They need to be cheap, defensible and practicable. There have already been three attempts to put such a system in place. The current effort will probably take five years, but this time it will work."(1)

Patent awareness in Europe is certainly increasing. The Quick Scan novelty search service(2) is used to screen an increasing proportion of applications for EU research funding, and the IPR Helpdesk is helping the many small companies which do not currently exploit their inventions. "We do not necessarily want to increase the number of patents," says Schmiemann. "The aim is to encourage technology transfer."

A new emphasis on innovation and technology transfer runs right through FP5(3), with every project now required to produce a Technology Implementation Plan (TIP) to prepare for the subsequent exploitation of research results. ●●●

In the US, federal research funding provides a launch pad for many academic start-up companies.

(1) See 'Proposals for an EU Patent', edition 4/99.

(2) See 'Look Before You Leap', edition 4/99.

(3) See 'A Catalytic Role', edition 3/99.

The Flanders Interuniversity Institute for Biotechnology puts the results of academic research in the hands of those who can convert them into marketable products.

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Centrifugal force

In the US, 'spin-off' start-up companies play a critical role in the exploitation of university research. Normally, the university licenses an innovation to an outside group, in which it commonly retains a shareholding.

"We would prefer to license to big companies rather than to start-ups, but many of the innovations are too embryonic," explains Louis Beernem, managing director of the centre for technology transfer at the University of Pennsylvania in Philadelphia. In practice, spin-offs work on the first and second phases of product development and are then bought out by larger companies with the resources to market and distribute a new product.

There are problems however. "In the US, we have the technology and the finance – but what is often missing is good management," says Beernem. "We recommend start-ups to sell out as early as they can."

Networking key to start-ups

Europe has its own experience of start-up companies, exemplified by the Flanders Interuniversity Institute for Biotechnology (VIB) in Belgium. VIB groups nine of the best biotechnology activities of four Flemish universities in one non-profit organisation. Started in 1995, it involves 750 scientists and technicians, and has an annual budget of more than €50 million. Through its technology transfer department it aims to promote local economic growth and facilitate transnational collaboration with industry, rather than to maximise financial returns.

The institute's output of inventions has grown from five in the first year to 48 in 1998, and it already has 60 patents. "You cannot wait for enquiries," emphasises Rudy Dekeyser, the VIB technology transfer manager. "You have to promote your portfolio. We have already licensed 40% of our patents and are collaborating with 25 companies, half of them from outside Belgium." VIB has also set up its first spin-off companies – deVGen was created in 1997 with starting capital of €8.5 million and already employs more than 40, while CropDesign, formed in 1998, is capitalised at €11 million and has a workforce of 28.

"The keys to the successful creation of such companies are world-class, cutting-edge technology, the involvement of leading scientists, a proprietary position, a wide platform with broad applications, and the potential to create considerable added value in the first three years," suggests Dekeyser. "Without this last element, it is very hard to attract investors."

The technology transfer department's evaluation of new technologies, supported by an independent advisory board, includes assessment of the visibility, track record and entrepreneurship of the scientists involved. The proprietary position is determined by in-house literature and database searches, and through contacts with patent agents. VIB then writes a business plan for presentation to the investor community, using external consultants as necessary.

Two-way street

The Amsterdam workshop was the third European event on technology transfer co-hosted by AUTM. When the series started two years ago, the assumption was that best practice could only be found in the US. It has quickly become apparent that America also has much to learn from Europe. The traffic in technology transfer expertise is now two-way – with the European Commission playing a central role. ●

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The Building Blocks of Biotech

The Fifth Research Framework Programme's 'cell factory' key action clearly reflects guidelines identified by the Biotechnology and Finance Forum, which continues to stress the need for effective regional and European support for new biotech firms as sources of employment and economic growth.

The Forum[1], launched in 1997 as a joint initiative of the European Commission, Directorate-General XII (research) and the European Association of Securities Dealers (EASD), held its second conference in Lyon at the end of March in conjunction with the International Life Sciences Forum, BioVision.

The event was designed to stimulate scientific entrepreneurship, to improve scientists' awareness of the opportunities and dangers involved in financing new ventures, and to identify the critical infrastructural elements necessary to nurture a dynamic new generation of European biotech companies.

Successful flotation

Investors and scientists need one another, but they inhabit different worlds and have different priorities. The effectiveness of the Forum as a platform for improving mutual understanding between these two cultures has already been demonstrated in the most practical way possible. A Dutch company presented at the first conference, in May 1998, has raised €55 million on EASDAQ, while at least two others are in the process of flotation. Other firms have secured their continued growth through deals with large pharmaceutical groups or with private investors.

An initial public offering (IPO) on the stock exchange is not always successful, and the conference highlighted two particular areas of difficulty. First, a biotech company's intellectual property assets may not generate revenues for many years, making their valuation extremely uncertain, and second, the timing of the flotation is both critical and easy to get wrong.

Europe's fledgling biotechnology companies can be strengthened by linking specialised regional business incubators at European level.

Shortage of management skills

In summarising the key messages to emerge from the conference's five discussion panels, EASDAQ's Chairman Stanislas Yassukovich drew attention to the overriding importance of complementing technical skills with managerial ones. Neither venture capital funds nor business angels are willing to invest in scientific excellence alone. Young entrepreneurs must learn to prepare and follow business plans, focusing their research on the needs of specific markets, and properly managing their intellectual property rights. As a company grows, marketing and financial management expertise must, where necessary, be brought in from outside.

The environment for the creation and early growth of biotech start-up and spin-off companies could be improved by establishing more specialised business incubators, said Yassukovich. But such incubators, like regional 'bio-valleys', need to be linked at European level in order to maximise their impact.

Venture capital, which until very recently was scarce in most European countries, is now relatively plentiful. But early-stage seed capital, vital if companies are to reach the stage at which venture capitalists become interested, is still in short supply – at least, it is difficult to find. Greater transparency, improved mutual understanding and better channels of communication between entrepreneurs and investors are still urgently needed.

A full conference report is available on the Forum's web pages (see Contact). ●

(1) See 'Investors and Biotechnologists Do Business', edition 4/98.

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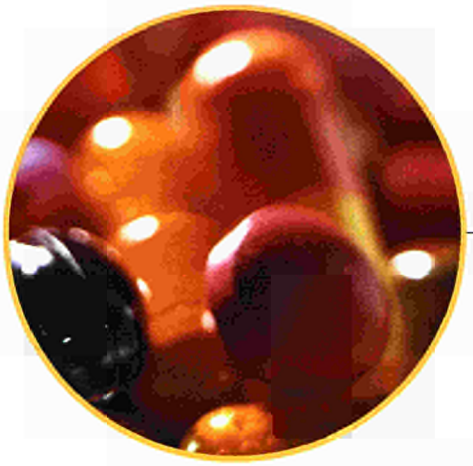
Just What th Docto



Europe's national public health systems have developed in very different ways, producing greater regional variation in clinical practice and in the financing and administration of healthcare than there is in patterns of disease. By bridging these cultural differences, Community research is contributing to the health of Europe's economy as well as to that of its people.

University industrial liaison groups should be doing much more to help scientists with patent protection.

Health is a concern shared across Europe, and few major threats to it are confined within national borders. The fragmentation of Europe's healthcare policies and systems places it at a disadvantage, both socially and economically. The multiplicity of markets and regulatory environments increases the cost of developing new medical drugs, devices and information technologies, and limits the returns on such investment. The lack of standard methods for handling medical data inhibits understanding of the underlying causes of ill-health, and denies European citizens equal access to the best available care.

Added value

Scientific and technological research is one of the principal ways in which the EU contributes to public health (see box), supporting the co-ordination of national initiatives and the exchange of experience between them, helping to achieve economies of scale in the development of new technologies, and promoting the standardisation needed to facilitate the exchange of health data.

By encouraging the pooling of Europe's scientific resources, and the accelerated adoption of best practices and best technologies, EU research not only helps to maintain Europe's position at the forefront of medical knowledge.

It also facilitates its conversion into practical solutions to urgent problems, and the realisation of its potential benefits to the European economy and to the health of Europe's citizens.

1. Economic Medicine

Biotechnology and biomedicine are starting to provide cures for conditions previously regarded as untreatable. But in Europe, their promise as sources of new wealth and new jobs has yet to be fulfilled.

The Biomed 2 programme of the Fourth Research Framework Programme (FP4), with a total budget of €358 million, supported over 600 projects. Seventeen of these – including the two featured here as case studies – were demonstration projects (see chart).

The Biomed and Biotech programmes both made considerable efforts to involve new industrial participants, especially small, high-tech companies, says Stéphane Hogan of the new Quality of Life programme (see box, page 19). "But it is a continuing trend. Under FP5 we

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are, more than ever, trying to stimulate the participation of small and medium-sized enterprises, and the creation of new companies as spin-outs from research centres and large firms."

The focus has therefore shifted from fundamental to applied research. "The links between discovery, production and end-use must be consolidated ... research must lead to quantifiable future wealth and job creation," reads the official text of the specific programme.

Hogan is encouraged by initial response to the programme's first call. "For the sub-areas with deadlines in June, we received nearly 1,800 proposals," he says. "And with the advent of clusters, the projects tend to be large. Demand is particularly strong in the new environment and health key action, which brings together elements of the former Environment and Biomed programmes."

Not charity

The application-oriented approach makes perfect sense to Dr Gareth Sanger of the British pharmaceuticals giant SmithKline-Beecham, former chairman of the European Neuroscience Industrial Platform (ENIP). "Commercial companies do not take part in European research as a form of charity," he says. "We want to improve our access to new ideas, and to the best scientific expertise in Europe. We hope that, as a spin-off effect, our participation will help pure research. But that is not our primary aim."

This does not justify the widespread suspicion among scientists that industry will simply grab any new invention it finds useful. "Patenting provides a framework within which knowledge can be exploited to everyone's benefit – including the inventor's," says Sanger. "But there is still massive ignorance about patent protection in academic circles. The industrial liaison groups within European universities should be doing much more to support their scientists on this issue."

Nevertheless, the perception is spreading that the contributions of industry and of academic research can and should complement

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European Union Health Policy

According to the 1991 Treaty on European Union, the Community should contribute to the prevention of disease and the protection of health through:

- scientific research
- health information and education
- taking health protection into account in other Community policies

Although the Community as a whole bears responsibility for achieving a high level of health protection and for directing actions to prevent major threats to health, however, the Treaty specifically excludes harmonisation of the laws and regulation of the Member States in the area of public health.

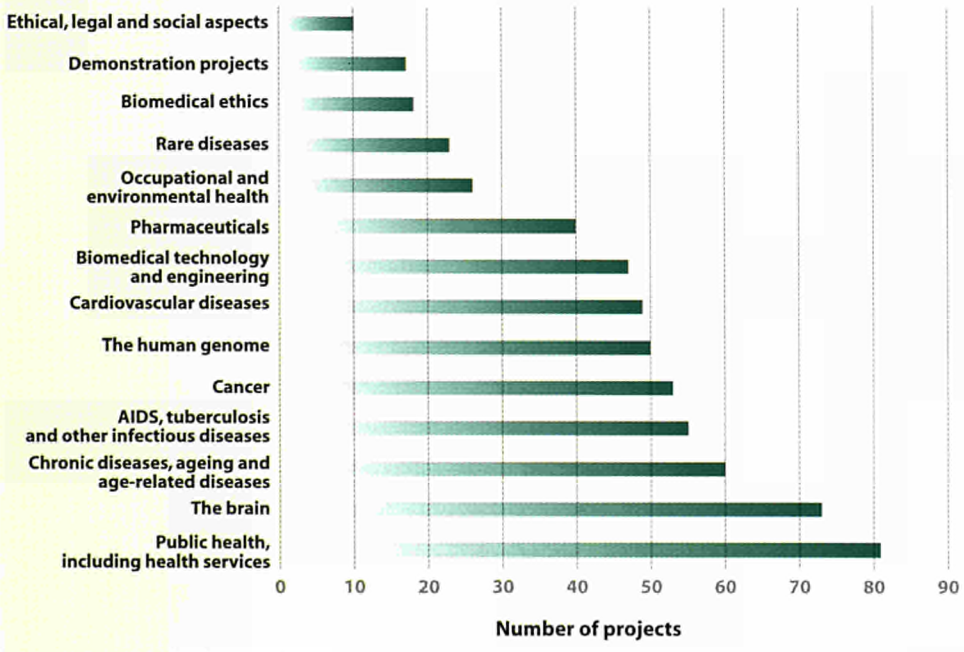
Since 1993 the Commission has developed public health programmes covering cancer, AIDS and other communicable diseases, health promotion, drug dependence, health monitoring and rare diseases. A communicable disease surveillance and response network has also been established, while growing interest from Member States in the exchange of public health information and experience has led to the launch of new studies regarding the reform of health systems.

In April 1998, the Commission published a Communication outlining a possible new Community public health policy based on action in the areas of:

- improved information for the development of public health
- rapid reaction to major health threats
- tackling health determinants through health promotion and disease prevention

Research being carried out both under FP4 and FP5 will make a significant contribution in all three areas.

Projects under FP4's Biomed 2 programme (1994-1998), by research area



RESTORATIVE DENTISTRY

Less Time in the Dentist's Chair

An innovative non-invasive diagnostic technique could dramatically improve the quality of life of many thousands of dental patients each year.

For the large numbers of people who have lost one or more teeth, as well as for those requiring cranio-facial reconstruction, bone-anchored titanium implants have proved remarkably successful as a permanent basis for false teeth, bridges and prostheses.

Such implants can fail, however – often without the patient being aware of it. "By the time the clinician realises that failure is occurring, it is too late to do anything about it, and the implant is lost," explains Professor Neil Meredith of the Leeds Dental Institute in the United Kingdom.

Exciting technology

The stability of the screw-like implants depends on the stiffness and strength of their bond with the surrounding bone. As the bone heals following placement, osseointegration should increase stability, but may be threatened by premature loading. Subsequent overloading can also compromise the implant, causing the bone to migrate away from it.

"The problem is that no quantitative diagnostic technique is available, either to predict the performance of an implant at the time it is placed or to monitor its stability in the years that follow," says Meredith.

He is the co-inventor of a resonance-frequency analysis (RFA) technique which makes use of the fact that, unlike an artificial hip, dental implants are exposed to the surface.

"We have developed a transducer which can be screwed to the tip of an implant, using the same fitting which attaches the prosthesis," he explains. "One piezo-electric element excites a cantilever at frequencies from 5,000 to 15,000 Hz, and a second one measures the response. The resonance frequency, indicated by changes in the amplitude and phase of the signal, is a function of the stiffness of the interface between implant and bone."

Encapsulated in medical-grade epoxy, the device has been built to withstand sterilisation in an autoclave, making it suitable for the operating theatre as well as routine clinical use.

The transducer with a prototype of a hand-held, battery-operated instrument. Results are displayed immediately on the liquid-crystal display, and can be downloaded to a PC via an infra-red link.

Pain free

The test itself is completed in less than 1.5 seconds. It involves no discomfort to the patient and is totally safe – secondary displacement in the implant is less than one micron.

In a current Biomed 2 project(1), prototype devices, instrumentation and software are being extensively demonstrated in major clinical centres in Italy, Spain, Sweden and the UK. The trials have already established the method's technical viability, and will provide the clinical evidence needed for regulatory approval. They have also elicited considerable interest in a commercial system from clinicians world-wide.

Meredith and his colleagues have now developed an implant stability index which, for the first time, makes possible accurate comparisons between different procedures and implants. It will also allow dental surgeons to determine when it is safe to load an implant immediately after placement, and to fit implant and prosthesis in a single surgical procedure.

For many patients, this will mean less time in hospital and a shorter wait for the treatment they need.

(1) Project BMH4972257 – The clinical measurement of implant stability and treatment outcome using resonance frequency analysis.

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one another. "The European Commission and national governments have played an important part in this cultural shift," Sanger says. "But US achievements have also had a tremendous impact – people have seen that novel genes developed by university research can be converted into flourishing biotechnology companies."

There are now 14 industrial platforms, initiated under the former Biotech programme with the intention of creating an interface between European industry and the EU research programmes, though each pursues an independent path. ENIP, for example, now aims to provide a channel for the flow of venture capital to commercial neuroscience.

"We want fund managers to look at the opportunities generated by research," Sanger explains. "We hope they will encourage academic scientists to start up their own companies."

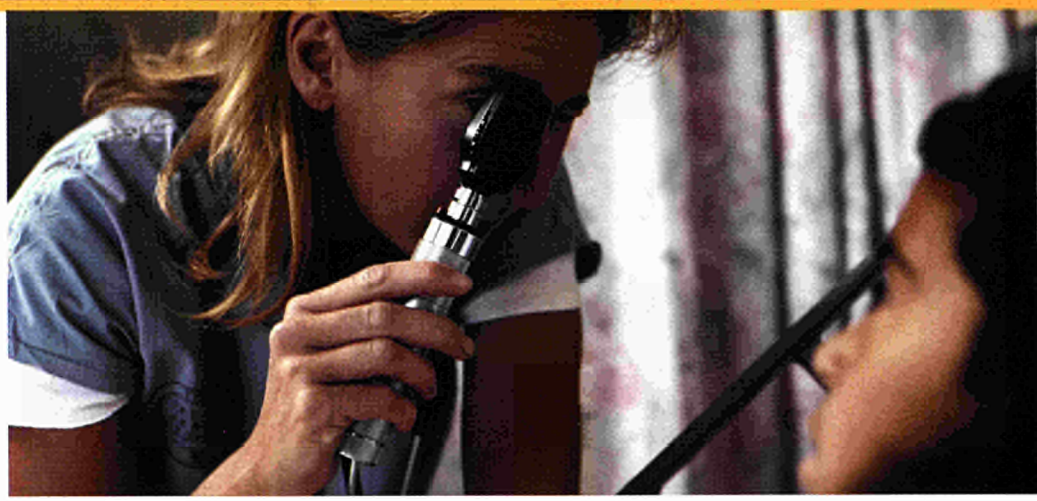
Regulatory obstacles

"The real challenge is to encourage Europe's citizens to keep themselves healthy," says Dr Hannu Hanhijärvi of SITRA, the Finnish National Fund for Research and Development, who chairs the Healthy Ageing Europe industrial platform, HAE2000.

"National systems still take as the basic model of healthcare the consultation with a doctor and the prescription of a medicine. But as the population ages, they will simply be unable to keep pace with growing demand, unless we can enable people to take greater responsibility for maintaining their own health."

The links between diet and health are critical, Hanhijärvi believes. "But the health claims approval process for foodstuffs is a mess. Each Member State has its own procedures, while EU law forbids manufacturers from making specific health claims for proprietary foods. This inhibits development – with little chance of a commercial return, no one is willing to invest in the trials needed to demonstrate a health benefit conclusively."

The result is that almost every type of food is sold as 'low-cholesterol', and consumers have no way of distinguishing between a product with a well-documented health benefit and one that is merely supported by a slick marketing campaign. "Clear European legislation, permitting properly substantiated health claims, would have significant economic and public health advantages," says Hanhijärvi.



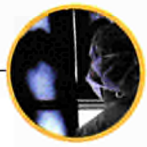
2. Can I See a Doctor, Please?

Traditionally thought of as a means of making medical images available remotely, telemedicine is starting to reveal its much wider power.

"EU research investment in the field of medical telematics is less than 0.5% of that made by private companies and national governments," says Luciano Beolchi of the User-Friendly Information Society programme. "But the significance of the work to date has been to bridge the gaps between the experiences of different regional and disciplinary cultures."

The healthcare sector of FP4's Telematics Applications programme supported the development of the basic vocabularies, protocols and standards needed for data to be exchanged between countries, between technologies and applications, and between specialities and levels within healthcare systems. It then implemented pilot projects of a sufficient size to demonstrate the technical feasibility and the clinical benefits of new information and communication technologies, operating in real healthcare settings.

The Quality of Life programme



The thematic programme 'Quality of life and management of living resources' focuses on specific areas in which new scientific knowledge about the structure and function of living things can help to avert serious threats to Europe's quality of life. Four key actions, and several elements of the planned generic research activities, concern medicine and health directly – Food, nutrition and health (KA1), Control of infectious diseases (KA2), Environment and health (KA4), and The ageing population and disabilities (KA6).

FP5 as a whole targets research which is likely to lead to new products – if not directly, then within a defined timescale. Here, this means research whose concrete benefits can be foreseen, in terms both of public health and of economic and employment growth.

15 November is the deadline for submission of proposals relating to the following health-related topics under the first call:

- Infectious diseases – new strategies for treatment and prevention
- Infectious diseases – public health issues
- Chronic, degenerative and rare diseases – evaluation of therapies; databases; registries and sample banks
- Genomes and diseases of genetic origin – novel expression systems; biophysics, statistics and computation
- Neurosciences – brain development; behaviour, cognition and functional mapping
- Public health and health services research – improving health systems

NEUROPROSTHESIS

One Giant Step for the Paralysed

This October, a small group of paraplegic patients will walk again, thanks to an implanted system of semi-automatic electro-stimulation.

Professor Pierre Rabischong of the Montpelier Medical School in France, who leads the six-country team of surgeons, doctors and engineers undertaking this pioneering work, emphasises that – despite the title of their Biomed 2 project, 'Stand up and Walk'(1) – they cannot perform miracles.

"Those who suffer spinal cord lesions not only lose control of the muscles in their feet, legs and lower back. They also lose sensation," he explains. "By attaching electrodes which stimulate the right muscles in the right sequence, we can enable them to stand and to walk short distances – even to climb steps. But without feedback from their lower limbs, they will always need elbow crutches or a walking frame to maintain their balance."

Walkman

The functional electrical stimulation system developed by the partners consists of three main elements. A programmable control unit the size of a portable cassette player will be strapped to the patient's waist and connected to a simple keypad on the crutch. This will transmit both power and control signals to a device implanted in the abdomen, through a radio-frequency (RF) link to an antenna beneath the skin. The implant, built around an integrated circuit developed by IBM, will send pulses to 16 neural and epimysial electrodes.

"Stimulating a nerve directly requires only one milliamp of power, so wherever possible we will use neural electrodes," says Rabischong. "But some key muscles are controlled by nerves buried deep within them. Here we will attach electrodes delivering up to 20 milliamps on the surface of the muscles, as close as we can to the motor point."

CE mark

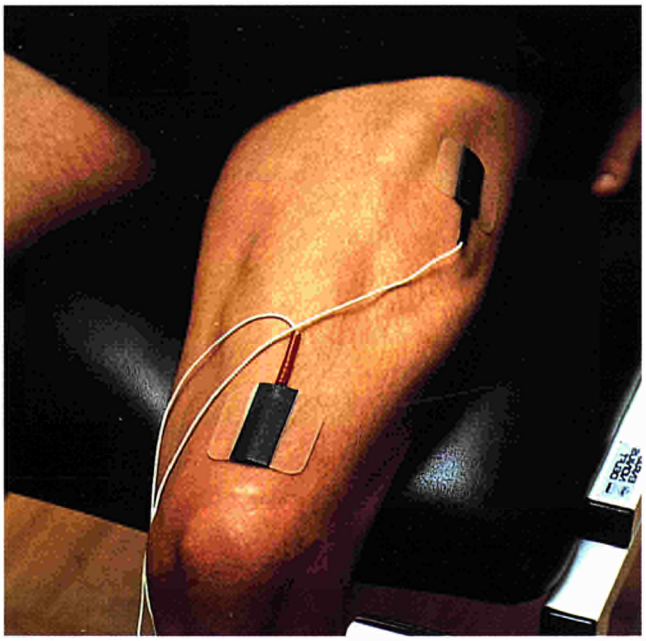
The project's work covers much more than the development of hardware and software. The European Clinical Network formed by the partners has prepared the three protocols which had to be approved by ethical committees in each of the participating countries before the system could be used. These cover surgical and rehabilitation procedures as well as technical specifications.

"Using a single set of protocols greatly simplified the process," Rabischong says. "And although its success provides no guarantee of approval elsewhere, it makes it more likely." In regular training events, the six surgeons have perfected a minimally invasive technique for attaching the electrodes, while the six doctors who will manage the patients' rehabilitation have prepared for the critical post-surgical phase in which the patients will learn to use the device.

"They have all had a chance to use the control unit already, connected to electrodes on the skin, so they have some idea of what to expect," explains Rabischong. "And we hope to bring them together so that they can help one another to optimise their individual methods of control."

Europe alone has 300,000 paraplegics, many of them very young. But before the system created by Rabischong and his colleagues can be made more widely available, the equipment must acquire CE-mark certification. By helping them to accumulate the clinical evidence necessary for approval, the Biomed project has enabled them to take a giant step towards this goal.

(1) Project BMH4961501.



Muscular stimulation via externally placed electrodes enabled an Italian paraplegic patient to stand and walk during pre-surgical training. Implanted neural and muscular electrodes will give even better results.

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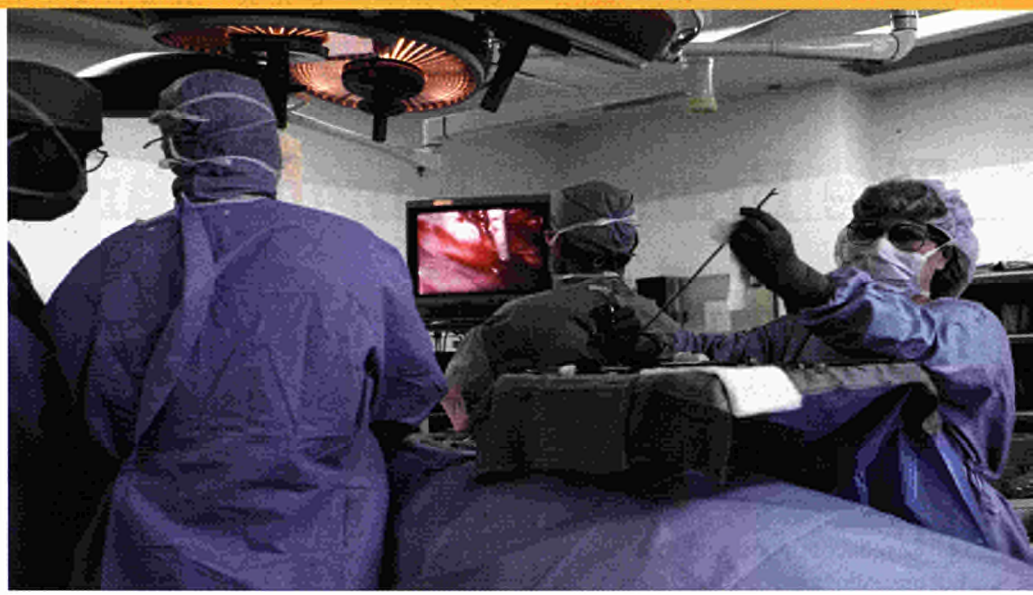

"A cycle has been completed," says Beolchi. "Interoperability may not have been finally achieved, but we have made enough progress to create a viable platform for the self-sustaining growth of a European health telematics industry. Now it is time for national governments to implement the systems which we demonstrated."

Parallel universes

"The first generation of EU projects has been about establishing a common infrastructure," agrees Vic Peel of the University of Manchester in the United Kingdom. "Now, the task is to build applications which make use of that infrastructure."

Until the mid-1980s, medical information systems almost exclusively supported the work of individual clinicians. "Even hospital-wide systems were extremely unusual," says Peel. "At the same time, administrators began to adopt business systems to handle tasks such as purchasing and payroll. But these were two separate universes which never touched."

Europe's insurance-based health systems – in France and Germany, Italy, Portugal and Spain – invested heavily in accounts-based information technology. In the centrally-funded British and Scandinavian systems, meanwhile, despite long traditions of epidemiological research, there was scant investment in the technological means to make such studies really effective.

"The grand challenge, even today is to implement systems with the capacity not only to record the individual clinical event, but to assemble a continuous personal health history for each patient, and to aggregate those records as the basis for strategic planning. Such a challenge can best be addressed through EU-wide co-operation," says Peel.

Electronic health record

Now, the electronic health record (EHR) – giving any doctor access to any patient's full medical history – is within sight, and pilot schemes are under way in several Member States. But Peel considers it vital that such systems are fully interoperable. "The UK has 260 district general hospitals," he says. "The US has several thousand. Development of European medical application software will only become viable when we create an EU-wide market for it. Until then, we will be forced to rely on American systems, often poorly suited to our needs."

It is not just a question of economies of scale, however. "At a personal level, individual patients, wherever they are in the EU, will be able to have much greater confidence in the quality of treatment when clinicians can access and share their continuous case histories," Peel says. "At the level of European public health, such systems will offer enormously powerful research databases, informing medical knowledge and allowing much more efficient allocation of scarce financial resources."

Medicine cabinets on-line

The health telematics theme is taken up in FP5 by Key Action 1.2 of the User-Friendly Information Society programme, and focuses on three areas. First, new products and services will be developed, enabling patients to play a more active part in their own health maintenance, treatment and rehabilitation. Second, new systems will be built to simplify and speed up health professionals' access to information – including medical images, patient records, and aggregated health data. Lastly, the concept of 'telemedicine for citizens' will be explored.

"This is the newest and most exciting area," says Beolchi. "We envisage a telemedicine cabinet to replace today's medicine shelf – a TV-like appliance offering video consultation, remote diagnosis and access to personal medical records and appointment booking systems, as well as simple medical and dietary advice."

Now it is time for national governments to implement the health telematics systems demonstrated under FP4.

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The Brain - a Moving Target

A robotic arm, a tiny ultrasound probe and a powerful image processing system will allow neurosurgeons to see deep within the brain as they work.

Minimally-invasive endoscopic surgery reduces trauma and speeds recovery. But the endoscope can only give the surgeon a clear view of open, liquid-filled sites. When operating within solid tissue, he must rely on imaging technologies such as computer tomography (CT) and magnetic resonance (MR). Keyhole surgery on the knee joint, for example, can be minutely planned using high-resolution CT or MR images taken prior to the operation.

"Neurosurgery presents particular problems," says Dr Volker Paul of Germany's Fraunhofer Institut für Biomedizinische Technik (IBMT), who leads the Telematics Applications Programme's Roboscope project(1). "You can hold the bones of the knee in place. But in the brain, the procedure itself causes the tissue to shift. To avoid damaging blood vessels and healthy tissue, the surgeon must be able to monitor such movement and adjust the position of his instruments accordingly."

Inside view

CT's use of x-rays makes it unsuitable for continuous imaging during surgery, while conventional cylindrical MR devices do not allow the surgeon access to the patient. Most neurosurgery currently involves the removal of a large section of the skull, enabling the surgeon to work with a microscope.

"We are using a third imaging technology," says Paul. "Ultrasound cannot work through bone, but we are developing an ultrasound probe which can be inserted through the same 15mm hole used for the microsurgical instruments. Placed to one side, just inside the skull, it will allow the continuous updating of high-resolution preoperative images in real time, throughout the operation.

Roboscope will link this unique ultrasound technology, a robotic manipulator arm, and powerful image-processing software capable of correlating ultrasound and CT or MR images, to create an integrated demonstrator system.

"The surgeon will use preoperative images to define the boundary between a tumour and the surrounding tissue," Paul explains. "The robotic arm will guide the instrument, precisely following the surgeon's movements, but will not allow its tip to cross that boundary."

Product development

IBMT and its partners are building an innovative system for mapping the ultrasound images produced during surgery on to those acquired before the operation. It will require both powerful algorithms and special hardware employing parallel processing, and the consortium does not expect to perform image fusion in real time within the project.

"But we have made excellent progress," says Paul. "We have demonstrated the technology to manufacture a transducer for the ultrasound probe just a few millimetres thick, and have tested the wiring to connect it to the components outside the skull."

He is confident that they will produce a working prototype by the time the project ends in mid-2000, and says that the consortium is committed to creating a commercial product. "It is hard to say how long this will take," he admits. "But we are actively seeking new partners to share the cost of product development."

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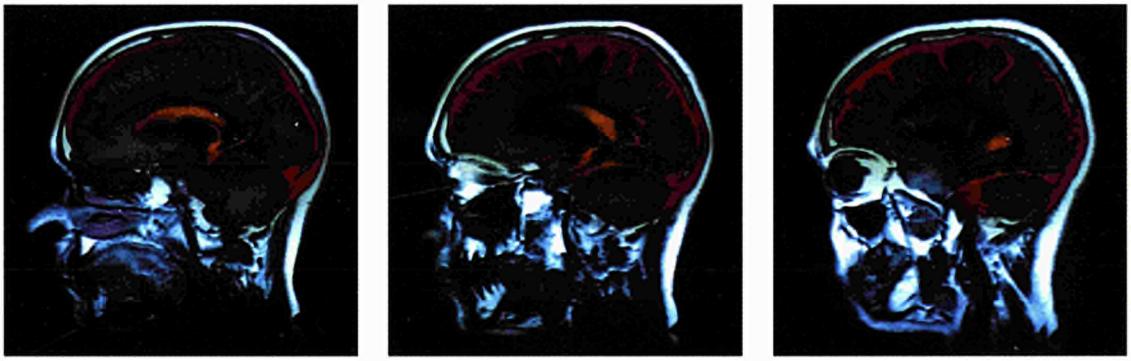


Using ultrasound to update high-resolution magnetic resonance images of the brain taken before the operation will offer a cost-effective basis for neural microsurgery.

(1) Project HC4018.

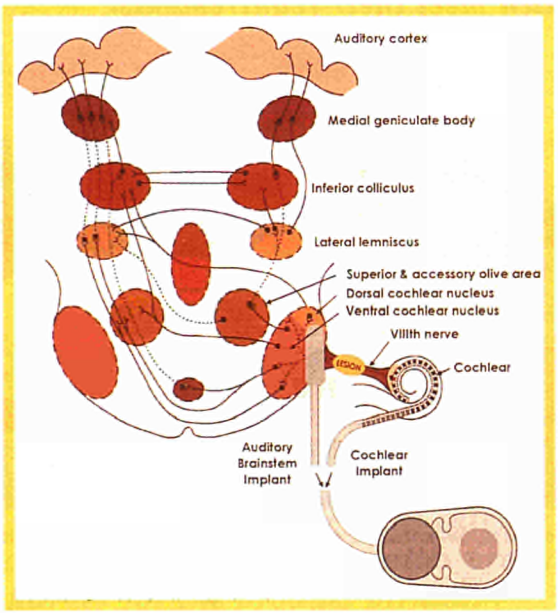
. . . And the Deaf to Hear

The help of an Innovation Relay Centre has been critical in a partnership to create a device capable of overcoming previously untreatable deafness.

The cochlear implant, developed in the 1970s, offered the first successful treatment for profound deafness. A tiny speech processor implanted under the skin sends electrical signals from a microphone above the ear directly to an electrode in the cochlea, bypassing the damaged parts of the ear. From the cochlea, the auditory nerve carries the signals into the brain, where they are perceived as sound.

But even the most sophisticated cochlear implant is ineffective when the auditory nerve itself is damaged. Since 1997, the University Clinic of Navarra (CUN) in Spain has been working with a small British company, Cochlear UK, to develop electrodes to stimulate the surface of the cochlear nucleus, the region of the brainstem which processes auditory signals – bypassing not just the ear but the auditory nerve as well.

Their Auditory Brainstem Implants (ABIs) have been given to over 50 patients whose auditory nerves had been destroyed by tumours, and have restored some degree of hearing in every case. "We have determined the correct parameters for electrical stimulation, and shown that the materials we use are safe," says Dr Manuel Manrique of CUN.



The Auditory Brainstem Implant bypasses the auditory nerve as well as the inner ear, transmitting electrical signals directly to the brain.

Fine-tuning

But stimulating the surface of the cochlear nucleus produces rather a jumble of sound, and patients still have difficulty understanding speech. The partners hope that a new implant with electrodes which penetrate below the surface of the brainstem will produce better results, allowing sounds of different frequencies to be processed in different regions, and thus become more clearly distinguished.

"We have already designed the device, as well as an instrument for inserting the electrodes, and we are about to test it for the first time on animals," says Manrique. "The brainstem controls many critical functions, and penetrating electrodes greatly increase the risk of damaging it, so it is essential that we perfect the technique before we offer it to human subjects."

He thinks it will take three years before the first human implants can be undertaken at CUN. If all goes well, these will be followed by a two-year multi-centre study involving hospitals in a number of European countries, on the basis of which an application will be made for CE-mark certification of the final device.

Contractual basis

The collaboration between CUN and Cochlear UK has been supported from the outset by the Innovation Relay Centre (IRC) CENEO at the Instituto Científico y Tecnológico de Navarra (ICT).

"Both partners wanted to establish a firm contractual basis for what they expected to be a long-term partnership," explains IRC manager Fernando de la Puente. "We helped each to clarify their requirements, and drew up an initial contract. This covers the present applied research phase, but looks forward to Cochlear UK's exclusive exploitation of the results obtained, under a licensing agreement with CUN."

"We are both very keen that CENEO should continue to work with us," Manrique confirms. "We want to run the multi-centre trials as an EU project, and hope that the IRC will help us to develop the proposal and to find suitable partners."

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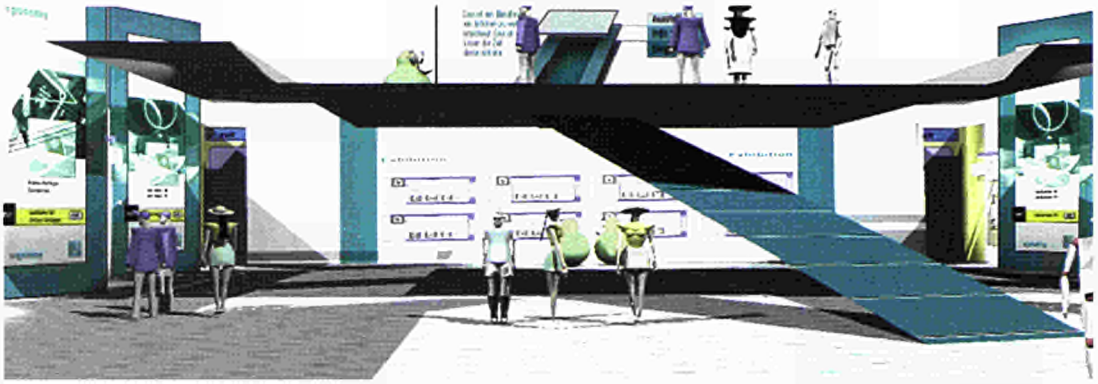
Bringing On-Line Shopping to Life

The Internet is a great forum for buying goods and services – provided you know what you want. It still offers consumers far too little assistance to make choices which meet their requirements.

Bringing together virtual reality (VR) systems with the Internet can overcome that drawback, making it a more interactive and flexible medium for commerce.

A virtual reality electronic shopping system is now operating on the Internet, following development by the Esprit project, VR-Shop[1]. Consumers can use a website to examine products before purchase, ask shop assistants questions about goods, and discuss the products with other shoppers.

"The technologists still have considerable work to do to make it available on a range of hardware platforms," concedes Andrea Müller, of the Fraunhofer Institute IAO of Stuttgart, which led the project. "But by 2002 we expect the system to be fully operational. In particular, we look forward to the arrival of interactive TV which we think will be the best option, and which is being developed by the parallel Home-VR project[2]."



A bookshop, but not as we know it. A view of the Virtual Bookstore inside Fraunhofer IAO's VR-Mall.

Open for business

An on-line bookshop and travel agency are already open for business on the existing website. Other stores – a car sales showroom and a telephone shop – are still dummies.

An Internet-based VR environment can actually make for more reliable purchasing than conventional shopping – it can offer a holidaymaker a truer impression of what a resort looks like, or allow a reader to inspect an expensive art book without damaging the pages. Drivers can shortlist the cars they would like to test drive on the road, after a virtual reality inspection.

Fashion items can even be tried on through VR. The consumer is represented at the on-line shopping mall by an 'avatar' – a digital agent representing the individual in size, shape and facial appearance. The user can view a fashion show on-line, and then dress their own avatar in the clothes they like. Similarly, avatars can represent the customer at on-line auctions, bidding for lots by raising a virtual hand.

Interactive

One of the key benefits of the system, the project's partners believe, is the opportunity to make Internet buying more interactive. Studies conducted by the Emnid research institute in Germany have shown that the main factor holding back web users from becoming web consumers is their sense of isolation when buying on-line. Although 20% of Germans say that they would be willing to buy on-line through a 3D system, only 1% currently make purchases via the Internet.

Virtual reality overcomes this isolation. At present, VR shoppers may simply be given a video presentation of a product. But as the technology is developed, so the buyer will be able to question a real shop assistant through an audio or video conference link. And when several people visit an on-line site at the same time they will meet each other in a virtual form, enabling them to discuss products.

"We want to give the customer the opportunity for a much richer experience than simply looking at lists and filling in on-line forms," explains Müller. "We can already offer the possibility of getting a better overview of products. We are now developing a community platform so that customers can talk to other shoppers or assistants in the shop."

Initial feedback on the VR-Shop indicates that its most popular applications are for standard products such as books and CDs. But as it grows more sophisticated, users will be able to see the outside of hotels, the actual rooms they are considering booking, and even the view from their window.

More than fun

The Internet certainly poses a serious threat to traditional retailers, with travel agents and even estate agents increasingly exposed to on-line competition. But virtual reality commerce on the Internet and via interactive TV promises to give Europe's electronic shopkeepers a corresponding boost. It will encourage information technology companies to exploit the latest Internet commerce technologies. It will broaden the range of goods and services which can be effectively sold via the Internet. And it will

make the Internet a much more attractive environment for the consumer.

"The members of virtual communities today still consist mainly of students and technical researchers who are thrilled by the technology and the capacity it allows them for contacting and chatting with people all over the world," Müller points out. "But in VR-Shop we have shown that virtual communities can offer more than fun and play. They provide a perfect platform for co-operative work, distributed learning – and new forms of on-line shopping and trading, offering a high level of customer service and support."

Not all on-line trading is currently suited to virtual reality. Development costs for retailers are substantial and they need large memory capacity on their computer systems to receive 3-D visitors. But the longer-term opportunities are obvious. ●

(1) Project 25024 – Virtual reality electronic shopping system.

(2) Esprit project 28949 – Communication from the home to VR-based local communities.

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TELEMATICS FOR CUSTOMS

Countering the Counterfeiters

The counterfeit goods industry has grown so large that it represents a serious threat to the viability of the EU's internal market, says the European Commission. A new telematics project promises to make life much harder for the product pirates.

Fake goods account for between three and four per cent of world trade, and cost the EU an estimated 20,000 jobs. They are equally dangerous to Europe's consumers who face health and safety risks from fake products ranging from car parts and kettles to pharmaceuticals.

The MUSYC project(1), funded by the Telematics Applications Programme, involves customs authorities from six EU countries, supported by a number of businesses whose goods have been illegally copied. It promises a much improved success rate in detecting fake goods entering the EU, based on improved information exchange using multimedia systems.

Dangerous

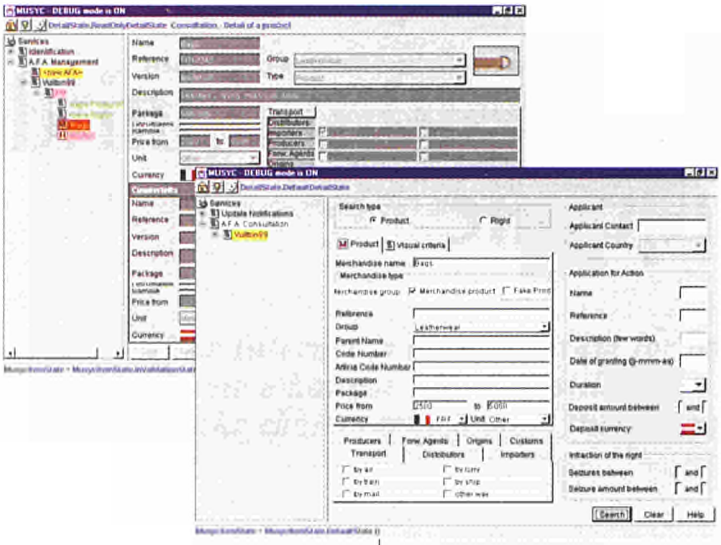
It is not only jobs and legitimate businesses that are undermined by counterfeit goods. Many fake products are dangerous. There is a thriving market in counterfeit car parts, electrical goods and pharmaceutical drugs.

In France, the most common counterfeit products are shoes, representing 21% of confiscated items, followed by clothes, watches, electrical goods, car components, perfumes and leather goods. In Germany, clothes account for 90% of impounded fakes, most of which infringe trademarks, though some breach copyrights or patents.

While some of these products pose a serious threat to the well-being of consumers, others only challenge the health of legitimate companies. Digital technology now allows high-quality audio files to be transmitted over the Internet, making it possible to produce imitation CDs and cassettes of the same quality as the originals. Textile piracy, too, has grown in sophistication as the Internet has made it easier to copy branded goods, leading to rapid counterfeit production of the latest fashions.

Tackling breaches of trademarks and copyrights is a priority of the European Commission, as well as of customs officials ●●●

(1) Project 31992 – Multimedia Systems for Customs



Product details, including images, submitted by a registered right holder – in this case Vuitton (left) – are immediately accessible to customs officials using a simple form-based search engine.

●●●

in Member States. Commissioner Mario Monti recently presented proposals for simplifying design protection through the Office for Harmonisation in the Internal Market, recognising that copying of designs is a serious problem.

A solution

MUSYC offers a high-technology solution to the threats posed by fake products. Customs officials – initially in France, Germany, Italy and Spain – agreed to share a distributed database on which manufacturers would post information to assist detection of counterfeit goods. They were subsequently joined by customs administrations from Austria and the Netherlands, and negotiations are currently under way to include the United Kingdom, Greece and Portugal.

Manufacturers already committed to supplying information to help detect counterfeit goods include well-known victims such as Nike and Adidas, as well as Mercedes-Benz, which wants to eliminate the trade in illicit replacement car parts. IT systems producer Dr Materna of Germany, Atos and Steria of France, Atos-ODS of Spain, and Sogei of Italy are suppliers and partners to the project.

"The idea came from France and Germany which wanted to set up a consortium to fight back against the counterfeit trade," recalls Dominik Wischermann, the project leader at Dr Materna. "Italy and Spain joined during the project design phase. By last year, we had developed a prototype for customs administrators, and since then the system has been progressively refined to meet their requirements."

It is already clear that the high-quality material which the system offers will help customs officials. "This includes both photos and graphics and written descriptions of counterfeits," explains Wischermann." Useful details are given, such as the colours in which fake products are currently being produced, as well as obvious means of spotting their packaging – spelling mistakes or the omission of logos used on original cartons.

The technology is based on Internet protocols, but uses client-server applications rather than open-access web pages. Secure intranets will link customs officials, giving them shared access to the database. Officials may also use the system to exchange information on counterfeit seizures, which they currently circulate by e-mail, but which could be enhanced by pictures of seized fakes. Manufacturers will use a parallel system, based on the same hardware and software, to submit requests to customs officials to post new information on the site. For obvious security reasons, they will not be given access to the customs officials' site itself. Each member country will maintain its own database.

First performance

MUSYC is still in its developmental phase – but not for long. The project started to roll out a working version in July, and the system should be fully operational in the participating Member States by the end of 1999.

Inflicting serious damage on the counterfeit product industry would be of enormous benefit to legitimate businesses in the EU and to consumers – and for the first time this is now a realistic possibility. All that is needed is for the MUSYC to begin. ●

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JRC 1998 annual report

CL-NA-18-704-EN-C;
ISBN 92-828-6476-6

1998 saw some important changes at the JRC, including the appointment of Herbert Allgeier as its Director-General and the renewed emphasis on research which underpins and supports the policies of the European Union. In practical terms, the new Institute for Health and Consumer Protection (ICHP) was established during 1998 and, for the first time, the JRC prepared its own separate work programme within the Fifth Research Framework Programme.

The report highlights the JRC's successful collaboration with members of the European scientific community – for example, opening a new cancer treatment facility in Petten, the Netherlands. It also reviews some of the most prominent projects undertaken by JRC institutions in 1998.

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Constructing the European Information Society 1998

This new report from the FAIR project, part of the ACTS programme, includes the executive summaries of 50 recent research papers, analysing the impacts of information and communication technologies on how people live and work, as well as market trends. The report is only available electronically.

Contact:
http://www.databank.it/dbc/fair/page08.htm

Photonic Technologies in Europe (CD-ROM)

Developed by the ACTS project Horizon, the CD-ROM covers the work of the 35 research projects that make up the programme's photonics domain, describing field trials to validate their work. Guidelines for prospective implementers of the technology, representing a distillation of the expertise built up, are also included.

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Information Engineering – Projects and Perspectives 1994-1998

ISBN 92-828-5225-3

This report reviews 64 projects supported by the European Commission in the last four years in the field of information engineering – an area which is of continuing importance under the User-Friendly Information Society programme of FP5. The publication covers multimedia publishing and distribution, information management and retrieval, personalised content delivery, business, manufacturing and commerce, and infrastructure and support. It also gives full contact details for each project.

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Interactive Electronic Publishing – 1998 Workshops

ISBN 92-828-4390-4

The European Commission has published a report on expert workshops held in 1998 to identify key issues facing the research and technological development community in the coming five years, in the field of interactive electronic publishing. Three areas in particular are addressed – accessing and exploiting digital content, future research topics, and recommendations for broadcasting topics in FP5.

SWOT Overview of Manufacturing Industry in Europe: Background to a European Strategy for IMS

EUR 18103 EN

Scale-intensive, science-based firms are the best prepared to benefit from participation in the Intelligent Manufacturing Systems (IMS) transnational research programme, according to a report prepared for the European Commission – the report leaves unanswered the question of whether efforts should be made to facilitate the participation of other firms which might also benefit.

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Climate Change Research and Policy: Updates

EUR 18088 EN

Although underground carbon sequestration cannot be considered as the ultimate solution for reducing anthropogenic greenhouse gas emissions, it can be effective in the short term, according to this report. The first section covers the monitoring of climate change, providing information on climate observation and modelling, while the second examines climate policy, stressing the importance of considering ecological and economic impacts before the implementation of new climate change strategies.

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THERMIE-ALTENER – Renewable Energy Report

ISBN 92-828-3796-3

The report, which reviews recent projects from the Thermie and Altener programmes designed to help stimulate the development of renewable energy technologies, includes an overview of the barriers to their further development.

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http://europa.eu.int/en/comm/dg17/dg17home.htm

FAIR: Agriculture and Fisheries Food Project Synopses

EUR 18306 EN; ISBN 92-828-4787-X

This catalogue provides details of all projects relevant to food and nutrition research funded under FP4's FAIR programme, in the categories of consumer nutrition and well-being, advanced and optimised food materials and nutritious food products, and generic food science.

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Catalogue of project ideas for Key Action on water

€50

The Innovation Relay Centre North Rhine-Westphalia at ZENIT has compiled a new catalogue – including contact details – of more than 200 project ideas, expressions of interest and technology offers in the field of the key action on sustainable management and quality of water.

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Energy Technology Strategy 1995-2030: opportunities arising from the threat of climate change

The possible contribution of new technologies to alleviating climate change is considered in a new report from the Institute for Prospective Technological Studies (IPTS). It examines to what extent technology can contribute to a possible structural change within energy markets, leading to a less carbon-intensive exploitation system, and assesses the mechanisms by which change might be effected and facilitated.

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Patinnova '99 – an opportunity to influence patent policy

Patinnova '99, from 18-20 October in Halkidiki (Greece), will draw IPR experts, inventors, innovators and intermediaries from all over Europe. Participants will have a real opportunity to influence the development of an EU Patent, say the organisers. Mandates given by the audience at Patinnova 97 led directly to the establishment of the esp@cenet service and the Commission's free IPR Helpdesk.

The conference will examine recent and forthcoming technical and policy developments, with the second day devoted to detailed workshop sessions led by experts and practitioners from industry, the academic world and the patent professions. Three parallel workshop strands will address developments in patent information systems, policy issues and awareness-raising initiatives, and patent litigation.

Patinnova will be followed immediately by the European Patent Office's Epidos annual conference (EAC), taking place at the same venue from 20-22 October. A special rate is offered for attendance at both events. If possible, participants should register before 15 September, as accommodation cannot be guaranteed after that date.

Contact
Latest details of the Patinnova programme are available at:
http://www.cordis.lu/patinnova99/home. html
Register on-line at the European Patent Office website: http://www.european-patent-office.org/epidos/conf/pat_eac99/register. htm

Digitisation of European Cultural Heritage

21-23 October, Utrecht (the Netherlands)

This event will examine Europe's contribution to improving access to historical and cultural sources through digital resources, in particular exploring different approaches to digitisation.

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Improved traditional foods for the next century

28-29 October, Valencia (Spain)

This international congress on the latest research into the nutritional properties of traditional foods will build links between the new Key Action 'Food, nutrition and health' and the FAIR programme of the Fourth Research Framework Programme.

Scientific understanding of Europe's rich heritage of traditional foods will help to improve processing technologies, and the safety, quality and nutritional properties of these foods. The transfer of knowledge between scientists, technical staff in food industries and consumers should contribute to the satisfaction of consumer needs, the enhanced competitiveness of the European food and drink industry and improved understanding of the role of traditional foods in health and well-being.

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Water '99 – Sustainable management and quality of water

11-12 November, Erfurt (Germany)

Organised by the Innovation Relay Centre for South Germany, this event will address three themes – water as a natural resource, integrated environmental protection and waste-water treatment, and reuse of sludge. It will highlight demand-oriented research topics in order to stimulate co-operation between universities and institutes.

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Note

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