EMBL &cetera

SPECIAL EDITION
SCIENTIFIC PROGRAMME 2001-2005

4
September 2000

Newsletter of the European Molecular Biology Laboratory
published by the Office of Information and Public Affairs

Developing a new dialogue

EMBL/EMBO sponsor major Conference on Science and Society

What is currently happening in biology will have a deepening impact on society in the near future. While this sharpens the need for the broad public to be well-informed about science and scientists to be more aware of social concerns, attempts at dialogue are often frustrating. Scientists have too often seen their work misinterpreted and misrepresented; journalists and others frequently feel that researchers do not make a serious effort to communicate. It is time to develop a mature dialogue between science and the public. This can only be accomplished through a broad-based effort involving scientists, educators, politicians, writers, artists, and many others.

EMBO and EMBLare bringing together the elements necessary to catalyze such a dialogue by sponsoring an interdisciplinary conference on Science and Society from November 10-12 this year. "We would like to contribute to a reflective, cross-cultural, multi-disciplinary dialogue about the impact of the life sciences in the post-modern world," says Halldór Stefánsson, who heads Science and Society activities at EMBL Heidelberg, where the conference will be held. A special emphasis will be placed on scientific communication and alternative ways of presenting science to the public, including by means of the arts and theater.

Participants will include biologists and a spectrum of professionals engageed in interpreting and communicating how basic and applied scientific research affects individuals and society. "This will provide a forum for the 'doers' and 'communicators' of science, as well as students, to explore the recent dramatic changes that have occurred in the life sciences," Stefánsson says.

The conference has been set up to provide ample time for meaningful discussions and exchanges, and the organizers hope for active participation from the audience. Each thematic session will consist of a few individual presentations followed by a panel discussion among experts from a variety of related fields.

Conference sessions:

- Session I: From Science to Society: Case Studies, Risk Studies
- Panel discussion: How to restore public trust in science
- Session II: Medical Uses of Genetic Information
- Session III: On Human Genome Projects: Uses and Abuses
- Panel discussion: Public understanding of genetic information
- Session IV: Biotechnology, Bio-industry, Bio-business
- Panel discussion: Biotechnology and its discontents
- Panel discussion: Science in the spotlight

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EMBL's Scientific Programme 2001-2005 presented to Council

EMBL's Council of Member States held their annual summer meeting in July at the Main Laboratory in Heidelberg. Topics of discussion included EMBL's Scientific Programme for the next five years, technology transfer, the status of pending ILO cases, and financial matters including salary adjustments for 2000 and EMBLpension schemes.

Director-General Fotis Kafatos made an in-depth presentation of the Laboratory's Scientific Programme for 2001-2005. Council elected to hold a special meeting in October as a prelude to their final vote on the plan and its financial component, the Indicative Scheme, scheduled for the November meeting. The text of the final proposal is published in this special edition of EMBL*&cetera.*

Council enthusiastically received the Director-General's report on developments in technology transfer at EMBL. The next issue of EMBL *&cetera* will focus on the Laboratory's technology transfer initiatives.

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from genes to thoughts

EMBLPhD students round up leading scientists for a two-day journey through the world of neurobiology in the first EMBL PhD Student Symposium, "From Genes to Thoughts", at the Main Laboratory in Heidelberg, October 20-21.

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Philippe Busquin

Philippe Busquin, Commissioner for Research at the EC, visits EMBL and discusses his vision of a "European Research Area" in an interview.

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science & society

Developing a new dialogue

EMBL/EMBO Conference on Science and Society

Developing a New Dialogue

10-12 November, 2000, EMBL, Heidelberg, Germany

register now at www.embl-heidelberg.de/Conferences/SciSoc00/index.html

"The whole of Western literature has not been kind to science and is filled with images of scientists meddling with nature with disastrous results," writes Lewis Wolpert. The scientists of books and films usually fit into a handful of stereotypes – there is the remote, ivory-tower type incapable of remembering to pick up his laundry, the mad scientist bent on world destruction, the researcher with pure intents whose world spins out of control because he tampers with the fundamentals of nature. This is particularly odd because the last century has spawned so many scientists with a deep social conscience, who have been deeply concerned about social issues even as their ideas have changed the world. Albert Einstein and Werner Heisenberg, Max Perutz and Francis Crick... the list goes on and on of researchers who have occupied themselves with human and social issues. But as Maynard Olson points out, humanity is facing problems of increasing complexity, and "scientists are often the source of the unwelcome news that these problems are real, that some of them will get worse before they get better, and that politically popular 'solutions' to them are poorly considered. Shooting the messenger who brings bad news will remain in style."

Yet the technology and knowledge that have been produced by modern biology promise to usher in sweeping changes in medicine, agriculture, and many other fields that have an important impact on our lives. Thus there is an urgent need to improve the communication between science and society, and to create a public that is capable of contributing to intelligent debates about the future that this knowledge will create. " "We all believe in better public education about science, but our ideas about how to promote it may be unrealistic," Olson says. "It is implausible that there will be big changes in public 'scientific literacy.' We need to learn to do better talking to people where they are."

The European Molecular Biology Laboratory (EMBL) and its sister, the European Molecular Biology Organization (EMBO) are taking concrete steps to address these issues in a major conference entitled "Developing a new dialogue;" the conference will be held in Heidelberg, the headquarters of both organizations, from November 10-12. "We would like to contribute to a reflective, cross-cultural, multi-disciplinary dialogue about the impact of the life sciences in the post-modern world," says Halldór Stefánsson, who heads Science and Society activities at EMBL. "This will provide a forum for the 'doers' and 'communicators' of science, as well as students, to explore the recent dramatic changes that have occurred in the life sciences." A special emphasis will be placed on scientific communication and alternative ways of presenting science to the public, including the modes of theater and the arts. The conference will include biologists, educators, science communicators, and government representatives from throughout Europe.

The conference has been broken down into four thematic sessions – each will consist of individual talks followed by round-tables with expert panels from a variety of areas. The organizers hope that this format will encourage a high level of audience participation.

The first theme, "From science to society: case studies, risk studies," deals with scientific responsibility and public perceptions of how science really works. Communication between scientists and the media and the wider public is often plagued by misunderstandings, but the problems can only be relieved through dialogue. "The idea that knowledge is dangerous is deeply embedded in our culture," says Wolpert, a developmental biologist who will speak in the first session. While scientists have access to special knowledge of the world, "they have neither special rights nor skills in areas involving moral or ethical issues."

Julian Kinderlerer

Other participants in the session include Robin Weiss, John Collinge, Brian Wynne, and Claire Marris, speaking on topics such as AIDS, BSE, and public perceptions of risk from science. The panel discussion will center on the theme "How to restore public trust in science;" participants include Beate Weber, Tom Wilkie, Julian Kinderlerer, Barbara Jasny, and Maurizio Iaccarino.

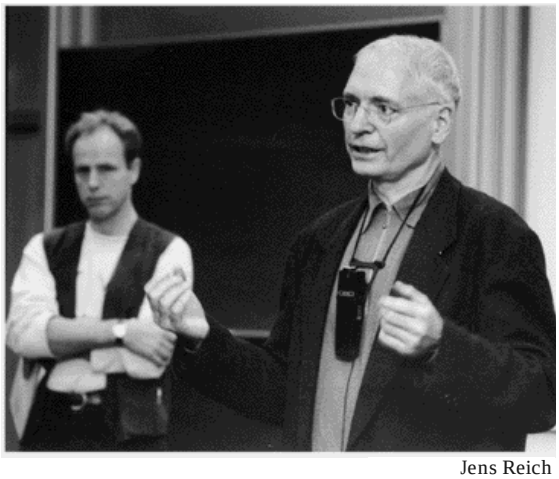
The second theme deals with "Medical uses of genetic information: gene therapy, prenatal diagnostics, and population genetics" and the title of the third is "On human genome projects: uses and abuses." "An avalanche of new knowledge and new techniques with relevance for human biomedicine appears to be impending," says speaker Jens Reich. Technologies such as the cloning of mammals have raised questions about whether it might be possible to clone human organs as spare parts; it may prove easier to deal with genetic diseases in the "germline" – egg and sperm cells – than through methods like gene therapy, which attempt to combat genetic defects in millions of cells in adults. Issues such as these will have to be discussed on a wide social scale. "I deem it necessary for us as scientists to prepare for the impending public discussion," Reich says.

Other speakers in the session include Andrea Ballabio, Peter Goodfellow, Kari Stefánsson, Alexandre Mauron, Sheila Jasanoff, Maynard Olson, and Benno Müller-Hill. The discussion panel will focus on the public understanding of genetic information and the participants will be Barbara Cohen, Jean Louis Mandel, Alastair Kent, Alexandre Mauron, and Vivienne Parry.

The last session will take up the topics of "Biotechnology, bio-industry, and bio-business." "New ethical questions have surfaced with the growth of biotechnology, bio-services, and bio-business sectors among the populations of Europe and the world," Halldór Stefánsson says. "Aheightened awareness of such ethical questions is essential among all the parties concerned... In a democratic society it is the public that will, in the long run, have the last word through its voting at the ballots as well as through its manifestation of consumer choices. An important first step must consist of ongoing efforts at dialogue between the different social groups – the producers (the scientists), the communicators (the journalists), and the consumers (the public) – to elucidate how they perceive and interpret the various new developments in technologies and products growing out of the life sciences."

Talks will be presented by Hans-Jörg Rheinberger, Mark Cantley, Sheila Jasanoff, Stefan Flothmann, and David Dickson.

The closing session will be a panel discussion called "Science in the spotlight," led by Ivo Schneider and Carl Djerassi, dealing with the theme of science and theater.



Jens Reich

"Science is inherently dramatic – at least in the opinion of scientists – because it deals with the new and unexpected," remarks Carl Djerassi. "But does it follow that scientists are dramatic personae? Or that science can become the stuff of drama? Until now, 'science-in-theater' has proved to be a rare genre, although playwrights of the caliber of Brecht, Dürrenmatt, Whitemore, and Stoppard have on occasion chosen scientists or scientific themes as components for the plots of major plays."

The conference will be held at the EMBL Main Laboratory in Heidelberg. Registrations can still be made on-line at www.embl-heidelberg.de/Conferences/SciSoc00/index.html.

Science Citation Index available on a trial basis

The Science Citation Index, which started life in 1962 and now contains data going back to 1945, is recognised as a very valuable bibliographic resource for researchers. It is produced by the Institute for Scientific Information (ISI), based in Philadelphia, who also produce the Journal Citation Reports, listing the "impact factors" of journals. EMBLis currently offering trial access to the service, to allow EMBL scientists the chance to see it for themselves.

The Science Citation index allows you to search by author, institution or subject, or to look for specific published articles, and then view either the references mentioned in the article, or look at how many times the article itself has been cited. If required you can see full details of citing articles, including abstracts. Hypertext links allow you to follow a research trail, going from one article to others that have cited it - and then following links from those articles to others – ad infinitum. This allows you to see which articles have made the most impact – those which have collected a large number of citations. It can also help researchers to find articles that approach a topic from another angle, or from a different field of research, opening up new lines of enquiry and assisting an interdisciplinary approach to areas of interest.

On a very pragmatic level, this information can also be of great interest to those judging grant requests or job applications. The citation index can demonstrate that a piece of research has been of wider interest, or has made an important contribution to your area of work.

The data contained in the Science Citation Index is very carefully selected and controlled. Over 5,700 journals are covered by the index, with around 260 new journals being added each year. A total of 17,000 new records are added to the database each week. To be included in the index, journals have to meet certain criteria, both qualitative and quantitative, including:

1. Timeliness of Publication – prompt and regular publication, which indicates a healthy backlog of manuscripts;
2. International Editorial Conventions – such as informative titles and abstracts, and complete cited references which optimize retrievability of source articles;
3. Broad Appeal – English language articles will reach the largest possible audience;
4. Peer Review - indicating high standards and overall quality of research.

EMBL is running test access to the Science Citation Index via the Web interface of ISI, called Web-of-Science. This trial is being run in cooperation with the research libraries of the HGF - the Hermann von Helmholtz-Gemeinschaft, whose members include the DKFZ, DESY and the MDC-Berlin. Access will be available until September 30 at http://wos.isitrial.com.

Planning EMBL's future

In November 2000, Council will decide on funding for the Scientific Programme and Indicative Scheme for 2001-2005. Here is the final proposal, as submitted at the July Council meeting.

The Scientific Context: An Accelerating Revolution in Biology

In the second half of the 20th Century, Biology underwent one of the greatest scientific revolutions of all times. As a result, for the first time in history we are beginning to understand the fundamental nature of life itself - a subject at least as interesting as the nature of the cosmos or the ultimate composition of matter. This revolution continues to accelerate, and with it a new technological revolution is gathering pace in medicine, agriculture and industry.

In the current period, Biology is being transformed into an information science, through the power of the systematic methods of bioinformatics, genomics and proteomics. Simultaneously, Biology is becoming more integrative. It seeks to understand the logic of living systems in molecular terms at successively more complex levels of organization: macromolecules and their dynamic complexes, living cells, developing organs and organisms. A striking evolutionary unity of life at the molecular level has become evident, greatly facilitating the transfer of biological knowledge from tractable model organisms to complex species including humans. Biology is even transcending its historic boundaries, for example joining with chemistry in the interdisciplinary field of chemical biology, and blending with the cognitive sciences in the neurosciences.

Modern Biology increasingly depends on novel methods, new equipment and large-scale facilities, both physical (e.g. synchrotrons) and electronic (interconnected global databases). In addition, basic research in Biology is increasingly interdependent with biotechnology and medicine, which apply the discoveries of fundamental research but also provide new methods and pose novel problems. Fundamental biological research and its innovative applications in industry and medicine are progressing in close dialogue.

Functional Genomics: A Central Theme served by Inter-Unit Initiatives

In the coming five years, the major theme of EMBL will be Functional Genomics, closely integrated with biology from the molecular to the multicellular level. A major landmark of human history - the first reading of the information in the human genome - was achieved in June 2000. A defining moment though it is, this was only the beginning. When EMBL's next scientific programme starts in January 2001, the human genome sequence will be available together with finished or draft sequence of several multicellular model organisms (the worm, the fly, the rice plant and Arabidopsis, probably the mouse), as well as a plethora of finished microbial genomes. At the start of the 21st century, Biology will be faced with the enormous task of understanding genomic function: how the entire information of the genome results in the biology of the organism, its phenotype. EMBL is in an excellent position to be amongst the pioneers in this ambitious undertaking. It combines a unique culture with an exceptional blend of great strength in basic biological research, bioinformatics and instrumentation development, including the technologies of genomics and proteomics.

Genome function must be understood in the context of biology, at successive and interconnected levels of increasing complexity. It must be understood in terms of the structure of macromolecules and their complexes, and their in vitro function; in terms of molecular dynamics in the living cell in support of cellular structure and function; and in terms of the roles of macromolecules, complexes and cells in developing multicellular tissues, organs and organisms. Molecular information is required to understand the higher levels of organisation, but the converse is also true: the biology of the molecules of life can only be understood ultimately in their cellular and multicellular context. Thus, all the Units that the Laboratory has nurtured in previous years are now timely. They have become indispensable for a serious effort to understand how genomes work through biology. Functioning not as isolated units but as organisational entities within a coherent whole, the EMBL Units (Programmes and Outstations) will pool their complementary expertise towards shared goals and create a powerful center for functional genomics in Europe. Thus, how well we deliver on our central theme will depend on the health (including the funding) of each of our Units, but also on our ability to integrate their distinctive core activities through inter-Unit initiatives.

These initiatives (Bioinformatics; Systematic functional genomics / proteomics; Molecular machines; Intracellular RNA world; Biological systems analysis; Interface with medicine) represent a real innovation in EMBL's mode of operation, which requires some explanation. Through the inter-Unit initiatives we intend to maximise interactions between groups from throughout the Laboratory to achieve synergy of purpose, so that a "bottom up" organisation can tackle the large, ambitious and interdisciplinary projects that are currently needed in the life sciences. In this new era, the Laboratory needs to address major biological problems in a concerted, interdisciplinary manner for which individual EMBL research groups have neither the size nor the breadth of expertise; this requires a mechanism beyond the spontaneous cross-group collaborations that are already prevalent at EMBL. While most of the resources required for the initiatives will come from resources allocated to the Units, the initiatives will affect resource allocation by orienting group leader searches (always subject to the cardinal principle of individual excellence), and by guiding the choice of scientific facilities to develop, as well as the central allocation of competitive fellowships.

To make the concept of inter-Unit initiatives more concrete, let me review the initiative on Molecular Machines. It is

becoming increasingly obvious that biological function is mediated not by individual gene products, nor by single protein-to-protein interactions, but by multimolecular aggregates that constitute complex molecular machines. For a systematic analysis, we need to develop methods to isolate such complexes and to characterize them in terms of composition, structure, biochemical mechanism, remodeling capacity and in vivo function within cells and developing organs. This initiative has already crystallized as a center of activity in the Laboratory. The TAP-tagging methodology of B. Séraphin (Gene Expression) has been validated as exceptionally powerful for the gentle isolation of multimolecular complexes from cell extracts; together with the expertise of M. Wilm's Group (Biochemical Instrumentation), they place EMBLat the cutting edge of non gel-based proteomics methodologies. Several groups in Developmental Biology (D. Bohmann, S. Cohen, A. Ephrussi,) are currently incorporating this approach in their work. Advanced microscopy approaches to identifying protein-protein interactions in the living cell have been introduced in Cell Biology and Biophysics (R. Pepperkok, P. Bastiaens), and collaborations with developmentalists using advanced microscopy are being explored. Finally, structural biologists at both Heidelberg and the Outstations (e.g. C. Müller and S. Cusack in Grenoble) are moving towards ambitious projects to determine the structure of protein complexes; increasingly these involve collaborations with other colleagues at EMBL.

Inter-Unit initiatives are well-suited to the special features of the Laboratory. They are part of our strategy for achieving landmark advances in a "bottom-up" manner, in an era in which large projects are becoming the norm in Biology, and in an institution that has rather small groups and an unusual personnel turnover system. This system makes EMBL unique, and remains appropriate for an international laboratory whose statutory mission is to promote molecular biology across Europe. It is unlike other successful systems which are based on tenure and are more appropriate for national institutions: for example the star system with very large group sizes in the Max Planck society (or the Howard Hughes Medical Institutes in the USA), or the system of institutional long-term support in tenured positions that has been so instrumental at the LMB. At the EMBL, we recruit almost invariably investigators starting directly from postdoctoral positions, give them complete academic independence and sufficient resources to form rapidly a research group that is modest in size, support them in this manner for up to 9 years, and then encourage them to move on to senior positions in the Member States ("seeding"). To name but a few of the recent successes of this system, this was the career path of Tony Hyman and Marino Zerial (MPI Dresden), Angus Lamond (Dundee), David Tollervey (Edinburgh), Werner Kühlbrandt (MPI Frankfurt), Peter Becker (University of München) and Matthias Mann (Odense University). In addition to the tangible benefits of returning new stars to the Member States, our system gives EMBLflexibility and youthful dynamism; the downside is the appearance of continuous "loss" of key personnel, considerable disruption and costs associated with turnover, and minimal options for top-down planning. We see the inter-Unit initiatives as an important mechanism to preserve the benefits of our system while sidestepping its limitations, especially in respect of planning.

Another example of such initiatives is Bioinformatics. This of course is the focus of our Hinxton Outstation, the European Bioinformatics Institute (EBI), and it is so important that the EBI is scheduled to receive approximately 60% of the increase that we are seeking in our funding baseline: to develop the massive information resources that are now essential for the molecular life sciences, to train the bioinformaticists that Europe desperately needs in academia and industry alike, and to do the future-oriented research that will keep us at the forefront of developments. But the big challenge will be not just to do bioinformatics in isolation, but to integrate that approach with wet biology. In the area of genome expression analysis, Alvis Brazma at the EBI has taken the lead to develop world standards, algorithms and software for capturing, storing in databases and comparing DNA microarray data from diverse laboratories ("Array Express"). In developing this project, the experience in Heidelberg of instrumentation developers (W. Ansorge) and of molecular biologists who are beginning large microarray projects (M. Hentze, F.C. Kafatos and others) will be invaluable. Significant input will also be coming from the computational biologists in Heidelberg who are in daily contact with the experimentalists, and can form a vital link between the EBI and the Headquarters Laboratory. This concerted effort spans the Bioinformatics and the systematic functional genomics / proteomics initiatives.

The Headquarters Laboratory in Heidelberg

The Heidelberg Laboratory is the centerpiece of the EMBLsystem, and largely accounts for its reputation, high standards and competitiveness. Furthermore, it is the location of much of the wet biology research, technology development and advanced training at EMBL, and the largest source of outstanding alumni who benefit directly the Member States when they leave the Laboratory. As recent reviews attest, EMBL Heidelberg continues to have vibrant, internationally recognized top-quality research programmes which continue to evolve as developments in science require. The instrumentation programmes are also highly innovative, with recent major successes in mass spectrometry and novel microscopies.

During the current Scientific Programme (1996-2000), an inadequate budget and the necessity of building up the approved new EMBL Units - the EBI and to a lesser extent the Monterotondo Programme - forced the Heidelberg Laboratory to shrink significantly. It lost 8% of its research group complement and had to trim some 10% of the staff positions in the Units (technicians and Staff Scientists). Increased numbers of PhD students kept the number of personnel approximately constant, but are no substitute for technicians and Group Leaders. Moreover, the supply and small equipment budget per group remained constant, without inflation compensation, effectively reducing the actual resources. Similarly, capital investment for large equipment and for the building's infrastructure has been very inadequate. We are seriously concerned about the loss of critical mass and competitiveness of the heart of the EMBL system. This cannot continue.

Being pragmatic, and in view of the continuing need to expand other parts of EMBL, we are only requesting a modest restoration of resources in Heidelberg for the next five years. These will be concentrated on two priority items that will immediately improve the conditions in the Laboratory significantly. One is the provision of some additional research personnel (in total 18 postdoctoral fellowships) on a competitive basis, to encourage ambitious but risky projects and collaborations that can include other EMBL sites. If required by the projects, other types of research personnel may

also be considered (e.g. engineers, programmers).

The second item to which we have given top priority for Heidelberg is the development of core research facilities. These are essential because of the increasing importance of new instruments in molecular biology in general, and the new theme of functional genomics that requires its own novel instrumentation. The facilities will have dual function: they will be important not only for EMBL researchers but also for supporting our extensive visitors programme. Much of the hardware will come from a proposed off-baseline equipment fund (see below), while the staffing and operating needs are to be met from the additional funding requested for Heidelberg. Among the major facilities we wish to develop are facilities for systematic genome expression studies (especially DNA microarrays), for proteomics (mass spectrometry and 2D gel analysis), and for novel microscopies. A prototype we wish to emulate is our Advanced Light Microscopy Facility, which has already become a center of competence and is now promoting a network of advanced microscopy facilities in Europe; in this case most of the equipment is available, but the staffing needs reinforcement.

The Heidelberg Units have been consolidated in the last five years into four main programmes that are designed to cover the levels of biological organisation, from the molecule to the developing organism. A fifth, smaller unit is devoted to biochemical instrumentation. Even as the Heidelberg Laboratory was shrinking, we established a new Developmental Biology programme through recycling of resources from other programmes, to complete the intended coverage. These consolidated units are to be sustained in the new 5-year period at the current reduced steady state (of course with their coverage evolving through turnover). We are only requesting for now the restoration of one group, to bring back essential chemical expertise in the Laboratory. The Heidelberg Units and their main themes can be outlined as follows:

Structural and Computational Biology:
Biology-driven analysis of macromolecular structure using all available structural techniques; single particle analysis focusing on membrane proteins; structural principles of macromolecules; computational approaches to biological analysis.

Gene Expression:
Analysis of genome expression; gene expression as an integrated process involving continuous remodeling of chromatin and RNP complexes; understanding nuclear structure and real-time gene expression through advanced light microscopy.

Cell Biology and Biophysics:
Processes that confer identity to membranous compartments; generation of cell asymmetry; microtubule- and microfilament-based morphogenesis; development of advanced light microscopy methods to study molecular events within cells in real time; integration of experiments and modeling to understand the dynamics of cellular structure.

Developmental Biology:
Developmental signaling processes analyzed by genome-wide expression patterns; biochemistry of protein complexes, and light microscopy of real-time signaling in multicellular systems; asymmetry in single cells related to asymmetry of cell populations; mouse genetics as related to development and physiology.

Biochemical Instrumentation:
Automation of purification methods leading to high-throughput mass spectrometry; emphasis on targeted proteomics and collaborative efforts in global proteomics; DNA and protein microarrays; technology improvements for medium-scale DNAsequencing projects.

The European Bioinformatics Institute (EBI)

The central ambition for the EBI is to be the premier public sector bioinformatics service provider in Europe, and a center of excellence in research that prepares the future, trains badly needed experts and provides scientific input into new services. Much has been achieved in the service programme since the start-up of the EBI in 1995. The challenge will be very much greater in the next five years, as the flood of genomic (and soon post-genomic and proteomic) data dramatically expand the demands: to handle and annotate these data, and to make them available to the community openly in the form of user-friendly information resources. Research and training could not be high priorities in the past because of severely limited resources, but this must be corrected in the future.

In terms of providing information resources, the EBI will need to:

Render robust (enhance current activities):

- EMBL-Bank (the nucleotide database; a global public partnership with GeneBank in the USA and DDBJ in Japan)
- SWISS-PROT / InterPro / TrEMBL (the world's choice protein sequence database; SWISS-PROT is an equal partnership with SIB in Geneva)

Build to viable strength (develop full services from current nucleus):

- European Macromolecular Structure Database (partnership with RCSB in the USA)
- EnsEMBL (continuously updated baseline public annotation of the human genome, and across all vertebrates; partnership with Sanger Center)

Establish and operate (present and future databases and related activities):

- ArrayExpress (public DNA microarray db from present conceptual design; algorithms and tools for expression analysis)
- Additional databases (e.g. EST and STS dbs, Mitochondrial DNA db, Radiation Hybrid db, SNP and other sequence variation dbs, metabolic pathways db, databases from multiple external collaborations)
- New information technologies for optimum use of dbs (currently CORBAand SRS)

Substantially increase emphasis on:

- External services (improvement of main service delivery platform, notably web presence, analysis tools, integration of the various EBI information resources and the user interfaces to them)
- External collaborations (national bioinformatics centers, EMBNet)

In terms of research and training, our ambition is to make the EBI a world-class center within two years. It is worth recalling that in 1994 and again in the current Scientific Programme we had planned for the EBI a research programme consisting of six modest-size research groups. We had no chance to pursue this goal with the available finances, as the provision of services had to take precedence. The research programme has shrunk to 2 full-time

groups; although they are of high quality, they are clearly below critical mass. Yet, as we know from experience at other Outstations, keeping the service activities of the EBI at world-leading level will require their interaction on a daily basis with cutting-edge, future-oriented research. The EBI will need to be enriched with scientists who develop new concepts, approaches and algorithms in genome-related bioinformatics, as well as with pioneers of new bioinformatics areas and those who strive to create comprehensive information systems for biology. We aim for a major expansion of the research programme, using mostly external funding to build on an institutionally-supported nucleus. Related to this expansion will be a strong emphasis on training activities, which will require the robust operation and close collaboration of the service, research and industry support programmes. Advanced training needs to be addressed towards academic researchers, industry, as well as national centers of bioinformatics service, research and training. In view of the scarcity of bioinformatics personnel in Europe, an appropriate mission for the EBI is to train their trainers.

In its early years, the EBI succeeded in creating a much appreciated industry support activity (BioStandards programme, co-funded by industry and initially by the EU). It brings to Hinxton key bioinformatics personnel from approximately 20 European pharmaceutical companies, for advanced training workshops and discussions concerning novel improvements in bioinformatics methods and tools. With additional funding, this unique and valuable activity could be expanded to other industrial sectors, and the outstanding BioStandards workshops could also be made available to the academic community.

In conclusion, a substantial build-up of the EBI will be required for it to make its expected and essential contributions towards development of bioinformatics across Europe - in the same way as EMBL-Heidelberg has done and is doing for molecular biology. The EBI must have the personnel and equipment (computers, peripherals and networks) to develop its core services further (including new database resources that we expect to be second to none) and to create sophisticated user interfaces that will facilitate their adoption. It must also be able to build a top-quality research programme, which will prepare the future directions in bioinformatics and participate in training while providing scientific input into the services.

To achieve these goals, the EBI will need to get substantial new funding, and to attract additional high-quality personnel. These two requirements are interrelated. In terms of resources, the EBI will require additional funding both from EMBLand from external sources. Its total budget will need to more than double, reaching 24 MEURO in 2001 and at least 30 MEURO in 2005. By comparison, the NCBI's budget is already ca. 35 M$ this year (approximately the same as is planned for launching in 2001 a new Bioinformatics Institute in Japan), and is projected to grow to 100 M$. Thus, we see no room to decrease our funding request to the EMBL Council. Although the EBI accounts for ca. 60% of the requested total increase in the EMBLbudgetary baseline, the resulting institutional contribution of EMBL will only reach ca. 40% of the total budget that will be required for the EBI. We consider this as the minimum level of ring-fenced commitment that the EMBL must make to remain credible as the parent organisation of the EBI.

The competitiveness of the EBI will require that we retain our present top-quality staff while recruiting others in what is very much a seller's market. It has taken considerable managerial and inspirational skills on the part of the present joint heads of the EBI to retain the present top-quality team and group leaders through the last two years of increasingly inadequate budgets, including the last year of financial crisis triggered by the withdrawal of EU support. While G. Cameron will remain as head of services, M. Ashburner has resigned but has agreed to serve as acting joint head until EMBL can recruit a full-time Director from the scientific side. The search for this recruitment has begun and will get into high gear as soon as the financial commitment (for all of EMBL, including the EBI) is voted upon by Council in November this year. Importantly, the MRC and the Wellcome Trust have notified us that they will open their competitive bioinformatics research funding schemes to the EBI once the other elements of reinforcing the EBI are in place. Without doubt, for the EBI to recruit effectively and to compete for external resources in a credible manner, it must have adequate and predictable funding. We hope that competitive renewal of EU funding will become possible through the interim genome-related initiatives being considered in Brussels, and later through Framework Programme VI, thus complementing the multilateral commitments of the EMBLCouncil.

The Monterotondo Mouse Biology Programme

In the era of functional genomics, the shift towards human biology has enhanced the importance of the mouse as the only tractable mammalian model system. The EMBL central laboratory in Heidelberg has facilities adequate for two major and three minor (i.e. occasional) mouse users and these facilities will continue to be used in full. However, Monterotondo is an essential complement for EMBL's focus on mouse biology.

Since 1994, EMBL Council has a clear commitment to establish four mouse biology groups at Monterotondo, a process we began in January 1998 when the facilities became available. The initially approved funding proved inadequate for steady-state operation but, since it was provided for five and actually needed for only three years, it sufficed (with some supplementation from central funding) for a programme consisting of three groups and a staff scientist. EMBLand its international scientific advisors (including a recent SAC review) agree that Monterotondo has the potential to make a major contribution to the European effort in mouse biology, but will require expansion to achieve critical mass. We will continue to work to realise that potential, and seek from Council the additional resources to bring the Programme to viable size, six groups in total, including the necessary facilities (with additional animal house space to be provided by the host country).

In the recent past, the Monterotondo programme faced two unfortunate developments, one internal and one external. Internally, damaging uncertainties arose out of our Coordinator, K. Rajewsky, being courted by Harvard. We agreed with him a deadline for clear decision-making, and followed the Review Panel suggestions in committing a reasonable package of resources to retain him with us. Although we understand his decision, we much regret that Klaus opted to move overseas (and the consequent loss to Europe as well as the EMBL). With his stepping down, we have appointed W. Witke as Acting Coordinator and will be conducting an open search for a Coordinator. The Council's decision about resources in November will be needed before attempting to finalize such an appointment. As the departure of K. Rajewsky and his Staff Scientist (U. Kalinke) will reduce the number of

research groups to two, we have also initiated a search for a group leader.

The external unfortunate development was the loss of EU support for EMMA, which reduced the operation of this important facility to stand-by mode, supported by CNR. Needless to say, we regret this development and hope for renewal of support, as we are convinced that EMMA (with a central repository at Monterotondo and a network of collaborating national nodes) is essential for Europe. Although the EMBL Programme does not absolutely require EMMA, we view EMMA as a great asset both for Europe and locally (potentially an important contributor to the mouse activities on campus, and EMBL's partner in a shared animal house). Close interaction between a renewed EMMA and the EMBL Programme will be highly desirable, without any net transfer of resources in either direction between the two entities.

The Mouse Biology Programme at Monterotondo has a broad remit, to address important questions in the biomedical sciences using mouse as a model and the excellent technologies now available in that system as tools. In filling the two currently available positions and the final two that we hope will be funded in November the primary criterion, as always, will be individual excellence. The Programme already has two excellent scientists with specialties in Cell Biology and Developmental Biology / Neurobiology and it will be wise to create synergy by reinforcing these areas. However, we must remain mindful of the importance of the mouse as a favourable system for studies of vertebrate physiology and integrative biology, including as model for human diseases. Sophisticated analysis of mutant mice in terms of molecular physiology and other aspects of phenotype is becoming necessary and we will keep this and other desirable goals in mind, as we recruit and make choices for facilities to support a dynamic, expanding mouse biology programme.

The Hamburg and Grenoble Outstations

These EMBL units are universally appreciated for their quality, service to users and cost-effectiveness. The Grenoble Outstation began the current quinquennium with the approved expansion of its laboratory facilities, and has been instrumental in bringing the ESRF beamlines to an exciting level of quality for structural biology. A fair assessment is that despite its small size it plays a major role in making Grenoble a world center for structural biology, and in serving well the needs of numerous visiting scientists. Its activities are channeled through the Joint Instrumentation Group (JIG) and the Joint Structural Biology Group (JSBG), which have mixed ESRF and EMBL membership; the EMBL contribution is increasingly recognized by all concerned. The lack of resources unfortunately precluded the purchase of BM14, which would have been highly beneficial to both the service and the research functions of the Outstation, but it is hoped that collaboration with the new owners of the beamline will make some of the beam time available for these functions.

The Hamburg Outstation has developed an even more impressive record of serving the European structural biology community through its stellar Visitors programme. At the same time, a small, vigorous and necessary research programme has begun to grow. Past limitations on resources have precluded upgrading of the beamlines and ancillary facilities, but this is a major priority for the next quinquennium. The capital investment for upgrading the facilities at Hamburg is included in the request for off-baseline funding.

The intensified use of the Hamburg and Grenoble facilities by the user community, which is ongoing and will undoubtedly increase further, mandates the modest increase in personnel that is

TABLE 1: INDICATIVE SCHEME PROPOSALS 2001 TO 2005
ADDITIONAL FUNDING (KEURO)

	2001	2002	2003	2004	2005
EMBL PENSION FUND OPTION 6	500 500 500	500 500 500	500 500 500	500 500 NIS	500 500 NIS
SCIENTIFIC PROGRAMME					
EBI: core services and the nucleus of a research programme	2 000 2 000 2 000	3 000 3 000 3 000	3 500 3 500 3 500	4 500 4 500 NIS	5 000 5 000 NIS
Monterotonda: three additional research groups and associated facilities	1 000 700 700	1 500 1 200 1 200	1 500 1 500 1 200	1 500 1 500 NIS	1 500 1 500 NIS
Heidelberg: scientific facilities, postdoctoral support, restore 1 Chemistry Group	600 500 300	1 200 700 600	1 500 1 500 900	1 500 1 500 NIS	1 500 1 500 NIS
Hamburg and Grenoble: additional staffing for beamlines	300 300 200	500 300 200	500 500 200	500 500 NIS	500 500 NIS
Off-baseline non-recurrent funds for capital equipment	4 500 2 100 2 700	3 500 2 800 2 000	3 000 3 000 1 900	2 500 2 500 NIS	2 500 2 500 NIS
OVERALL TOTAL					
Optimum case scenario	8 900	10 200	10 500	11 000	11 500
Responsive case scenario	6 100	8 500	10 500	11 000	11 500
Minimum case scenario	6 400	7 500	8 200	NIS	NIS

NIS: New Indicative Scheme

requested. With it, we would be forced to curtail the service to users proportionally.

At Hamburg there are seven beamlines (excluding the yet to be commissioned new EMBL-MAD beamline) that are in operation 24 hours a day, seven days a week for more than 30 weeks of the year. The scientists supervise each experiment by external users including introduction to the beamline, preparation and strategy of the experiment, progress monitoring, data processing and trouble shooting. In addition they contribute to the development of state-of-the-art beamlines and beamline environment with innovative projects. The technicians provide a wide range of support services to the users including the provision and preparation of material, administration of the experiment at the beamline and continuous assistance for the duration of the experiment. At present there are altogether nine scientists and three technicians. Considering the very high and increasing throughput of visitors at Hamburg, and to ensure the highest quality of user support, the appropriate staffing level would be two scientists and one technician per beamline. This would require an increase of five scientists and four technicians.

On a similar basis Grenoble requires an increase of two scientists together with a software engineer who would work on data collection and processing and structure solution for all beamlines, and two postdoctoral fellowships assigned to ID 29 for work on advanced MAD methods. In addition to meeting current needs this postdoctoral support would provide an already proven training ground for future needs in beamline scientists. Taking both Outstations together this results in a request for seven scientists and the equivalent of six technicians.

Off-baseline Capital Investment Fund

The underfunding of EMBL over the last decade has resulted in an accumulated deficit in capital investment, which must now be addressed. Simultaneously, the EMBL needs to face the increasing dependence of molecular biology on large and novel equipment. Careful assessment of the baseline and of the needs for equipment and for investment in plant and building refurbishment point to a minimum total investment deficit of 16 MEURO over the period 2001-2005. Because of the previously deferred nature of these investments, and their magnitude, budgetary provision for them is made off-baseline. Ideally, they should be significantly front-loaded. Capital equipment needs include crystallography beamlines and peripherals, computers, electron and advanced light microscopes, high-throughput biochemical instrumentation for functional genomics and proteomics, etc. In addition, further deferral of investment in the plant and buildings in Heidelberg cannot be sustained. In prioritizing the requests from the Units the focus has been on supporting the new Scientific Programme (e.g. DNA microarray and other genomic/proteomic facilities, advanced light microscopy facility) and on serving the users (e.g. Hamburg beamlines). Decisions have been taken not to pursue lines of research that would require additional substantial capital investment (e.g. solid state and very high-resolution NMR).

Advanced Training and Visitors Programmes

Advanced training and support for visitors are very important and pervasive aspects of EMBL's mission. The Laboratory as a whole, and each one of its well-established Units, have a stellar record in these activities - a record that is universally and warmly applauded. A point worth emphasizing is that the intensity and the quality of these activities would be impossible without investment of resources for a robust scientific life in the Laboratory. It is the quality of its scientists and the institutional support that they receive which together make possible an unmatched level of commitment to training and provision of services to others. In the last five years, and continuing in 1999, we have more than delivered on the promise to enhance these activities further, but we have now exceeded the limit of what can be sustained without proper investment. In the structural biology Outstations of Hamburg and Grenoble, investment in beamlines, peripherals and associated facilities as well as their adequate staffing will be needed if the service to visitors is not to degrade, but to be sustained at the desired level of quality. At Hinxton, the quality of service to users cannot keep up with the huge waves of data and the associated exponential increase in demand for improved and novel information resources, unless these services are built on a robust and growing bioinformatics center, as described elsewhere. The advanced training needs that Hinxton could meet through the expansion of their industry programme and its extension to the academic community urgently demand additional resourcing. At Monterotondo, stabilization and achievement of critical mass in the research programme need to be achieved before a significant visitors' programme can be launched. Finally, in Heidelberg restoration towards the previous research group complement will be needed if the number of visitors we can accept as collaborators is to be sustained; furthermore, development and staffing of new facilities suited to the postgenomic era will be critical for the success of the scientific programme, but also for meeting the changing demands of visitors in this new era (proteomics, DNA microarray and advanced light microscopy facility).

The New Indicative Scheme: A Summary

Conventionally, an Indicative Scheme defines the ceiling of contributions (in constant prices) that the Member States decide to make for the implementation of an approved Scientific Programme. The decision to be taken by Council in this instance will not be routine. It will represent the level of ambition of the Member States for their communal Laboratory in the post-genomic era. If EMBLis to continue to serve effectively European science, bold decisions will be essential. Lack of resolve will, in the longer term, marginalize the Laboratory.

The baseline for the new Indicative Scheme is calculated on the basis of funding in 2000. If we include in it Council's special contribution that addressed the immediate crisis of the EBI after the failure of EU "infrastructure" funding, and if we omit the one-off contribution with respect to back payment of 1995 salaries, the baseline becomes 45,242 KEURO.

Initially we discussed with Council three conventional scenarios for additional funding above that baseline (Best, Middle and Worst case, respectively). After careful analysis it became clear that the lowest of these three ("Worst Case scenario") would limit funding to a level that would result in abandoning an entire Unit and degrading the performance of the Laboratory significantly. I could not contemplate that eventuality. The other two scenarios are presented as the two extremes in Table 2, where they are named "Optimum" and "Minimum". I firmly believe that the Optimum is not

TABLE 2: SUMMARY OF ADDITIONAL AND TOTAL COUNCIL FUNDING REQUESTED (KEURO)

	2001	2002	2003	2004	2005
Council contribution (see TABLE 1)	45 242	45 355	45 419	45 451	45 487
Plus EMBL Pension Fund Option 6	500	500	500	500	500
Plus Scientific Programme 2001 To 2005					
Optimum case scenario	8 400	9 700	10 000	10 500	11 000
Responsive case scenario	5 600	8 000	10 000	10 500	11 000
Minimum case scenario	5 900	7 000	7 700	NIS	NIS
Total additional funding					
Optimum case scenario	8 900	10 200	10 500	11 000	11 500
Responsive case scenario	6 100	8 500	10 500	11 000	11 500
Minimum case scenario	6 400	7 500	8 200	NIS	NIS
Total Council Contribution					
Optimum case scenario	54 142	55 555	55 919	56 451	56 987
Responsive case scenario	51 342	53 855	55 919	56 451	56 987
Minimum case scenario	51 642	52 855	53 619	NIS	NIS

overambitious; it is what the EMBL really needs, and I will argue for it in November. It summarizes the funding requirements for implementing in a timely manner the Scientific Programme as outlined above, without delays. I would, very reluctantly, be prepared to consider the Minimum but only as an Indicative Scheme for 3 years, thus giving the opportunity for reconsideration in 2003. As a potential compromise, I will be putting forward a new proposal for 5-year funding that is responsive, both to the needs of the Laboratory and to the problems that some Member States may have with a rapid transition to the optimum level of support.

As Tables 1 and 2 show, the funding profile of the "Responsive" scenario would be a little less than the "Minimum" in 2001, somewhat more than the "Minimum" in 2002, and at the "Optimum" level in 2003 to 2005. Taken over the five years in comparison to the "Optimum", the "Responsive" scenario represents an (unfortunate) one to two year delay in fully implementing the Scientific Programme, and a scaling back of the off-baseline capital investment by 9.1%.

Over the first three years and in comparison to the "Optimum" scenario, the "Minimum" case would represent a substantial scaling back of the planned scientific activities in every Unit of EMBL other than the EBI, and loss of 25.3% of the off-baseline capital investment. That in itself would be seriously damaging in terms of EMBL's ability to play a full and active part in strengthening European life sciences in the postgenomic era. But added to that damage would be the corrosive message that would be sent to the Laboratory, the wider scientific community and other external funding agencies on whom the financial health of the Laboratory will depend concerning the inability to commit an adequate level of essential core funding for a full five-year Scientific Programme. At a time of exciting challenges, expanding opportunities and urgent need to continue to recruit and retain high-quality staff in an increasingly competitive world that would be a singularly unfortunate European message.

Concluding remarks

The Scientific Programme proposal seems to us in the Laboratory as an exciting but realistic roadmap for the next five years. It is, we believe, a roadmap worthy of EMBL and essential for its future success. These years are going to be crucial as Biology adjusts to being big science, at the forefront of discoveries, at the source of a technological revolution that is gathering speed. The world centers in Biology will be redefined in the coming years, and the EMBL must continue to be amongst them. It will, if granted sufficient resources.

Back in December 1995, at the decision-point concerning the current 5-year period we accomodated to the realities of a lingering financial slow-down in Europe, and the aftermath of EMBL's political problems of 1993-1994. We were only given a real growth of 5.7% over 5 years and were told to get on with it, keep most of the Laboratory at steady state, expand Grenoble, and build two new Units, the Monterotondo Programme and the European Bioinformatics Institute. We did a lot during these last 5 years, both in science and in administration, while slimming the Laboratory down to the bone. We cannot go through that again. There is no fat left, and the challenges have grown.

I am not a believer in "Big is Beautiful". But the challenge that we have taken on, and the rewarding opportunity Council should surely wish to take to build on their existing investment - functional genomics integrated in biology - will

require resources. We must nurture the EBI as Europe's center in a new discipline on which all of Biology now depends. We must reinforce the essential foundation (our strength in structural, molecular, cellular and developmental biology) on which functional analysis ultimately must rest. We must introduce demanding new technologies for systematic analysis and enhance our interdisciplinarity (our ability to work jointly on ambitious projects, across the boundaries of Units, even across geographic distances). We must significantly strengthen our work on the biology of the mouse, the best model system for functional studies of mammalian genomes. These are all essential components of our strategy. It will be impossible to pursue them without a adequate financial commitment that exceeds the "Minimum" scenario.

At the end, permit me to be impolite and raise some science policy questions. Everyone recognises that we are no longer in the immediate post-war period, when biology was a footnote to the real thrust of science - physics and engineering (later on to include astronomy, space science and informatics). Our friendly competitors in the USA and Japan have understood, and have shifted massive resources into the life sciences. At the national level in Europe we are also beginning to see some shift. But what about the international European level? What is the current funding of EMBLas a percentage of all European international laboratories? What will be the funding of the EBI as compared to that of the NCBI and the new Japanese bioinformatics center in 5 years? What will be the European public sector bulwark against potential commercial monopolies in genomic informatics across the Atlantic?

The predicament is that the Laboratory, despite its world reputation and its services, is modest in size compared with other Institutions. Requests for double digit percent increases above the baseline are unusual and challenging. But these percentages (as with all percentage comparisons) are very misleading. At a time when the NIH budget in the USA is growing by some 2 billion dollars year after year, and when the molecular life sciences, having reached center stage in basic research, are widely recognised as vital for the future competitiveness of Europe, the absolute levels of additional funding requested for EMBLare far from exorbitant. Even for the largest Member State, Germany, the share (3.0 MEURO) is in the range of a small genomics grant; for a small country like Greece, the share (160 KEURO) is in the range of a single-investigator research grant.

Can 16 countries of Europe afford *not* to provide this level of additional investment in one of their premier research institutions?

Other issues arising at the Council meeting...

ILO cases

Council was informed that some EMBLstaff had put forth a complaint to the ILO with regard to the implementation of Judgement 1887. This complaint concerned both the percent increase, and fact that the increase applies to a one-year period. This case is now formally being dealt with by the ILO.

Pension scheme

Previous to the July meeting, the Finance Committee had proposed substantial changes to the EMBL pension scheme. Both the Staff Association and Administration were opposed to these changes, and jointly advocated for the existing scheme for current staff. These efforts were generally successful; the Finance Committee Working Group announced that:

- no change in interest rate will be applied to return of employee contributions;
- no change will be applied to conditions for staff leaving on open-ended contracts taking a cash sum instead of a deferred pension;
- normal retirement age will remain at 60, instead of 62;
- early retirement age will remain at 50, instead of 52;
- no change will be made to the amount of pension payable for each year of service (i.e., it will remain at 2% instead of the proposed 1.8%);
- in future, pensions will be adjusted for cost of living adjustments rather than being linked to salary adjustments.

Salary adjustments

Council has decided to grant the 2000 adjustment to basic salary scales and allowances with effect from July 1, 2000 as follows:

France:	1.4%
Germany	1.5%
Italy	2.5%
United Kingdom	2.4%

A European research identity

An interview with Philippe Busquin

Commissioner for Research of the European Commission

Philippe Busquin visited the EMBL in July. He took the time to discuss his vision of a "European Research Area" with Russ Hodge (EMBL) and Holger Breithaupt and Frank Gannon (EMBO). The interview originally appeared in EMBO Reports and is reprinted here with the permission of Oxford University Press.

WHAT TYPE OF IDENTITY CAN EUROPEAN SCIENCE ESTABLISH FOR ITSELF IN COMPARISON WITH AMERICAN SCIENCE OR INTERNATIONAL SCIENCE IN GENERAL?

This is one of the questions behind our communication on a "European Research Area," to specify the nature of the evolution of science in Europe, and here I would make three statements.

First: in general, Europe doesn't spend enough money for research and development; it spends 1.2 pecent of its Gross Domestic Product compared to 2.7 percent in the United States and 3.1 percent in Japan. I delivered this statement to the Heads of State at the beginning of this year, and they appreciated its significance.

Secondly: research in Europe is very fragmented. We have national programmes, as well as a European programme and intergovernmental organisations. But there is not much organised contact between them. My goal is to create links, to create a web. There is work for everyone, which must be optimised by avoiding a duplication of efforts while at the same time merging diverse programmes dealing with similar subjects to give them a sufficient critical mass.

Finally, there is a cultural point: Europeans have to reconcile themselves with science and research, because in Europe there is a certain lack of belief in progress. People are a bit frightened, and we do have to make scientific careers attractive for young people. As the new Commissioner, I voiced this triple programme; I had no precedents. We must find a solution for these issues in Europe. Particularly if you look at the new entries in the scientific society growing at a rate of 25.5 percent, and new products of science–if Europe wants to remain prosperous, keep its social system, and create employment, it has to invest more efforts into science. And it is very important that everybody is aware of that.

GIVEN THAT THE NATIONAL RESEARCH COUNCILS WILL DEFINITELY PUT UP RESISTANCE AGAINST THIS PROGRAMME AS NOT TO LOSE THEIR INDEPENDENCE–WHAT TIME FRAME DO YOU SEE TO OVERCOME THESE BUREAUCRATIC AND NATIONAL RESISTANCES?

Obviously, the world was not built in one day. First of all we have to deal with all the different national programmes, with the globalisation of economies and information, with the Internet etc.... In this context, national borders are a bit tight. And I think everybody knows that. The scientific community is becoming more and more European, if not international, as is industry. It cannot be forgotten that European research and the research commissioners are aiming at a common goal. In the treaty that created Europe it is absolutely clear: research has to contribute to growth, development and employment in Europe.

There is even more: from the historical point of view, research has been more a tool for economic development than a means for the acquisition of knowledge. Of course, nowadays the two are very close. That means we have to make one thing understandable to the Heads of State: if they want prosperous countries, they should take into account that today's research is an investment in economic growth and employment the day after tomorrow. That's a paraphrase of Helmut Schmidt's formula when he said, "today's investments are tomorrow's employment." We do have human potential in Europe, we have areas of expertise, and we should nurture those that are most promising. That does not mean we would not welcome exchange at the same time; there should be openness. But this area has to become more attractive. And therefore we should make sure that there is space here to attract the very best.

"Researchers have to be recog - nised as a rich resource for the future."

THE SYSTEM OF SUPPORT AND FUNDING FOR SCIENCE IS MOSTLY NATIONAL AT PRESENT, WHEREAS SCIENCE ITSELF IS VERY INTERNATIONAL. SCIENCE IS PART ECONOMIC AND PART CULTURAL; HOW CAN THE INTERNATIONALISATION OF SCIENCE TRANSCEND ASPECTS OF NATIONAL CULTURE WHICH MIGHT INHIBIT ITS DEVELOPMENT? FOR EXAMPLE, IT IS SOMETIMES DIFFICULT TO "TRANSLATE" ACADEMIC DEGREES IN DIFFERENT COUNTRIES, WHICH MIGHT INHIBIT SCIENTISTS' MOBILITY.

I think you have to consider Europe as a whole, with its advantages and disadvantages. For example, different educational systems provide us with creativity. Maybe I can't say this to biologists or philosophers, but homogeneity is our death. Heterogeneity is what we should strive for, it is very important. The United States is building its development on the basis of input from very different cultures. The problem is that in Europe we do have different educational systems, and we have to respect that, so we are lacking some tools. People in different countries have to confront this problem, and many of them eventually go to the States. And there they do not have these problems. Here I think we should not try to adopt the American model, because it's impossible.

A central component of Europe is diversity. The American model developed in a specific cultural, economic and social context, and thus it cannot simply be adopted in Europe. I think people make the mistake of believing this can be done. We need to take the good aspects of the American system and adapt them to our diversity. But if the diversity is the dominant element, if we are not able to create coherence and to work together, then we are faced with a real handicap. If educational systems do not converge, we are also obviously handicapped. But currently there are already projects aimed at achieving that goal, starting, for example, with making students more mobile. There is a European programme called "Socrates" that is establishing Europe already on the level of studies, and thus contacts between different cultures, and students of all disciplines are participating.

When talking about the U.S.: the NIH and NSF grant system has been proven to be highly successful. Should we not adopt the successful parts of this system?

Of course. We clearly have to consider that aspect of what is happening in the United States. This is not a question of the value of research, but rather of how to organise it better. There must be a desire on the part of politicians to work on this level. In Europe there are still divisions between research at the universities and industry, and there is not enough synergy. We need such synergy; we need to change mentalities. This division cannot remain. Basic research is leading more and more to innovations. And we need to create the necessary tools. Yesterday I learned about EMBL's involvement in Technology Transfer–this is the kind of activity that is important. In the United States, this has been done for certainly 20 years. That's the problem: the idea that the scientists should also be engaged in economic development. We should copy that kind of mentality from the United States, but not necessarily the whole system.

"We have human potential in Europe, we have areas of exper - tise, and we should nurture those that are most promising"

If a researcher in the United States wants to achieve a certain goal, he finds well-developed political instruments to proceed on the plan. What can researchers in Europe do to make sure that their views are properly represented on a European scale?

I think first of all they have to have more presence in society. Scientists are citizens, and they should actively participate in society to make other citizens understand the importance of research. Today that's really very important. In our everyday life, as well in the fields of health, the environment, food production, and quality of life, we have a growing need for science. Therefore, science and society have to be reconciled. Science must acquire a much better image in Europe. If that happens, it will be much easier to gain support and funding from politicians, who are highly dependent on the public opinion. If the public opinion in Europe does not want genetically modified organisms, the end effect will be a brake on genetic research in plants.

Does that mean that the researchers should become more involved in lobbying? Do you think that in addition to communicating and informing, it's a good idea for scientists to become lobbyists?

We are living in a governmental mode where social groups have to manifest themselves. Social groups that do not manifest themselves are forgotten by history. We are living in a different mode of society. The best-known social groups are those you can see on the TV, and that's usually the soccer teams... of course, I mean that ironically.

In science, events sometimes happen too suddenly to build a base of public support that can then exert an influence on political policy. What can be done in the face of this reality?

The ways Framework Programmes are currently defined, our ability to respond to new developments is quite restricted. We have little space and liberty, and therefore there is a need for certain flexibility. You cannot realistically set up a programme lasting over four years without adding a certain amount of liberty. The ideas and the progress of science are proceeding so rapidly that public research programmes require a certain amount of flexibility. We have faced this problem of lacking flexibility when the mad cow disease emerged. We managed to respond relatively quickly at this time, but eventually we will have to be able to re-orientate ourselves much quicker.

"You cannot set up a research programme over four years without adding a certain amount of liberty"

Right now a considerable brain drain of scientists from Europe towards the United States, perhaps because there they may find better funding. How could Europe become more attractive for scientists?

There is not a single answer to that question. First of all, a climate has to be created in Europe that is much more favourable for research. Researchers have to be recognised as a rich resource for the future. The present mentality is one in which politicians pose the question "Why should they be given money?" This mentality in Europe creates a vicious circle. It makes transforming research into a product much more difficult than in the United States. The link between research results and the development of an application is weaker, slower, and regarded as less important. So for many people, basic research is considered a luxury. This is not my opinion, but we have to look at the reasons behind it. Some people argue that we have enough research and researchers in Europe, but that the applications of their work are not well managed, that there is not sufficient innovation. It is true that we should improve our innovation process in Europe, but the more high-quality innovations we produce, the more researchers we will need.

First of all we need to re-establish the status of the researcher. He or she cannot be looked upon as somebody tucked into a corner and doing a little bit of laboratory work, so we have to re-establish the visibility of the researcher. To regain that in Europe, we have to demonstrate excellence. That's why I want to build centres of excellence here. I have met many scientists. They all know Stanford, Berkeley etc – Heidelberg is less known, even if sometimes the work that is done here may be more important than what is being done in Berkeley. The EMBL has Member States, for example, but to achieve a position in the scientific structure in the United States, you need to have a name–that's a precondition.

"To re-establish the visibility of the researcher, we have to demonstrate excellence"

European centres of excellence need to have a well-established name. Additionally, we definitely need the capacity to offer better conditions to scientists from America, India, China. This will make Europe more interesting. Once there is a strong, top-level research project with clear goals, the researchers will come. What we have to do is to create these conditions.

I WOULD LIKE TO QUOTE ONE OF YOUR RESPONSES TO A COMMENTARY ON THE EUROPEAN RESEARCH AREA PAPER. "OTHER, GREATER INVESTMENT IS NEEDED FOR RESEARCH IN EUROPE. PUBLIC SUPPORT MEASURES ARE NOT A SUBSTITUTE FOR PRIVATE INVESTMENT." DOES THIS STATEMENT HOLD FOR BOTH APPLIED AND BASIC RESEARCH, WHEN IT'S MUCH EASIER TO GET FUNDING FROM INDUSTRY FOR APPLIED RESEARCH? SECONDLY THERE HAVE BEEN REPEATED INSTANCES WHERE AN INTERESTING INTERNATIONAL PROJECT "FALLS INTO A HOLE." EUROPE SAYS "WE CANNOT FINANCE IT WITHOUT LOCAL SUPPORT", AND THE LOCALS SAY "WE DON'T WANT TO SUPPORT IT WITHOUT EUROPEAN SUPPORT."

Regarding the first question, basic research compared to applied research, we are witnessing a rapid evolution. In many systems, even from a legal point of view, basic research is considered as part of the domain of education, whereas applied research is meant to be part of the industry. Therefore you sometimes have a very strict separation of funding for basic and applied research. This concept is out-of-date. It dates back to an industrial society where an invention took 20 years to reach an applicable form. That is changing. Every industrial person I meet tells me that what is definitely needed now is quality basic research.

As to your second question: the link between Europe and local systems is quite critical because the same effort is not being made in research and development all over Europe. Some countries invest much more than others. In Sweden, for example, these days they spend 3.9 percent of the GDP for research and development. And that's not only the state, and it's not only public money, but it is also business money. You have to understand that on the European level, the states that spend a lot of money ask "Why should we give European money to a region that is making little effort?" Europe consists of 15 countries, each of which has contributed, each of which is

"Europeans have to reconcile themselves with science and research"

financing. The money the European Commission distributes comes from every member state. Therefore the efforts the member states make should be more consistent. We cannot resolve such issues between states that spend one or two per cent of their GDP, public money, for the research and others that spend only 0.2 or 0.3 percent. Here it's highly necessary to do some benchmarking.

THE PROBLEM ALSO AFFECTS INSTITUTIONS WITH CLEARLY INTERNATIONAL AIMS BUT WHICH FIND THEMSELVES IN A LOCAL NATIONAL PLACE–FOR EXAMPLE, SWISS-PROT. THIS IS A TRULY INTERNATIONAL PROJECT, WHICH SITS BY HISTORICAL ACCIDENT IN TWO EUROPEAN COUNTRIES. ALL DATABASES–WHICH ARE IN A SENSE IN ONE PLACE, AND IN ANOTHER SENSE EVERYWHERE–ARE CONFRONTING THE SAME PROBLEM. ANOTHER EXAMPLE IS THE EUROPEAN MUTANT MOUSE ARCHIVE.

Here it is clear that such structures should be developed for Europe as a whole. That's it, the spirit of Europe. But it is true that this is an evolution. We want the structures to serve and to be accepted by all Europeans. Therefore, we have to provide a level of quality, which everybody can accept. By this means we create dynamic. And then we need structures like you, like EMBO and EMBL, that lift such quality to a European dimension. The Commission wishes to work together with structures like this. And not only with a single place in one member state.

YOU MENTIONED THE DIVISION OF APPLIED RESEARCH FINANCED BY INDUSTRY, AND BASIC RESEARCH, AND THAT THIS SYSTEM DOESN'T WORK ANYMORE. BUT INDUSTRY IS

WITHDRAWING FROM BASIC RESEARCH. AN EXAMPLE IS THAT ROCHE CLOSED THE INSTITUTE OF IMMUNOLOGY IN BASEL. SO WHAT IS THE PLAN TO GET A SYNERGY OF GOVERNMENT AND INDUSTRY, HOW TO GET INDUSTRY BACK TO FINANCE BASIC RESEARCH?

The principle of basic research is that it has to be disseminated well. It has to be accessible and include well-known names. Because of this, a single company cannot be responsible for financing basic research. These efforts have to be spread. The principal role of business is to make money. I believe that the challenges of the life sciences imply an initial, collective effort. Everybody has to contribute. At a later stage of the R&D, competition will become more important in, for example, the production of a specific medication. I think competition and market together work to create the necessary dynamic. We have seen in certain types of regimes that without these two components, there is no progress.

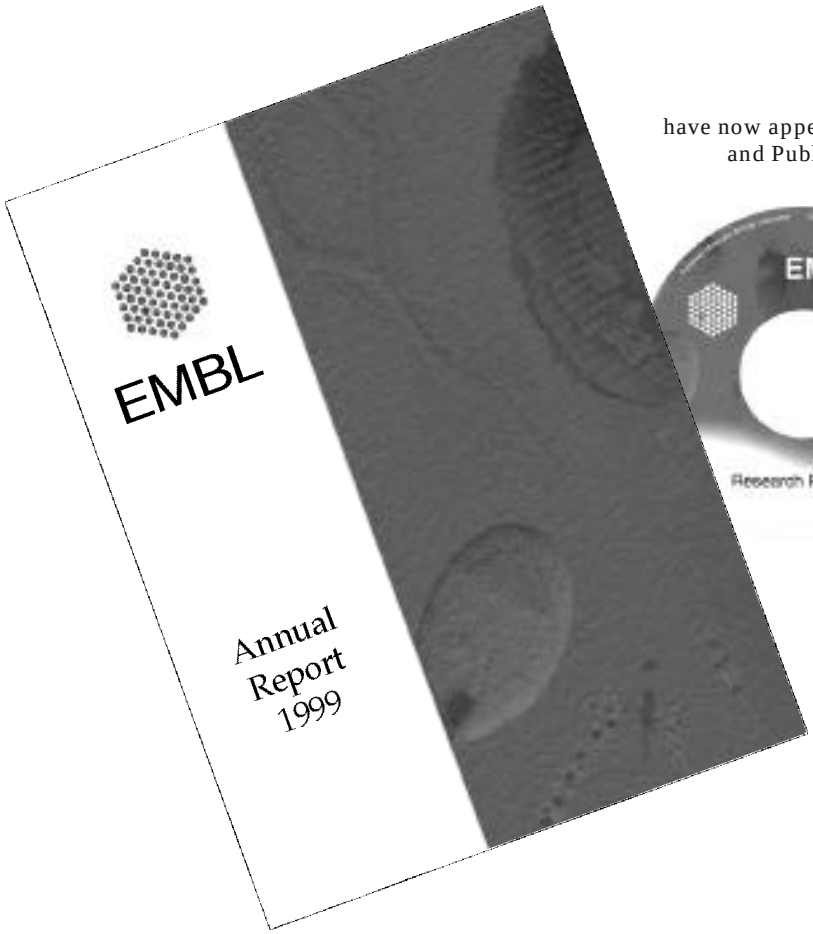
"Scientists should actively par - ticipate in society to make other citizens understand the impor - tance of research"

The balance between these two factors and how much basic research will be supported will be different for different sectors. In the life sciences, I believe that basic research will always be done. In other sectors, for example, in materials, of course, basic research still exists, but the balance can be much different. Progress in science is not the same in all areas, so research programmes will need a flexible geometry.

COMMISSIONER BUSQUIN, THANK YOU FOR THE INTERVIEW.

Translated from the French by Anka Stark.

photographs by Russ Hodge



The EMBL Annual Report and Research Reports for 1999

have now appeared and can be ordered from the Office of Information and Public Affairs (OIPA) at the Main Laboratory in Heidelberg. Contact information appears below.

The Research Reports are written by EMBL's groups for molecular biologists and contain a summary of the group's activities, a list of group members, and a literature list for the year.

The Annual Report is written and produced by the OIPA and is intended for a wider audience, including non-scientists.

EMBL *&cetera* is published by the

Office of Information and Public Affairs, EMBL, Meyerhofstrasse 1, D-69117 Heidelberg

Tel. +49 6221 387 252; fax +49 6221 387 525; e-mail: info@embl-heidelberg.de

Editor: Russ Hodge; Associate Editor: Sarah Sherwood; Design: Sarah Sherwood, Russ Hodge

Contributors: Fotis C. Kafatos, Katrin Weigmann

Printed on recycled paper by ColorDruck, Leimen

From Genes to Thoughts

Neurobiology to be the focus of a conference organized by EMBL PhD students

PhD students discuss details of the upcoming conference around the cafeteria table.

Katrin Weigmann talked to PhD students Michi Hannus, Freddy Frischknecht, Giuseppe Testa and Valentina Greco about the trials and tribulations of organizing a conference.

HOW DID THE IDEA TO ORGANIZE A STUDENT CONFERENCE COME ABOUT?

Hannus. I was in Boulder in 1995 as an exchange student; it was a tradition there that the first-year graduate students organized a scientific meeting on a subject of their choice, something of general interest. For three days, every student in the department just dropped their pipettes and joined that meeting. It was a combined effort, and people were really enthusiastic. The atmosphere was great. So we decided to try the same thing here at EMBL.

HOW DID YOU START?

Frischknecht. When organizing such a meeting, the first thing you need is support. When Ann Westerholm and I put forward the idea at a graduate committee meeting, we were met with 10 or 15 seconds of silence. Finally one committee member said it was a good idea, but advised us to keep in mind that we would be busy finishing our PhDs and so on. Then Fotis came in and said, I think it is a beautiful idea and you should do this.

Hannus. So we started with a brainstorming session and unanimously agreed on neurobiology as the topic of the meeting. Many areas in biology have neurobiological aspects: structural biology, biocomputing, development and cell biology.

Testa. And even in naming the conference we got into a very interesting discussion about the topic -- whether to call it “Of genes and thoughts”, or "From genes to thoughts". We decided on the latter because we really wanted to convey the idea of going from molecular mechanisms to more complex issues. We want to cover the whole spectrum. In fact, one nice outcome of the symposium would be to fuel a discussion about whether it would be possible to conceive an understanding of thinking in terms of molecular mechanisms.

Hannus. We wanted to create a relaxed atmosphere and hope students from EMBLwill attend all of the talks to get the whole picture. In terms of conference format, we wanted long presentations with very good introductions that everyone can follow. And the speakers should be able to interact with us later on.

Frischknecht. Big scientific conferences do not leave much room for students to have any real exchange with the speakers. The focus of our meeting is on accessibility of this to students, in an informal setting.

Testa. EMBL student have the good fortune to be able to attend many conferences and talks in-house. We wanted to do this meeting on a larger scale to attract people from outside EMBL. We have announced it all over Europe, which seems to have worked quite well.

Greco. We already have 60 registrations from outside. People will be coming from over 10 countries as far as Israel, Estonia, and Japan.

HOW DID YOU SECURE FUNDING?

Hannus. Fotis generously provided DM 10,000 from the Director General's budget to get the whole process started. After that we split the jobs up between us. Valentina and Thomas were in charge of finding sponsors.

Greco. It wasn’t easy at first. We really had to run after sponsors and sell our idea to them, though in a few cases the money came all by itself. We went through rounds of excitement and depression. The point is to use the right key word -- like mention a company’s competitor and suddenly a business supports you without any effort.

Testa. Also many of the journals expressed a general interest, though only two sponsored and advertised us. Maybe this is because we didn't have a track record. We hope that when other PhD students do it next time, this conference will have set a precedent, so companies and journals be eager to participate.

WHY ARE INITATIVES LIKE THIS ONE IMPORTANT FOR STUDENTS?

Frischknecht. Being given this opportunity goes to show how we have an exceptional atmosphere here at EMBL where students are integrated into all levels of scentific activity. Hopefully this will sow the seed for students elsewhere to do similar things -- and for professors and institutes to let them do it. It would be nice to see this as a pilot project initiated at EMBLand taken up by other institutes in Europe.

--interview by Katrin Weigmann

For more information see
http://www.EMBL-Heidelberg.DE/Conferences/PredocSymposium/