FIVE YEAR ASSESSMENT REPORT

RELATED TO THE

SPECIFIC PROGRAMME:

QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES

COVERING THE PERIOD 1995 - 1999

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June 2000
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FOR THE PROGRAMME
“QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES”.

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We, the undersigned, Five Year Assessment Panel for the Programme “Quality of Life and Management of Living Resources”, are pleased to present our report to the European Commission.

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EXECUTIVE SUMMARY

Science and technology have enormous potential for the creation of wealth for the European Community and its Member States, for contributions to the general wellbeing of EU citizens and improvement of the Quality of Life of people worldwide, and for the implementation of European policies. The European Union must ensure that it is in a position to harness and exploit its scientific and technological bases – both academic and industrial - to attain a competitive global position. A key to successful exploitation is to ensure that there is continuity between those generating new concepts and information and those in a position to use it for the creation of new products and processes. The challenge facing the EU also includes the solution of environmental problems to allow a sustainable development for the future European society.

The scope of the five-year assessment

First, the panel notes with satisfaction that the funding for the Life Sciences has risen from 831 Meuros in FP3 to 2413 Meuros in FP5. The panel finds it important that this development continues with subsequent Framework Programmes. The increasingly important role of the Life Sciences in the European economy can only be supported by sufficient research funding both nationally and through the EU.

The panel's task was to carry out an assessment of the implementation and achievements of Community RTD activities in the Life Sciences during 1994-99. This period covers part of the third, most of the fourth and the early period of the fifth Framework Programmes (FPs) of the European Union. Because of the size and complexity of the area to be evaluated, the panel focused its efforts on three major aspects. These were:

— the general performance of the funding programmes,
— how the programmes are perceived by the European Life Science community,
— how the outputs have contributed, or will contribute, to the wellbeing of the European Union.

To help the deliberation of the panel, it met with representatives of the European Commission, those responsible for public funding of research in selected Member States, the European Science Foundation and the European Medical Research Councils. In addition, the panel distributed questionnaires to 285 leading life scientists, in both academia and industry, in all EU Member States, of whom over 48% responded (see Appendix I). The panel also consulted the extensive series of evaluation reports commissioned by the Commission as well as its recent questionnaire exercise for the five-year assessment of the Framework Programmes.

The views of the academic and industrial scientific communities

The overwhelming majority of respondents to the panel's questionnaire exercise considered that the EU funding programmes do add valuable extra dimensions to the existing national schemes. These dimensions provide a strong element of the European Added Value to the Framework Programmes.
Firstly, the funding of **research networks** has established transnational collaborations that would be impossible to achieve with national funding. Secondly, the programmes, through training and fellowships for pre-doctoral and post-doctoral researchers, have increased the mobility of scientists between Member States. Thirdly, there is support of **infrastructure** and of **large-scale facilities** serving the European research community and this is considered possible only with European funding. Two laudable examples of such projects launched with support from the European Commission are the European Bioinformatics Institute (EBI) of the European Molecular Biology Laboratory and the European Mouse Mutant Archive (EMMA).

Although research funding by the EU amounts to only about 5% of the total public research funding in the Member States, the additional contribution from the EU is worth much more through the added value of European collaboration. A prime example of this was the sequencing of the first eukaryotic genome (yeast) through a project funded by the EU. Only by funding a **large network of interacting laboratories** all over Europe was this project possible with the sequencing resources available at that time. Other examples of success stories include:
- the European research which led to the development of an implanted device for paraplegics which allows them to walk again;
- the "European Atlas of Avoidable Deaths";
- research networks addressing the forestry-wood chain, renewable biomaterials and conservation methods for food.

Other aspects of the research programmes that received recognition by the academic respondents to the questionnaires were the efforts (albeit inadequate) to promote **research in regions of Europe with a comparatively minor research volume**. Scientists in both academia and industry valued the schemes to promote **young investigators** as well as, very recently especially, **women scientists**. Both these latter aspects, however, require substantial additional efforts to make a real impact.

Alongside these broadly appreciative views, there is equally widespread dissatisfaction about certain aspects of the programmes. Most importantly, there is a strong perception in the European academic research community that the EU research funding strategy is **much too heavily based on ‘top-down’ approaches**. This community believes that too little freedom is given to the researchers themselves to decide on the scientifically relevant initiatives for future directions. The industry viewpoint was more mixed and while some companies would support the view that the more fundamental research should be supported by Framework Programme funding, others believe that there should be a more applied or commercial emphasis.

This perception of rigidity is reinforced by the unnecessary **complexity of the application forms** and the instructions to applicants for making their proposals for funding. An opinion voiced by both academics and industrialists in the large Member States is that often the effort that it takes to apply for EU funding does not justify the outcome, i.e. the process is too complicated and lengthy, the success rate low and the **grants are too small**. There is also the view that EU research goals are **overambitious for the little money available**. Then there is the perception of a **lack of continuity and too short a duration** of EU funding mechanisms. For example, the abrupt discontinuation of the funding of European infrastructure (which affected the EBI and EMMA) could have been detrimental.
The evaluation procedures of EU grant proposals received considerable criticism from many quarters. There is often doubt as to the appropriate professional competence of some panel members and the procedures seem inefficient to many practising scientists. The lack of transparency of the review procedures is also disturbing. For example, the membership of the various review panels is not made public. Considerable doubt about the value of anonymity in the selection process was also expressed.

One final issue raised by the panel’s questionnaire was the problem of how to promote industrial exploitation of European research. The almost unanimous opinion of questionnaire respondents was that present EU schemes of networking between academic and industrial research are too complicated and restrictive to permit efficient outcomes. However, the growth of 'Demonstration Projects' involving both industrial and academic partners should encourage industrial exploitation of research in the longer term. More consideration should be given to technology transfer and intellectual property issues.

Conclusions for Framework Programmes 3, 4 and 5

The panel concludes that the Life Sciences research programmes of FP3 and FP4 have, particularly through the promotion of European networking and benchmarking, contributed decisively to European competitiveness. An impressive list of success stories re-enforces this conclusion. It is too early to judge the results of FP5 but the panel recommends that the momentum built up by FP3 and FP4 should be maintained into FP5 by providing the continuity required for success. The significant change towards a more problem solving approach in FP5 has led to the perception of a lack of continuity with the earlier programmes. More effort is needed to encourage the scientific communities to realise the continuities between FP4 and the Key Actions and Generic Activities of FP5.

The panel experienced difficulty in accessing information related to the outcomes of the Life Sciences research programmes of FP3 and FP4. The information does exist in the form of catalogues and meeting reports but all too often these are not well enough distributed and, in some cases, lack any index or list of contents which may help to find particular projects. The panel strongly recommends that more effort be spent on dissemination of this valuable information to the scientific community and the general public. In particular the panel suggests that greater use be made of electronic forms of dissemination.

Recommendations and suggestions for future Framework Programmes

On the basis of its evaluation of the Life Sciences research programmes of FP3 and FP4 and the first year of the Quality of Life programme in FP5, the panel makes the following recommendations and suggestions.

Recommendations on general issues

Key Actions
Keep the present distinction between policy-driven Key Actions and Generic Activities. Define the Key Actions in harmony with national programmes, i.e. in the context of the development of the European
Research Area (ERA). It must be recognised that EU funding is limited compared to national funding, therefore, Key Actions need to have clear priorities and sharp focus in the research programmes.

**Input of active research scientists**
Solicit the input of active research scientists into the formulation of the Framework Programmes, for example through the European Life Science societies.

**Cohesion**
Rethink and reshape the measures for promoting research competencies in those regions of Europe with a comparatively minor research volume (essential considering the enlargement of the European Union). While existing strengths should be funded by the Framework Programme a new instrument to develop and enhance cohesion of the scientific community should be funded from other EU programmes.

**Technology transfer**
Continue efforts to encourage and promote co-operation between industrial research and universities and public research institutions. Organise advanced training courses for research workers, technology transfer officers and patent lawyers in the biosciences throughout Europe.

**The funding process**
Make the application processes user-friendly by restructuring the web sites and application forms towards simplicity. Increase the transparency of the grant reviewing process and competencies of the review panels. Greater attention should be given to the need for continuity in EU research funding. Flexibility should be built into the next FPs to enable European research to respond to new challenges.

**European Added Value**
Framework Programme funding should contribute to European Added Value. The panel has defined its concept in the report.

**Ethical issues**
The measures for promoting the visibility and implementation of research on bioethics and for scrutinising the ethical dimension of funded research projects should be intensified in FP5 and in future FPs.

**Public understanding of the Life Sciences**
A major challenge for present and future Framework Programmes will be to encourage participation of the public in the on-going debate concerning the Life Sciences in order to promote mutual understanding of the issues involved.

**Ecological issues**
Another issue of increasing importance will be to promote the generation of concepts and technologies needed for the development of a sustainable high-tech society in harmony with existing ecosystems.

**Suggestions for the next Framework Programme**
**Euroexcellence**

Funding for generic Life Science research should be increased substantially to counteract the recent erosion of competitiveness of European research, resulting from the much greater investment in Life Sciences in other parts of the world. To maximise the return on this investment, the increased funding should be accompanied by bold new initiatives:

a) **Transnational network projects and platforms.**
   The successful programme of research network grants would be improved by a strategy that gives freedom to the researchers to define themes, size of teams and modalities of funding the selected activities. This programme could be called EUROEXCELLENCE and should aim to promote excellence in Europe by networking. It should emphasise new developments in key and emerging areas of the Life Sciences. In order to harness European strengths and to achieve critical mass, the Commission should consider the possibility of including platform proposals in the EUROEXCELLENCE programme, to be supported by block grants, and solicited from consortia of scientists defining an area for funding. Each grant should be of at least a four-year duration and be managed by the consortium and subjected to external mid-term evaluation, permitting a timely decision whether or not support will be renewed without a gap. To ensure the quality of the selection process, evaluation of the EUROEXCELLENCE network and platform proposals would best be handled by outside bodies, comprised of high quality scientists experienced in scientific evaluation, for example by European agencies designed for the purpose. The mechanism of subcontracting has to be worked out, but models already exist in the Commission. By installing this new scheme for reviewing, a clear-cut signal would be given to the Life Science community that the EUROEXCELLENCE programme strives for true innovation as well as scientific excellence.

b) **Young investigators**
   To promote excellence in the Life Sciences even further, a programme for career advancement of young researchers should be initiated, with particular consideration given to the difficulties of managing young careers and young families. These EUROEXCELLENCE CAREER AWARDS should guarantee funding for a minimum of five years in order to support a sustained research effort. They should also recognise the needs of young researchers to take short career breaks for maternity/paternity and childcare, and the special needs that transnational mobility entails.

c) **Advanced training**
   Continue funding training and mobility. A programme for EUROPEAN GRADUATE SCHOOLS should be started at Centres of Excellence in all Member States. This programme should be directed towards the encouragement and training of doctoral students in the Life Sciences to work across disciplinary boundaries.

**European research infrastructure**

Provide support for the establishment, maintenance and use of key infrastructure elements and major scientific facilities. Base the establishment of infrastructure or major facilities on real needs, quality and European Added Value. Areas requiring special attention are for example bioinformatics, DNA and protein chip technologies, proteomics, transgenic repositories, genetic databanks for agriculture, fishery and forestry, electronic publishing as well as clinical research dependent on the European dimension, for example epidemiology and health technology assessment.
<table>
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<th>Abbreviation</th>
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<tr>
<td>AIDS</td>
<td>Auto Immune Deficiency Syndrome</td>
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<tr>
<td>AIR</td>
<td>Agricultural and Agro-Industrial Research (including fisheries) (specific RTD programme of FP3)</td>
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<tr>
<td>BIOMED 1/2</td>
<td>Biomedicine and Health (specific RTD programme of FP3/4)</td>
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<tr>
<td>BIOTECH1/2</td>
<td>Biotechnology (specific RTD programme of FP3/4)</td>
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<tr>
<td>BRIDGE</td>
<td>Biotechnology Research, Innovation, Development and Growth in Europe (FP3)</td>
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<tr>
<td>BSE</td>
<td>Bovine Spongiform Encephalopathy</td>
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<tr>
<td>CAP</td>
<td>Common Agricultural Policy</td>
</tr>
<tr>
<td>CEEC</td>
<td>Central and Eastern European Countries</td>
</tr>
<tr>
<td>CEN</td>
<td>European Committee for Standardisation</td>
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<tr>
<td>CFP</td>
<td>Common Fisheries Policy</td>
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<tr>
<td>COMM</td>
<td>Communication (document from the EC)</td>
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<tr>
<td>CORDIS</td>
<td>Community Research &amp; Development Information System</td>
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<tr>
<td>CRAFT</td>
<td>Co-operative Research Action for Technology</td>
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<tr>
<td>CREST</td>
<td>Scientific and Technical Research Committee (advises the Commission)</td>
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<tr>
<td>DG</td>
<td>Directorate General</td>
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<tr>
<td>DNA</td>
<td>Deoxyribonucleic acid</td>
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<td>EAG</td>
<td>External Advisory Group</td>
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<td>EBI</td>
<td>European Bioinformatics Institute</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>EFTA</td>
<td>European Free Trade Association</td>
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<td>EGE</td>
<td>European Group on Ethics</td>
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<tr>
<td>ELSA</td>
<td>Ethical, Legal and Social Aspects (advisory group in FP4)</td>
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<td>EMBO</td>
<td>European Molecular Biology Organisation</td>
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<td>EMMA</td>
<td>European Mouse Mutant Archive</td>
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<td>EMRC</td>
<td>European Medical Research Councils</td>
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<td>EPO</td>
<td>European Patent Office</td>
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<td>ERA</td>
<td>European Research Area</td>
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<tr>
<td>ESF</td>
<td>European Science Foundation</td>
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<tr>
<td>ESPRIT</td>
<td>European Strategic Programme for Research and Development in Information Technologies (specific RTD programme of FP4)</td>
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<tr>
<td>ETAN</td>
<td>European Technology Assessment Network</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>EUR</td>
<td>European Union Report (number)</td>
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<tr>
<td>EURAGRI</td>
<td>European Agricultural Research Initiative</td>
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<tr>
<td>EUREKA</td>
<td>Framework for European Technological Co-operation</td>
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<tr>
<td>FAIR</td>
<td>Agriculture &amp; Fisheries, including Agro-Industry, Food Technologies, Forestry, Aquaculture and Rural Development (specific RTD programme of FP4)</td>
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<tr>
<td>FAO</td>
<td>Food &amp; Agricultural Organisation</td>
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<td>FP</td>
<td>Framework Programme</td>
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<tr>
<td>GAEIB</td>
<td>Group of Advisers on the Ethical Implication on Biotechnology</td>
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<tr>
<td>GM</td>
<td>Genetically Modified (foods/crops)</td>
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<tr>
<td>GMO</td>
<td>Genetically Modified Organisms</td>
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HIV - Human Immunodeficiency Virus
ICES - International Council for the Exploration of the Sea
IMT - Industrial Materials and Technologies (specific RTD programme of FP4)
INCO - International Co-operation (bursaries)
IP/IPR - Intellectual Property/ Intellectual Property Rights
IRC - Innovation Relay Centre
JOULE - Joint Opportunities for Unconventional or Long-Term Energy Supply (specific RTD programme on non-nuclear energy of FP4)
MAST - Marine Science & Technology (specific RTD programme of FP4)
MRC - Medical Research Council
OECD - Organisation for Economic Co-operation and Development
PHARE - Aid for Economic Reconstruction for Central and Eastern European Countries
QoL - Quality of Life and Management of Living Resources Programme (in FP5)
R&D - Research & Development
RTD - Research & Technical Development
SAP - Scientific Basis for Fishstock Assessments and Predictions
SFM - Sustainable Forestry Management
SME - Small and Medium Size Enterprises
SMT - Standards, Measurements and Testing (specific RTD programme of FP4)
S&T - Science & Technology
TMR - Training and Mobility of Researchers ("Fourth Activity" of FP4)
TSE - Transmissible Spongiform Encephalopathy
TSM - Technology Stimulation Measures
USPTO - US Patent Office
WTO - World Trade Organisation
1. INTRODUCTION

1.1. The Task

The panel has been entrusted with the five-year assessment of the implementation and achievements of Community RTD activities in the Life Sciences, covering the period from 1995 to 1999, as laid down in the decision on the Firth Framework Programme (1999/182/EC). Within this period the Third Framework Programme has come to an end, the Fourth Framework Programme is at its height, whereas the Fifth Framework Programme has been launched. Therefore the panel has had to consider all three Framework Programmes. The total area covered by the evaluation is great both because three Framework Programmes are included and because the activities within the Life Sciences have a large share of the total R&D efforts in the three programmes, as indicated in the following figure:

![Figure 1. FP3, 4 and 5 Activities and Budgets](image)

The panel’s work has been complicated because of the absence of a straightforward continuity through the three Framework Programmes. Therefore, the objective has not been to scrutinise a coherent and continuous research programme or research supporting system through a five-year period but rather to
take a look at a rapidly changing and growing system for supporting European research in the Life Sciences.

The work has been both helped and complicated by the many other evaluations performed or in progress. The panel has of course had access to the previous five-year evaluation but also to the annual evaluations, to evaluations of the peer review system used by the Commission, to evaluations of the whole Framework Programmes and so on. The panel's task was not to repeat what has been done in these evaluations but to use them as a basis for its work. On the other hand, the panel has studied to what extent and with what results recommendations from previous evaluations have been used by the Commission.

Because of the size and the complex nature of the area covered by the evaluation and also because of the technical restrictions on the panel's work (see Section 2) it has not been feasible for the panel to make a detailed examination of the quality and relevance of the research carried out through support from the European Union. The panel has addressed more general questions including priority setting, relevance, exploitation, continuity and renewal and the relation between European and national efforts. Furthermore, the panel has decided to look forward and concentrate its advice and recommendations on the future instead of just giving marks for past performance.

1.2. The general objectives of the EU Framework Programmes

The overall aim of the Community's Fifth Framework Programme is both to strengthen the scientific and technological excellence in Europe and to invigorate the links between high quality research and economic competitiveness and social wellbeing in Europe. The goal is basically similar to the stated aims of previous Framework Programmes. But there has been increasing emphasis on social wellbeing, especially in the Life Sciences with the concept of Quality of Life (see Section 3).

The panel is in full agreement with this general goal. But the panel must add that this broad goal makes for very many priorities, which may not be in conflict with each other but are, at the very least, in competition with each other. Thus the Fifth Framework Programme aims at supporting outstanding basic research, supporting networking, training and mobility, supporting a European infrastructure, adding to European competitiveness in industry, agriculture and fishery and with special regard to small and medium size enterprises (SMEs), furthering the exploitation of research, supporting European policy in agriculture, fishery and health, contributing to the quality of life and finally furthering public discussion, understanding and acceptance of science and technology. It is not without reason that the Fifth Framework Programme has been called the widest and most complex research programme in the world. (See the Final Report of the 1999 FP Monitoring Panel.)

1.3. Changes in the research system

The traditional boundaries between basic and applied science, university and industrial research are disappearing. Science is increasingly involved with society. This development is reflected also in research strategies aimed at attaining national technological, economic and social objectives by giving funding to universities via problem oriented research projects and programmes instead of funding basic research – even though universities are still major knowledge producers. In consequence of the so-
called new ‘social contract’ between science and society science must contribute and be transparent to society. This need for closer links and for transparency contributes to the complexity of the decision processes both at the national level and within the European Union and its bodies in implementing the European research programmes.

1.4. National and European efforts

European research is highly fragmented, contains too much duplication of activities, there is a shortage of highly qualified scientists, especially in key areas, and an ageing workforce. These challenges call for better co-operation so that national efforts and research programmes together with European Union programmes can aim to create a European Research Area. The enlargement process also challenges the European science community.

In this connection it must be borne in mind that the European Union research programmes, even if they are large by national standards, only contribute a little over 5% of the total public expenditure on research in Europe. The European funding can have a decisive influence if spent with care. But this funding must always be considered in tandem with national funding and policies. Therefore, the concepts of European Added Value and of the European Research Area are recurrent themes in the panel’s work.
2. METHODOLOGY

This five-year assessment report has been prepared by a panel of the following independent external experts:

Professor Michael William Elves, St. Albans, U.K.*
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Professor Lucien Laubier, Centre d'Océanologie de Marseille, France
Professor John Pope, Burgh St. Peter, U.K.
Professor Peter C. Scriba, University of Munich, Germany*
Professor Kai Simons, EMBL, Heidelberg, and Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany
Dr. Marja Sorsa, Director, Ministry of Education, Helsinki, Finland
Professor Renato Ugo, Assobiotech, Milan, Italy
Professor Heinrich Wohlmeyer, University of Agricultural Sciences, Vienna, Austria

Mrs. Marta Victor, Cimatec, La Spezia, Italy (Rapporteur)

The first seven panel members were appointed in September 1999 and contracts concluded in October 1999, two months later than originally planned. Due to technical problems the panel's first meeting was on November 16, 1999, again two months later than planned. Furthermore, the last two panel members (*) were only appointed in January 2000. One of these participated in the work from the third meeting on January 14, 2000, while the second participated only from the fourth meeting on February 17 and 18, 2000.

Moreover, the panel had to start the work without a rapporteur. The rapporteur's participation started with the meeting in February 2000 but a contract between the Commission and the rapporteur was only signed after the fifth meeting on March 17, 2000.

The panel held seven meetings, all in Brussels. The work of the panel, however, was carried out under a serious time pressure. The draft report was presented in mid-May and the final report in mid-June, in accordance with the original timetable.

The Commission has undertaken a large questionnaire survey concerning finished research projects form the Third and Fourth Framework Programmes. This addressed respondents from universities, public research institutes and centres, public authorities, large enterprises, SMEs and private research institutes and centres. Nearly 1700 questionnaires were sent out, with the return rate being about 21%.

The panel had access to a draft report in March, and the final report in April 2000 concerning the results of this survey. The panel took into account especially the “Summary of Results for the Specific Programme Quality of Life and Management of Living Resources”, based on 352 completed questionnaires and presented to the panel in May. There will be references to this summary as ‘the Commission’s questionnaire exercise” throughout this report.
The panel also made its own questionnaire survey. This was undertaken by E-mail and fax to top scientists and industrial companies in Europe. The questionnaire used, summaries of the answers obtained, lists of the scientists responding and return rates are reported in Appendix I. The panel will refer to the answers obtained throughout this report.

The panel made visits to France, Germany, Italy and the United Kingdom to discuss the relation between the European research programmes and national efforts with policy-makers. The panel held a meeting in Copenhagen with representatives from the EMRC (European Medical Research Councils) and the ESF (European Science Foundation). Appendix II gives a list of the persons met and of the questions discussed at these meetings.

The panel attempted to arrange a meeting with members of the European Parliament who have been involved in the work in the Parliament with both the Fourth and Fifth Framework Programme. Due to technical difficulties such a meeting could not be arranged. However, a telephone interview with a UK Member of the Parliament proved helpful.

Appendix III gives a list of the more major reports, documents, etc. made available to the panel and used in its work. The total amount of information available and provided and relevant to the work of the panel is enormous and Appendix III contains only a selected part.

The panel wants to emphasise that it has had the fullest support and help from all employees in the Research Directorate General (formerly DG XII), as well as from others at the Commission. Appendix IV lists the EC officers met, and the panel acknowledges with gratitude their contributions.

Given the immensity of this evaluation task and the time constraints, it has been difficult to achieve more than an adequate performance with this report. The panel has studied the European Technology Assessment Network (ETAN) report "Options and Limits for Assessing the Socio-Economic Impact of European RTD Programmes" from January 1999. The panel agrees with most of the conclusions in this report concerning the five-year assessment. Regrettably it has only to a very limited degree been possible for the panel to follow the recommendations therein.

The panel therefore wants to emphasise that significant gains are possible in the quality and usefulness of evaluations through the provision of better working conditions for evaluation panels.
3. OBJECTIVES, AREAS AND PRIORITIES FOR RESEARCH

The areas of the assessment are the EU research activities in the Life Sciences within Framework Programmes 3, 4, and 5 (FP3, FP4, and FP5). This five-year period, though, covers only about two-thirds of the total funding allocated to these programmes. During the period 1995-1999, research initiated in FP3 (1990-1994) came to an end, research activities funded in FP4 (1994-1998) were at a peak, while in 1999 many FP4 research projects were still in progress and the first proposals for FP5 (1998-2002) were being evaluated. There is of course factual continuity between the programmes, but there are also factual changes and no simple correspondence between areas and objectives from one programme to the next. FP5 is especially different from the previous programmes, as indicated in the next table.

FP3, Life Sciences and Technologies:

<table>
<thead>
<tr>
<th>Mio ECU / Euro</th>
<th>Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>184</td>
<td>Biotechnology (BIOTECH programme)</td>
</tr>
<tr>
<td>373</td>
<td>Agricultural and agro-industrial research (including fisheries) (AIR programme)</td>
</tr>
<tr>
<td>149</td>
<td>Biomedical and health research (BIOMED programme)</td>
</tr>
<tr>
<td>125</td>
<td>(Life Sciences and technologies for developing countries, not included in the present evaluation)</td>
</tr>
</tbody>
</table>

Source: Second European Report on S&T Indicators 1997 (EUR 17639)

FP4, Life Sciences and Technologies:

<table>
<thead>
<tr>
<th>Mio ECU / Euro</th>
<th>Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>595.5</td>
<td>Biotechnology (BIOTECH 2 programme)</td>
</tr>
<tr>
<td>374</td>
<td>Biomedicine and health (BIOMED 2 programme)</td>
</tr>
<tr>
<td>739.5</td>
<td>Agriculture and fisheries (including agro-industry, food technologies, forestry, aquaculture and rural development) (FAIR programme)</td>
</tr>
</tbody>
</table>

Source: Second European Report on S&T Indicators 1997 (EUR 17639)
FP5, Quality of Life and Management of Living Resources:

<table>
<thead>
<tr>
<th>Mio ECU / Euro</th>
<th>Key Actions / Action Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>290</td>
<td>KA1. Food, nutrition and health</td>
</tr>
<tr>
<td>300</td>
<td>KA2. Control of infectious diseases</td>
</tr>
<tr>
<td>400</td>
<td>KA3. The “cell factory”</td>
</tr>
<tr>
<td>160</td>
<td>KA4. Environment and health</td>
</tr>
<tr>
<td>520</td>
<td>KA5. Sustainable agriculture, fisheries &amp; forestry, and integrated development of rural areas including mountain areas</td>
</tr>
<tr>
<td>190</td>
<td>KA6. The ageing population and disabilities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mio ECU / Euro</th>
<th>Generic Activities – RTD of a Generic Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7. Chronic, degenerative and rare diseases</td>
</tr>
<tr>
<td></td>
<td>8. Genomes &amp; diseases of generic origin</td>
</tr>
<tr>
<td>483)</td>
<td>9. Neurosciences</td>
</tr>
<tr>
<td></td>
<td>10. Public health and health services research</td>
</tr>
<tr>
<td></td>
<td>11. Research relating to the disabled</td>
</tr>
<tr>
<td></td>
<td>12. Biomedical ethics and bioethics</td>
</tr>
<tr>
<td></td>
<td>13. Socio-economic aspects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mio ECU / Euro</th>
<th>Infrastructures</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>14. Support for research infrastructures</td>
</tr>
</tbody>
</table>

Source: Decision on the QOL Programme 1999/167/EC.

The Quality of Life Programme of FP5 covers a very wide area. Much can be said in favour of treating research within the Life Sciences as a whole. It is in agreement with the synthesis which has been the dominant force in biology during the last forty years. Even then there are important interfaces with other parts of FP5, especially within environmental research.

With such a wide area it is necessary to have clear ideas about what could and should be done, about focusing and about priority setting. It is also obvious that evaluation of such a wide area must address general problems. A detailed assessment of scientific content is clearly impossible and, if attempted, would distract attention from the important questions and problems.
In the following paragraphs the panel considers a number of general problems related to the setting of objectives and priorities. The general question on the position of EU funded research in Europe will, however, inevitably appear in many of the succeeding sections, especially Sections 5, 6, and 8.

3.1. The priorities chosen

The panel has considered the areas and priorities chosen in the various areas of the Quality of Life and Management of Living Resources Programme and the preceding programmes. Basically the panel finds that there is a reasonable continuity in programme areas and that the changes implemented in FP5 have been advantageous. The special questions relating to the top-down versus bottom-up approach are addressed in Section 4, as are the questions about the continuity or lack of continuity in funding and the problems caused by the delay in implementing the EU programmes - largely a consequence of the delay in approval of FP5 by the Council and the Parliament.

The Key Actions in FP5 display the priorities made during the definition of this programme. A number of these priorities are, however, so broadly phrased that they can only serve as vague indications about the areas of research to be covered. In other words, they allow for a very wide interpretation and do not indicate precise priorities.

3.2. The relation between the programmes and the future of the European research system

There is no clear concept of the desired and likely future shape of the European research system in the long term. However, the recent Communication from the European Commission, "Towards a European Research Area", does address this question (see below).

There are more than 600 universities in Europe and probably more than 50,000 research institutions. Several hundred thousand grants are given each year for research and the population of scientists is over 800,000 in the EU (Second European Report on S&T Indicators, 1997). The diversity is enormous.

It will therefore continue to be a national responsibility for universities, institutions and senior scientists in tenured positions to apply for and receive European grants and undertake research in cooperation with other European partners.

It is necessary to consider what the European research system will be like in 20 years’ time. How much can the changes be planned for, and what role could and should the EU and the European research programmes have in this connection?

The European Union’s FP5 accounts for only about 5.4% of the total public effort in research in Europe. It is necessary to see this expenditure in conjunction with national efforts. European Union funding has therefore, for the time being, to be ‘additional’ money. In this context it is important to stress that there is a need for continuity as well as flexibility in a research system (see Section 4.5). It is therefore necessary to be able to identify breaks and changes in programmes and understand the reasons for them. The research programmes should of course not be conservative and mere extrapolations of previous programmes. On the other hand, however, a stop-go policy must be
avoided and the possible harm to high quality research by withdrawal of resources must be taken into account. It is also necessary to consider the time scale of the European efforts. **There is a need for both a short-term view**, as that found in the individual Framework Programmes, **and for a longer-term consideration of the future of the European research system.**

The Commission paper "Towards a European Research Area" stresses the need for a European research policy. "The non-existence of a European Research Area is due to the compartmentalisation of public research systems and to the lack of co-ordination in the manner in which national and European research policies are implemented. National research policies and Union policy overlap without forming a coherent whole. If more progress is to be made a broader approach is needed than the one adopted so far. The forthcoming enlargement of the Union will only increase this need."

The Commission defines a number of aspects which must be included in the creation of a European Research Area. Among these are:

- Networking of existing centres of excellence in Europe and the creation of virtual centres through the use of new interactive communication tools.
- Defining a European approach to research infrastructures.
- A common approach to the needs and means of financing large research facilities in Europe.
- More co-ordinated implementation of national and European research programmes.
- Closer relations between European organisations for scientific and technological co-operation.
- More abundant and more mobile resources:
  - Greater mobility of researchers and introduction of a European dimension to scientific careers.
  - More prominence to the place and role of women in research.
  - Stimulating young people's taste for research and careers in science.
- Promotion of common social and ethical values in scientific and technological matters.

It is natural to consider the Quality of Life and Management of Living Resources Programme and the preceding programmes within Life Sciences in this context.

**3.3. The balance between contributions aimed at improving the quality of life and contributions aimed at improving European competitiveness**

In FP3 and FP4 the main focus of the research in the Life Sciences was on contributions to improve European competitiveness. In FP5 the focus was changed to include contributions aimed at furthering the quality of life, and at the same time emphasis was placed on a more problem solving approach. The Quality of Life and Management of Living Resources Programme has two aims: to further the quality of life by contributions to European policies in various fields (see Sections 8, 9, 10) and to contribute to European competitiveness, profitability and wealth creation. The contributions to European policies are the deliverables from the research system, an output issue. The contributions towards increased competitiveness involve a strengthening of the science base and furthering the exploitation of the research base and the research results. This is an internal issue. When setting priorities it is necessary to have both aims in mind.
3.4. Values

The development within Life Sciences has been very fast in the last forty years. The possibilities and consequences of this development are far-reaching and to a large extent unpredictable. It is therefore all the more important that the general public understand, participate in and influence debates and can therefore accept the development. The panel therefore wants to stress the importance of values, ethical perspectives, and social and ecological issues (see Sections 10, 13 and 14). Promotion of women in science (see Section 12) and the problems involving the younger generation must also be taken into account, and all in a mainstream manner.

There is a need for value discussions in the scientific community and between this community and society as a whole. There is a need for technology assessments. Openness in funding and transparency of work is an important part of good scientific practice and also necessary in gaining the required confidence of the general public. The public perception of research is decisive for the success of the research effort and for the use of research as a major force in the future of Europe (see Section 14). Public perception of science has seemed to become more equivocal through the latter half of the last century, as revealed by the four Eurobarometer studies on Biotechnology, and there is a crucial need to engender a new consensus in favour of scientific development which must underpin any future prosperity for Europe.

3.5. Cost-effectiveness

There will always be limited resources when compared with the possibilities for research and the demands for research results. The methods for measuring the profitability of investments in research are not precise. There is no doubt that research is a generally profitable endeavour for society. But that does not imply that all research is equally valuable and profitable. Timeliness is also considered to be a crucial factor. There is no doubt about the importance of research for economic development and improvements in the quality of life. But the connection is not simple. There are examples where research results are put to use immediately, but there can also be a long time lag before their use or exploitation. Some research produces the desired results within months or a few years, whereas in other areas, for example in forestry research and in climatology, the time scale may be decades.

When considering the use of research and the ensuing contribution to economic development it is also necessary to include the long-term costs of modern development (see Section 10).

Cost-effectiveness must always be taken into account when setting priorities. When research can have a direct influence on costs in other areas, the impact of costs must be included in the considerations. For example, in medicine, cost has a bearing on problems involving the ageing population, vaccines, and infectious diseases, with the trend now towards prevention rather than treatment.

3.6. The methods for priority setting

Although the areas and priorities are stated in the programmes and sub-programmes, the process leading to them is not completely clear, well described and systematic. No specific arguments are given...
for the exclusion of certain areas, although this must be extremely important in, for example, health science.

Proposals for programmes are put forward by the European Commission after a long period of consultation with the Member States’ representatives and external partners from both the private and public sector in Europe, using the results of evaluations of previous programmes and other material. The process is not very transparent. The inputs should be clearly defined and the decisions taken explicitly formulated.

The panel believes it is important that the best professional scientists in Europe should have a stronger role in the formulation of Framework Programmes. This process should involve the European scientific societies.

All proposals from the Commission are debated in the CREST and decided with the European Council and taking into account advice from the European Parliament.

3.7. Conclusions and recommendations

The panel finds that the objectives aim to cover too wide an area, due partly to the methods used for priority setting. The objectives are not the result of a clear European research policy but more of a series of political compromises. Of course, many of the priorities chosen are relevant to Europe, but they are not equally relevant with regard to European Added Value and European competitiveness. The panel finds that the present programme on the Quality of Life and Management of Living Resources is too complicated. For this and other reasons it may be worthwhile to consider simplifying the QoL Programme in future. The panel also wants to stress that it is important to solicit the input of the best professional scientists in the formulation of future Framework Programmes. The panel proposes that the European scientific societies within the Life Sciences be used to provide this input.
4. MEANS AND MEASURES

In research policy and in implementation of research policy as elsewhere it is not enough to have objectives. Tools, methods or means are important because objectives cannot be met without proper means and also because they may have unforeseen consequences.

A key question is how to get the best European scientists to apply and get funded with the best proposals. This is not only, or even mainly, a question of the general objectives of the research programmes but to a very large degree a question of the management or the means and measures used in implementing the programmes. It is also dependent on clear and easily understandable definitions and programmes and on simple, efficient and transparent procedures for application, evaluation of applications, and contract conclusions.

4.1. Top-down versus bottom-up approaches

An important issue is how to balance the top-down and bottom-up approaches in defining and implementing the programmes. The tendency over the five-year period going from FP3 through FP4 to FP5 has been for an increasing proportion of the funding to be directed towards problem solving. The areas to be supported are defined by the Commission and the Member States after wide consultation (including with scientists) and the scientists have to follow the directives from the top to be considered for funding. The share of generic research in the funding has been decreasing. In FP5 the Key Actions account for 77% of the funding in the Life Sciences.

This trend is the opposite of the research strategy followed by the US government. Federal funding in the Life Sciences is given mostly to boost research. In the USA there is a strong confidence that federal funding of basic research alone produces a knowledge base that will inevitably be exploited by commercial ventures. A recent analysis found that the enormous federal and industrial investment in basic research acts as a spur to US economic growth. (America’s Basic Research. Prosperity through Discovery, Committee for Economic Development, USA, 1998).

Evaluation of FP3, FP4 and FP5 must take this development in the USA into consideration. It must also be borne in mind that more stringent quality criteria can be applied with a bottom-up than with a top-down approach. When the scientists have decided for themselves what the important research topics are there is no reason to include other criteria besides scientific value in the evaluation of proposals. When the research topics are set from above there is a pressure to spend the funds in the selected areas, a pressure which may weaken the claim for quality.

Currently in Europe there seems to be an undue preoccupation with the need to be able to justify the expenditure on EU research programmes in terms of short-term benefits to society. This has led to the policy that EU funded research should to a large degree be directed towards applications. The sequence of events from basic research to useful applications including commercial applications, cannot be prescribed however. Sometimes basic research and applications develop simultaneously; sometimes practical outcomes arise unpredictably from the advances in the knowledge base, also an interactive process between fundamental research, technological development and applied research and development. What is obvious is that the whole S&T enterprise is dependent on advances in basic
research and that successful exploitation of the knowledge base requires efficient mechanisms for transfer of knowledge. If the balance in funding is skewed too much towards top-down approaches, the danger is that the expertise of the scientific community cannot be harnessed to generate the next generation of ideas and products.

The specific programme The Quality of Life and Management of Living Resources in FP5 with which the panel is concerned covers an extremely wide area (see Section 1.2). Obviously some of these aims can only be achieved through a problem solving and at least a partly top-down approach whereas other aims can best be achieved through the bottom-up approach. Furthermore, it must be realised that many areas in basic research are dependent on long-term support.

The conclusion must be that both approaches should be used but in different parts of the programme. The wide area of the programme implies that a single and simple set of means and measures cannot be applied but that means and measures will have to be considered in connection with the special objectives of the many different areas in the programme. But the bottom-up approach must be dominant in the areas aiming at supporting the European knowledge base. Support must be available for proposals of a very high quality, and this possibility must not be hindered by too narrow definitions of scientific areas.

The panel wants to add that there is overwhelming support for an increased emphasis on the bottom-up approach both in the answers to the panel’s questionnaires and in views expressed during interviews (see Appendix I and Section 3.7).

4.2. The tools

Currently the EU’s two main tools for all programmes in general are ‘Concerted Action’ and ‘Shared Costs’. Within the Quality of Life Programme the shared cost approach is the main tool.

There are also lower level tools including stipends, grants for networks, travelling, instrumentation, running expenses, salaries, etc. To some extent the grants from the EU are given as block grants, but the support is partly earmarked and given on the basis of detailed budgets. The panel wants to recommend the use of block grants, but allowing for a great deal of flexibility in their use. Scientists are generally very clever at getting value for money if they can decide for themselves how to spend it.

The EU funding is often seen as ‘additional’ money given to existing research groups and institutions (but in the UK EU research grants to government research institutions are supplanting national grants (see Section 5.2)). The panel will come back to the ensuing consequences in Section 5. But in a discussion of tools the size of grants must also be considered. There is a general consensus among European scientists and companies that there is a basic discrepancy between the investment required in producing an application and the size of the grant, particularly as the application may or may not result in a grant. It is difficult to get the best scientists to apply if the grants are small and it is difficult to evaluate the results of the support if the grants are small compared with the national and maybe other

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1 For the proposals received for the first deadline of the first call of the QoL programme, 89% of the 307 projects funded was the shared cost type, 5% was concerted actions, others were demonstration projects, thematic networks, etc.
international support to the research groups. This again calls for substantial block grants as a major tool. The Commission's questionnaire exercise provides the information that the average number of people recruited for a project is as low as 2.69. Again, many of the respondents mentioned insufficient funding as a major obstacle to progress.

4.3. Networks, stipends and mobility support

The Framework Programmes have had an important role in building up European networks in research and between public science and private enterprises. The importance of networks and the success in creating networks is stressed again and again in evaluations and questionnaires. The Commission's questionnaire exercise indicates that knowledge and network goals dominate over strategic management and exploitation goals. It also indicates that 50% of respondents expect to begin new collaborations with the same partners. Networks give rise to a creativity which is impossible to achieve within a single research group. Nowadays, research methodologies are more complex and added value is brought about through networks as there is a need to distribute the various tasks and to combine the different skills. All these skills are almost never available in one Member State. That is why networking across national borders is so useful. In the past, the best scientists generally assumed that they could do their work without getting involved in collaboration. Now they realise that they do need help. This represents an enormous change. Furthermore, the networks have already been, and continue to be very important in building up a European research community. Networks are discussed again in Section 8.4.

Awards for young scientists and grants to increase mobility within Europe also receive very positive recommendations in evaluations and questionnaires. Again these forms of support are contributing very positively in strengthening the European research community.

The panel therefore wants to stress that networking, awards, and grants to increase mobility (including Returning Fellowship grants) are some of the most important tools in the EU research programmes.

The panel also wants to emphasise that it is especially important to further the careers of young scientists in Europe. The opportunities for the best young scientists are currently much better in the USA than in Europe, where it is difficult for the young to get tenured positions and to establish their own research groups. It is recommended that there should be a systematic effort to follow up the careers of post-graduate and post-doctoral scientists trained in EU projects. There may be a problem of a brain drain within and from Europe, especially from the less advantaged regions.

4.4. Evaluation procedures in the selection of project proposals

The evaluation of the submitted project proposals is an important issue. The Commission has made an impressive effort to establish fair and blameless procedures for the evaluation of many thousands of applications received. Nevertheless the procedures are under criticism in the answers to the panel’s questionnaires and in the meetings the panel have had with external bodies (see Appendices I and II).

One of the problems is that the proposals are not sent out to reviewers but the reviewers go to Brussels for the evaluation. There are (supposedly) reasons of confidentiality for this procedure. However, since
funding organisations, both public and private, all over the world are distributing proposals to reviewers, it is difficult to understand why the European Commission should use practices which make it difficult for reviewers to use ancillary information that they can access more easily in their home bases.

A second problem is the composition of the evaluation panels. There seems to be a lack of real expertise in many of the areas being evaluated. For FP5 a call for applications for membership of evaluation panels was published and only those who sent back the completed application form were considered for participation. Many of the most qualified scientists did not care to answer. Yet it is absolutely essential for the quality and reputation of the EU programmes that the refereeing procedure involves the best scientists available in Europe and abroad and that this fact is well known.

A third problem is that the scientific content of the proposals is reviewed anonymously, so that the identity of each applicant is unknown to the referee. This is also contrary to accepted practice in most other funding agencies. In many cases not only is the anonymity more apparent than real but it prevents the use of ‘past performance’ as an evaluation criteria. The use of this in evaluations can inhibit new ideas and approaches for young scientists. On the other hand experience indicates that past performance is an extremely valuable criterion in evaluation of proposals from established scientists. So a procedure which excludes completely the use of past performance is problematic.

A fourth problem is that much effort is devoted to ‘weeding out’ proposals of obviously low quality. Increased use of ‘declarations of interest’ and a pre-screening procedure could alleviate this problem.

The Commission has not yet found robust procedures for the evaluation process. It may not be able to find an optimal solution with the staff available in Brussels for the Quality of Life Programme (and other programmes). Therefore, alternatives should be considered, for example, the reviewing of proposals in generic research could be sub-contracted to independent agencies in the Member States and to other European agencies. The mechanisms of sub-contracting have to be worked out but evaluation models already exist in the Commission.

Another or additional possibility would be to draw directly on the European scientific community through its scientific societies. Each European society for a given field (endocrinology, biochemistry, etc. as relevant for the QoL programme) could elect scientists for evaluation panels from its membership. For practical purposes this could take place, for example, at annual meetings. The scientists elected could, upon request from the EC, serve as referees for applications. Their written evaluations could be used in decision procedures for funding.

4.5. EU funding: instructions, application procedures, implementation, the need for continuity

The outcomes of previous evaluations and the panel’s questionnaires and meetings indicate that there are problems in the implementation of the Quality of Life Programme and preceding programmes. There needs to be more flexibility at the various stages of the process, including the call for proposals, the refereeing, the decision process and the execution of the research.
Among the problems mentioned are the difficult application procedures (the present guidelines for applicants comprise 86 pages), the long decision process, the long time before contracts are approved, and delayed payments. The problems caused by delayed payments are sometimes solved nationally because host institutions are able to underwrite the necessary money. But delayed payments can be a serious barrier to participation, both for small institutions in countries with rules which do not allow for extending money in advance, and for SMEs. The Commission’s questionnaire exercise indicates that 25% of respondents have experienced problems with delayed payments.

The instructions for applying are often perceived as difficult to understand. Courses have to be given nationally so that the scientists know what to do. The application forms are cumbersome and could be simplified. In general, the perception is that applying for an EU grant is much more difficult and time-consuming than applying for other grants. The Commission’s questionnaire exercise similarly reported that the majority of the respondents find the procedures for making an application for research funding difficult, slow and costly.

The demand for matching national funds also adds to the difficulties.

Research, especially basic research strengthening the knowledge base, depends on continuity, flexibility and renewal. If there is too much continuity there will be no room for new ideas and the young generation of scientists. However, complete lack of continuity can have damaging effects as well. A stop-go policy can be detrimental to a research system.

The EU programmes have a problem because of a lack of continuity. Of course scientific priorities must change with time, and the main priorities must also be decided by the responsible bodies, that is, the Commission, the Council and the European Parliament. But when these bodies decide on changes they should include the need for continuity in their considerations. There is also a need for planning ahead for a period that is longer than that of a Framework Programme.

There is no continuous funding from year to year in the European research programmes. The project grants are given on a short-term basis. Even if a research group continues to get support from the EU from one Framework Programme to the next, there will be periods without support. The research group can only survive at the expense of national funding, because national institutions and grant givers take on the continuity. Even then gaps in EU funding can lead to dismissal of key personnel followed by problems in hiring new people.

With a stop-go policy and with a lack of long-term support there is a limit to how much influence the EU can achieve through its research programmes. And there is a limit to how attractive EU grants are.

The panel is not suggesting, of course, that research groups should get guarantees for continuous support for the rest of their lives. Even the very best research groups must accept and do accept that they have to obtain a substantial part of their funding through competition and that they can lose from this. But the research groups need to know that the competitions will continue and will take place at the prescribed times. If the competitions are cancelled at short notice or are seriously delayed, then the research groups have difficulties. It is not a healthy research system if scientists do not know from one month to the next whether there will be money available for salaries and other costs.
It has to be added, however, that there is a lack of continuity in the funding policies of some of the Member States as well. There are examples where research groups can obtain grants for only one year and their working conditions are, therefore, unstable.

4.6. Infrastructure and large-scale facilities

European research in the Life Sciences is dependent on a strong infrastructure. Most of the infrastructure is provided nationally, but there is a need for European solutions in key areas.

The panel wishes to emphasise here the importance of bioinformatics. The European Bioinformatics Institute (EBI) in Cambridge is of vital importance. The Institute received a significant level of support from FP4. The panel understands that there have been serious problems in providing a continuous funding for the operation of this Institute, at least for the time being.

The European Mouse Mutant Archive (EMMA) was also established with support from FP4. Here again the operating cost problems seem to have been resolved recently. EMMA is a good example of a European solution to infrastructure needs.

There will be additional demands for European depositories in many areas, among these transgenic species. There is a need for European solutions in the field of biochips, DNA and protein array technology, gene banks for natural varieties, and to secure biological diversity.

The rapidly evolving field of electronic publishing also calls for common European efforts and solutions.

It is important for Europe not to become totally dependent on the USA in these key areas.

The demands for large-scale facilities in the Life Sciences are generally not as large and obvious as in other scientific fields. Nevertheless there are needs, for example, for access to synchrotron radiation, and it makes sense to meet these needs at the European level. European initiatives should also be considered in emerging areas such as stem cell research and tissue engineering while a lot of work remains to be done on the sequencing of bacterial, parasite and animal genomes.

How European infrastructure should be funded is a problem that has to be solved in a more robust and transparent way than has been the case so far. It is obvious that the EU support should be an important component of the funding. The FP5 scheme that defines European Added Value by providing travel funds for selected large capital facilities makes little sense. There should be real funding of the facilities as well. One way would be to devise business plans for each facility that applies for funding. Funding of facilities should be based on real European need and on quality. The funding should include a scheme for EU, national and other funding. Where possible, the scheme should include a plan for customer-based remuneration for services. Naturally, services such as bioinformatics or the Internet have to be without charge for the user. The principle should be that EU funding is terminated once there is no longer a need for it, either because the facility is paying for its services through its customers or because the service is no longer needed on a European scale.
Without public funding of infrastructures they would either not exist or individual scientists and research groups would have to pay for their use. This may be a long-term solution, but it could involve increased bureaucracy. Past experience demonstrates that efficient infrastructures in the areas mentioned above are dependent on public support. An additional and important reason for public support is that it allows for transparency of research and research results (see Section 14).

4.7. Follow-up and accountability

The follow-up of a programme and of project grants is important. Although there is a routine for annual and final reports, etc. site visits is a neglected area. Given their relatively very limited numbers, the Commission staff (highly qualified) is already overworked and lacks the time necessary for a proper follow-up. And it is demoralising for scientists if they get the (false) impression that reports are not read and used. The follow-up also provides very valuable information about the efficiency of the tools used in the programme.

The present efforts for combining follow-up procedures with procedures for dissemination of research results, to encourage scientists to write reports aimed at a wider audience, and to use the reports in a way that attracts a wide readership, should be strengthened.

Accountability is important both for those receiving grants and for those deciding on, and administering research programmes. Follow-up and evaluations are therefore important. The Commission’s efforts in evaluation of its research programmes are commendable, but that is not to say that procedures here cannot be improved. Good evaluations depend on clear definitions and objectives.

4.8. Conclusions and recommendations

It is important to maintain the present distinction between policy-driven Key Actions and Generic Research. The Key Actions must be defined in accordance with national programmes, i.e. in the context of the development of the European Research Area (ERA). EU funding should be considered together with national funding in each country.

Funding for generic Life Science research must be increased substantially within the next Framework Programme. One way to proceed would be to design a strategy that gives freedom to the researchers to define themes, size of teams and methods of funding. The panel suggests that this part of the Framework Programme be called EUROEXCELLENCE. The aim should be to promote excellence in Europe by networking and competition for quality, and it should encompass new developments in key and emerging areas of the Life Sciences. In order to harness European strengths and to achieve critical mass, the Commission should consider the possibility of including in the EUROEXCELLENCE programme platform proposals, to be supported by substantial block grants, and solicited from consortia of scientists defining an area for funding. The grants, which should be of at least a four-year duration, would be managed by the consortium and subjected to external mid-term evaluation. To ensure the quality of the selection process, evaluation of the EUROEXCELLENCE network and platform proposals would be best handled by outside bodies comprised of highly qualified scientists, for example, by European
agencies designed for the purpose. The mechanism of sub-contracting has to be worked out, but models already exist in the Commission. By installing this new scheme for reviewing, a clear signal would be given to the life science community that the EUROEXCELLENCE programme strives for true innovation as well as scientific excellence.

Such an initiative could run in parallel with similar national programmes. It will be valuable to encourage the same form of thinking both nationally and at the EU level.

To promote excellence in the Life Sciences even further, a part of the next Framework Programme should be aimed at career advancement of young researchers, with particular consideration given to the difficulties of young scientists in managing careers and families. EUROEXCELLENCE CAREER AWARDS should be distributed through this part of the Framework Programme, guaranteeing funding for a minimum of five years in order to support a sustained research effort. The awards given should include recognition of the needs of young researchers to take short career breaks for maternity/paternity and childcare.

The next Framework Programme must continue to fund training and mobility. A programme for EUROPEAN GRADUATE SCHOOLS should be started at Centres of Excellence in all Member States. This programme should be directed towards the encouragement and training of doctoral students in the Life Sciences to work across interdisciplinary boundaries.

The next Framework Programme must provide support for the establishment, maintenance and especially use of key infrastructure elements and major scientific facilities. The establishment and support of infrastructure or major facilities must be based on real needs, high quality and European Added Value. Areas requiring special attention are, for example, bioinformatics, DNA and protein chip technologies, proteomics, transgenic and other biological repositories, genetic databanks for agriculture, fishery, forestry, also research in health technology assessment, electronic publishing and access to information in electronic form.

The funding application processes must be made more user-friendly by restructuring the web sites and application forms with the aim of simplicity, and by increasing the transparency of the grant reviewing process. The expertise of the review panels is of the outmost importance.

It is necessary to pay greater attention to the need for continuity in EU funding.

At the same time it is necessary to allow for more flexibility and to facilitate new initiatives within the frames provided by the Framework Programmes.
5. COMPLEMENTARITY OF EUROPEAN AND NATIONAL EFFORTS

5.1. Background

The need for close co-ordination between Community and Member States’ research policies first appears in the Single European Act, 1987, as one of the Articles included in the new title on Research and Technological Development (RTD), and is confirmed more recently in article 130h of the Maastricht Treaty (replaced by Article 165 of the Treaty of Amsterdam). The European Council conclusions adopted in June 1995 decided that implementation of close co-ordination should involve a two-step procedure:

(a) exchange of information on Members States’ national research policies and Commission policy in ad hoc advisory groups constituted at the level of the specific programme committees for thematic areas, between Members States and EFTA countries’ representatives;
(b) strategic analysis on research and technology within the CREST.

The procedure was defined in detail by the General Director for DG XII at the end of 1995, and implementation started within a number of programme committees by the end of this year.

The different Programme Committees for the Biotechnology, Biomedicine and Health, and Agriculture and Fisheries specific programmes of FP4 progressively set up the ad hoc advisory groups for co-ordination. Following the conclusions of these groups, several initiatives were taken or strengthened by the Commission. One result of this was, for example, the FAIR ad hoc advisory committee's report on Member States’ RTD activities in the field of Food Safety, Diet and Health (EUR 18493). Other examples are the "Survey on the Current Status of 'Genomes' Research in the European Union" (EUR 18593) from the ad hoc advisory group for the Biomedicine and Health Programme and the report on protein engineering R&D programmes in Europe: "Co-ordination of Structural Biology in Europe: National, EC and Industry Joint Efforts". This was published in 1997 by the Co-ordination Group of the EC Biotechnology Programme Committee in association with the National Programme Managers and other bodies.

During this period, the panel is not aware of any changes in national policies of the Member States following the discussions of the ad hoc groups.

At the end of 1998 a 'synergy ad hoc group' was set up by the Quality of Life Programme Committee following the CREST conclusions, which recognised the usefulness of the work of the FP4 ad hoc committees on co-ordination of RTD policies and recommended the continuation of the exercise. This was for an initial period of one year, starting in June 1999. The objective of this ad hoc group is "to produce an authoritative report containing clear and realistic recommendations for improved co-ordination and making clear who is expected to follow them up". From a draft version of the report of the synergy group to the Quality of Life Programme Committee, responses from policy makers in the Member States to a questionnaire indicate a definite trend towards a need for co-ordination to address questions such as sustainability, clinical and epidemiological studies and infrastructures.
5.2. Conclusions and recommendations

The material studied by the panel indicates that co-ordination between EU and Member States' RTD programmes has been considered in very different ways within the three major fields of research of the Quality of Life and Management of Living Resources Programme. Within agriculture, agro-industry and fishery, there has previously been a lack of interest in improving the co-ordination between the EU programmes and the related national programmes and only a wish for exchange of information. This situation could be due to the importance of the two European policies, the Common Agricultural Policy and the Common Fisheries Policy, in the determination of both EU and national RTD programmes. These policies may well be sufficient in themselves to achieve a good co-ordination between EU and national RTD programmes which have the same priorities. More recently, in any case, interest in co-ordination has increased.

In contrast, in an innovative field such as biotechnology, there is a strong willingness on the part of the Commission to receive as much information as possible on Member States’ national programmes, with the purpose of achieving an efficient co-ordination between EU and Member States’ RTD efforts. The worldwide competition occurring in this field underlines the trend. In this specific programme, important work achieved by the Commission services has greatly developed the European coherence in biotechnology.

The specific programme Biomedicine and Health offers an intermediate situation. Monitoring panels have been sufficiently interested in a reasonably clear definition of the concept of European Added Value to perform a large inquiry at the level of project leaders (bottom-up approach).

There is in the various reports a great deal of discussion about the risk of duplication. This risk may be exaggerated. The research system, through the publication system, informal networks, conferences, etc., is quite able to avoid unnecessary duplication. Moreover, some duplication and competition is a valuable part of science. Since EU expenditure is only 5.4% of national governments’ public research expenditure EU projects normally only add support to work already under way in the partners’ laboratories.

The panel recognises that Commission decisions about which scientific field to support are largely taken without full knowledge of the actions of the Member States. An appropriate exchange of information seems to be the best response. The exchange of information on EU and Member States’ RTD programmes should become a reality in all fields of research, and result in the publication of scientific and technological audits and analyses of what is going on within the EU and the Member States.

There are many recommendations about the establishment of databases containing lists of projects, etc. Databases may be useful but it is not easy to keep them updated and, before too much effort is spent on databases, there should be a better understanding of how they can be used and who the customers for databases are.

Before too much co-ordination is attempted there is a need for a better understanding of the role of EU research programmes. This discussion must address the problems following from the fact that EU
funding is 5.4% of national governments’ funding of research. In most cases and in most Member Countries EU support is ‘additional’ money (although in the UK EU research grants to government research institutions are supplanting national grants (see Section 4.2)). There is a certain lack of continuity in EU funding (see Section 4.5). There is also a need for a better understanding of what European Added Value is (see Section 6).

It is important that transboundary issues, for example within agriculture, forestry, fisheries and healthcare, are addressed in the European research programmes within the Life Sciences.

In order to give better possibilities for flexibility, for initiating research at short notice (for example in emergency situations (such as BSE or chemical catastrophes)) and for co-operation without long time delays, the panel suggests that both in EU and in national programmes a small part of the resources (say 10%) should be reserved for co-operation between research teams working in the same new and important areas. Such a reciprocal mechanism could contribute to establish strong links at the scientific level, and promote co-operation also at the strategic level of policy-makers.

It must be added as a final comment that co-ordination and co-operation is not only a question of the formulation and implementation of European programmes but also of using the European policies as a basis for formulation of national policies. There can be big advantages for the Member States in using this input. Co-ordination can only be accomplished if there is a common need and if all partners have a real interest. Efficient co-ordination depends to a very large degree on efforts in the Member States. Co-ordination is difficult, moreover, because of different timetables, different institutional structures, different budget systems and different objectives.
6. EUROPEAN ADDED VALUE

6.1. Background

The importance of the concept of European Added Value for assessing the Framework Programme has been clearly recognised in the five-year assessment of the European Community RTD Framework Programmes report by the independent expert panel chaired by Viscount E. Davignon (EUR 17644) published early in 1997. That panel claimed that, together with "relevance", "European Added Value" should be the touchstone for selecting programmes and projects in future EU Framework Programmes. This criterion stems directly from the subsidiarity principle under which those activities that should be sponsored solely within Member States are clearly distinguished from those which should be funded at the European level. (UK presidency, second half of 1992.) Thus EU funding must add value to the efforts of the Member States.

The Davignon Report suggests that European Added Value be demonstrated by the following:

- The provision of important large-scale facilities which no individual Member State alone could develop and sustain;
- The co-ordination of the use of scarce nationally owned large resources, such as research vessels, to optimise their value;
- The promotion of internationally competitive R&D communities in new interdisciplinary areas such as information technology and biotechnology;
- The creation of strong European industrial platforms based on common technical standards able to compete or co-operate at a global level, for example in the field of mobile telecommunications;
- The development of pan-European norms and standards for commercial applications.

In addition to these features the European Union also has an obligation to ensure research to support European-wide policies in areas such as the environment, transport, agriculture, fisheries and communications infrastructure and to achieve research in specific areas such as Euratom.

The Davignon Report also emphasised that the primary instrument for adding European value is the European scientific community, which can be developed and sustained by:

- Ensuring support for European science and developing its existing strengths rather than attempting to correct or compensate for weaknesses;
- Encouraging the scientific community to work closely with users of science and technology outputs to exploit the fruits of research;
• Recognising that European critical mass can often be achieved in areas where no single Member State can mount a major effort.

The Davignon Report must be the reference paper for the analysis of the European Added Value concept and its practical implications.

However, it is difficult to decide how to take these criteria for European Added Value into account in assessing any given specific programme.

The assessment of the success of the European Community’s RTD programmes in achieving a European critical mass in science and technology is particularly problematical. In the major EU Member States there already exist research institutions, groups of scientists and research programmes of such a size and standing that they compare well with what can be created through the EU efforts. The real added value of EU programmes is that they bring scientists and research groups together from a number of Member States and in this way can create something new and qualitatively better. Thus one way that a European critical mass and, consequently, European Added Value can be achieved is through the development of and support for networks.

The panel also wants to stress the importance of encouraging young European researchers to gain experience and build their expertise through training fellowships and other measures designed to encourage their mobility and enhance their experience of the European scientific culture.

The EU Framework Research Programmes are addressed to the 15 Member States but in practice a smaller number of Member States participates in most of the individual RTD shared actions. In the case of the Life Sciences the number of Member States participating in individual projects ranges from two to five and there is no trend towards any increase in these numbers (see Figure 6.1).

Figure 6.1. Number of Member States Participating in Projects
6.2. European Added Value in FP5

The need for European Added Value was included in the evaluation and selection procedures of the FP5 specific programmes. The Quality of Life and Management of Living Resources, Guide for Proposers, Part 1, page 8, Programme Strategy makes the following statement:

"European Added Value. This will be achieved by addressing specific cross-border challenges, such as improving health and managing and exploiting renewable natural resources. Themes such as drug abuse, biosafety, bioethics and issues related to agriculture, forestry and fisheries should reinforce the scientific base in support of Community policies. Indeed many of the activities addressed in the programme, such as genomic research, neurosciences, infectious diseases, sustainable management and utilisation of forestry resources, fish management and human, animal and plant diseases, due to their size and complexity, are more meaningful if they are addressed at the European level."

6.3. Agriculture and Fisheries – FP4

The first discussion of the European Added Value concept appears in the external monitoring report for 1997. The comments of the Commission services on the report do not clarify the matter: even the wording "European Added Value" is lacking.

In the five-year assessment of the specific programme Agriculture, Fisheries, Forestry and Agro-Industry (Report EUR 17593) there is no specific mention of European Added Value, even though the report covers the period 1991-1996 and thus includes part of FP4. Nevertheless, the report underlines the evidence of increasing co-operation and networking among scientists and institutions in the European Union, and the growth of a genuine 'European mentality' which this is creating.

6.4. Biotechnology – FP4

As could be expected from the monitoring reports, the question of European Added Value is discussed extensively in the five-year assessment of the specific programme Biotechnology, covering the period 1991-1996 (Report EUR 17591). European Added Value is best demonstrated by projects that could not be performed without European transnational co-operation. Such added value is obvious in larger projects such as genome sequencing or industry platforms. In smaller projects, the strongest indicator of added value is inter-dependence of the project participants, demonstrated by joint publications.

6.5. Biomedicine – FP4

The external monitoring report for 1996 states that "the second call has attracted a high proportion of proposals for specific measures and support activities with a considerable dimension and European Added Value". This probably means that the proposals included large numbers of teams from different countries.

The external monitoring report for 1997 contains a short comment on European Added Value as such:
"The Panel has identified top-ranked proposals within the Third Call in which the principles of European Added Value and European dimension were perfectly met, due to the high degree of intellectual and experimental complementarity with which the goals of the project are pursued by participants of different Member States. However, the Panel agrees that the concept of European Added Value is difficult to define formally".

The panel suggests that "more guidance to review panels and applicants could be provided on interpretation and/or weighting of European Added Value".

Probably because of the comments above the panel for the external monitoring in 1998 decided to conduct a survey to establish the level of perception of European Added Value by means of a questionnaire, which was sent to project leaders of RTD projects (from the first call).

The four most important aspects considered by the project leaders as European Added Value were the following:

- Establishment of synergies
- Finding of partners/expertise unavailable at the national level
- Addressing common problems
- Sharing the cost of large facilities.

6.6. Conclusions

The panel finds that in practice there is no common definition of European Added Value within the services of the Commission in charge of either the different specific programmes in FP4 or the Key Actions in the specific programmes of FP5. This has been commented on previously by the 1997 Annual Monitoring Panel for Biotechnology which wrote in its recommendations: "[The panel] believes that in the current programme there is no apparent strategy of European value and which would make use of the European advantages".

European Added Value was a major item on the agenda during the meetings the panel held in France, Germany, Italy and the UK (see Appendix II). No single overall view emerged about what European Added Value is but there was no doubt that EU funding should be available only where the added value was clear.

Despite the lack of any clear vision regarding European Added Value, the panel has found evidence in many reports and surveys that suggest that EU RTD programmes can and do provide some added value.

(a) There has been real success in the establishment of networks through successive Framework Programmes. The added value here is the contribution made to the creation of a European research community and the establishment of contacts between the different Member States. In particular the panel would draw attention to the collaborations between academic researchers and those in the
private sector, including SMEs, which have been established through EU RTD funding (see also Appendix V).

(b) The EU programmes have been important for **researcher training and mobility**. The use of Fellowship schemes to allow young researchers to gain experience in other Member States has been welcomed by members of both the academic and industrial research communities (see Appendix I). Through these the EU is adding value by building up the scientific and technological expertise of the science base, which is an essential element to ensure the future of European competitiveness.

(c) To a certain degree EU programmes have supported the creation of a **supra-national European research infrastructure** and ensured **access to large-scale facilities**. The European Bioinformatics Institute (EBI) of the European Molecular Biology Laboratory and the European Mouse Mutant Archive (EMMA) are both excellent examples of this. As the Life Sciences develop in the future there will be an even greater need for such large-scale resources and facilities for European scientists and the EU must be ready and able to respond to these needs as they arise.

(d) EU funding has enabled **the conduct of multinational epidemiological studies and clinical trials** across national boundaries which could not have been done in isolation by individual Member States.

(e) The panel has already alluded to the importance of EU support for **research which will serve European policies** and mentioned specifically those in agriculture and fisheries. However, such research also supports other areas such as the development of the European regulatory framework and more generally the achievement of the EU's social objectives (for example in relation to environment, health, education and training, employment, social and economic cohesion).

The issue of standardisation has not been raised in the previous monitoring and evaluation reports and is also almost or completely neglected in the formulation of objectives within the Quality of Life Programme (whereas it is part of the remit for both the Joint Research Centres and the Competitive and Sustainable Growth Programme.) However, standardisation is an important factor in technology, also in biology. There is, for example, a need for standard analytical procedures, reference substances, safety standards and declarations. Standardisation must of necessity be performed at the European level. A **strong European effort on standardisation depending on the Life Sciences** is necessary to ensure European competitiveness and independence.

The panel finds that the most important way that the EU's Framework Programmes can bring about European Added Value RTD is through support for building up a European Research Community (or a European Research Area), by building networks and encouraging research training and mobility of researchers. It is important to ensure a strong European research community and research system capable of coping with and also collaborating with the best centres of science and technology in the outside world. It is particularly important for Europe to be able to operate on equal terms with the USA and Japan. This can only be achieved by supporting excellence and maintaining the highest standards in evaluation of research proposals. It is important to give the best scientists possibilities for original and imaginative research and not only to support the average. A policy which tries to make everyone happy will not be useful or successful.
The desire for cohesion will create tensions and, although it would *a priori* contribute to European Added Value if the research communities in those parts of the EU which are less developed could be strengthened, the net effect on European Added Value could be negative if support was to be at the expense of existing centres of excellence. The coming enlargement of the European Union will make these tensions even more obvious. In developing the European Research Area therefore the key must be support for excellence - wherever it is to be found - rather than attempting to improve the mediocre.

A clear understanding of European Added Value is needed, based on an understanding of the actual and possible roles for the EU in European research in relation to Members States’ RTD agendas. The starting point of this understanding should be the fact that EU support represents only 5.4% of Member States’ public research funding and that EU money is nearly always ‘additional’ money. A further important factor is that it is a national responsibility to ensure a strong public sector science base in a country’s universities and research institutions which can make use of the ‘additional’ money that the EU’s Framework Programmes can provide. There must be continuity between the Members States’ research capacities and those of the EU.

At present the added value concept is used in many different contexts and there have been so many different interpretations that it can be used to justify almost anything. The panel proposes that a definition of European Added Value be based on the Davignon Report. The definition should also take the following into account:

- **The need for a European infrastructure within the Life Sciences.**
- **The value of scientific networks across Europe and including both the public and the private sector.**
- **The importance of research which can only be done at the European level (for example in epidemiology and other health areas).**
- **The importance of efforts which will increase the qualitative level of European research within the Life Sciences and enhance the strength of the European science base.**
7. QUALITY OF RESEARCH FUNDED THROUGH EUROPEAN PROGRAMMES

European research in general and within the Life Sciences in particular is of high and, in many cases, of outstanding quality. There may be problems in exploitation of the research; these are addressed in Section 8.

It is easy and important to compare European research and also research in the individual European countries with research elsewhere. One example of a very careful and detailed examination is the "Second European Report on S & T Indicators" published by the European Commission in 1997.

Although many of the methods used in this and similar studies are backward-looking and although absolute figures are subject to uncertainty the trends are often highly indicative of the current state of affairs and of the future.

It is on the other hand a general problem that it is difficult to measure the effect of single research programmes. There are three main reasons for this.

First, 'quality' as an abstract concept is misleading. There is no such thing as absolute quality. Quality must be assessed in connection with objectives and contexts.

Secondly, nearly all research today is performed with multiple funding. There are very few instances where support is from one source only. One way for a foundation or grant giver to know precisely what is obtained is to be the sole or almost sole funding source. This was a policy previously followed for example by the Wellcome Trust in the UK and by the Howard Hughes Foundation in the USA. However, the increasing collaboration between different research groups, laboratories and institutions has made it impossible even for these big private foundations to avoid multiple funding.

Thirdly, there is often an important time delay in publication of research results. A research group publishes continuously and it is usually impossible to say precisely which publications result from work performed in a precise period of time.

Nearly all research support from the EU is 'additional’ money (see Sections 3.2 and 4.2). In fact, it is a principle that there must be co-financing from national sources. In many cases the research would have been undertaken anyway, although perhaps at a slower pace, and perhaps resulting in other research being abandoned.

Some grants carry high prestige. One example is the Human Frontiers Programme. This prestige is due partly to the strong competition and partly to the high quality refereeing. It is important that EU grants are not considered as easy money. One way of avoiding this is to have a stringent refereeing process including the use of the very best scientists as referees. It is also necessary to have a transparent and visible system. The scientists must understand and accept how the system works.

The comparatively small size and duration of EU grants imply that EU money is seldom responsible for the most innovative, ambitious and challenging research but more for standard research. The
Commission’s questionnaire exercise indicated that most of the respondents consider the work undertaken as technically complex but of medium risk.

It is possible to identify and measure publications, quotations, impact factors of journals, etc. However, it is difficult to prove the role of EU grants for individual publications. In some countries, for example in Italy, it is compulsory to attribute and mention the contract number at the end of a publication. But this gives no precise information about the significance of the support received. Very often in a scientific paper the economic support from several sources is acknowledged.

Similarly it is possible to identify patents and patent applications. But there are the same problems with time delay and multiple funding.

European co-operation can be established by studying the literature, or looking at the reports. Successful co-operation will always lead to joint publications. Transnational centres of excellence can be identified through publications and grants.

Mobility can be measured, and it is also possible to follow the careers of newly trained scientists, including scientists who have obtained stipends from EU programmes. This, however, involves a great deal of effort.

In-depth studies in specific fields are one of the best ways to ascertain quality but are again demanding. There is in fact no substitute for talking with scientists and checking, through site visits, what is happening on the ground.

It must also be taken into account that the quality of EU funded research is not only a question of published results but also of the quality of the scientists and the knowledge and expertise they have acquired.

In measurements of quality it is also necessary to differentiate between basic and applied research. If the aim of the research and of the research grants is to ensure a strong European research community obviously the qualities looked for are different from those of research performed to solve defined problems.

All grants from EU programmes must be followed by a report. This is important, but only if the reports are studied by qualified people and can be used for feedback (see Section 4.7). It is disappointing and demoralising for scientists to write reports if they have the (false) impression that they are not read. Scientists do not want to work in a vacuum. Follow-up of research grants is very important but involves a lot of work and use of qualified manpower. The annual monitoring groups have an important role here. As suggested in Section 4.7, consideration should be given to combining follow-up procedures with procedures for dissemination of research results, to encourage scientists to write reports aimed at a wider audience, and to use the reports in such a way as to assure a wide readership. It is also important to keep precise records of publications (see Section 8.1).
The panel is in no doubt that European support from the programmes in the Life Sciences has been used to sustain and create outstanding research. The Commission has provided the panel with descriptions of many successful research projects supported by the EU - see Appendix V.

The panel’s major conclusions are the following:

It is important to continue and strengthen the present efforts to measure the quality and quantity of European research and also research in the individual European countries and to compare with research elsewhere in the world.

The Commission must increase efforts in following up grants, both to support and evaluate grant holders as well as to obtain feedback on impact, results and problems.
8. IMPACT AND CONTRIBUTIONS TO EUROPEAN COMPETITIVENESS

In article 163 of the Treaty of Amsterdam it is specified that:

"The Community and the Member States shall ensure that the conditions necessary for the competitiveness of the Community’s industry exist. For that purpose, in accordance with a system of open and competitive markets, their action should be aimed at:

- Speeding up the adjustment of industry to structural changes;
- Encouraging an environment favourable to initiative and to the development of undertakings throughout the Community, particularly small and medium sized undertakings;
- Encouraging an environment favourable to co-operation between undertakings;
- Fostering better exploitation of the industrial potential of innovation, research and technological development."

Also:

"The Community shall have the objective of strengthening the scientific and technological bases of Community industry and encouraging it to become more competitive at international level, while promoting all the research activities deemed necessary by virtue of other chapters of this Treaty."

The evaluation of research projects of the specific programme Quality of Life and Management of Living Resources must therefore take specific account of their potential contributions to EU industrial competitiveness. This aspect is particularly important in the case of proposals related to the research-intensive biotechnology industry.

For the benefits from science and technology to be realised the outputs from the research laboratories must be taken up by those in a position to exploit them to create new processes, products or services. Those who generate new knowledge may not be best able to exploit it for wealth creation (and improvement of the quality of life). The exploiters may be in different sectors. There is a need, therefore, to ensure that information and ideas are also able to flow across sectoral boundaries – and in particular across the academic/industry divide. Furthermore, in today's world interaction between quite disparate scientific, engineering and technological disciplines is often needed for optimal progress. The speed at which new scientific knowledge is generated and novel technologies are developed makes it imperative that scientists, engineers and technologists communicate both within and between disciplines.

Traditional interdisciplinary departmental boundaries thus now represent barriers to progress and must be removed.

The key to successful exploitation of new ideas is to ensure that there is a continuity and connectivity between their generators and those in a position to exploit them to create new products. It is important therefore to develop a culture in which the potential exploiters understand the value that the science
base has for their businesses, whilst the generators of new knowledge should be considering the potential for exploitation lying in their work.

The results reported in the Commission’s questionnaire exercise indicate that knowledge and network goals dominate over strategic management and exploitation (see Section 4.3). They also indicate that the scientific community is seen as the primary intermediate as well as end user of results. More than half the respondents stated that they had no plans for the future commercial exploitation of project results. They envisaged that the major impact over the next ten years would concern the improvement of scientific and technological capability, the improvement of cohesion across the EU and implementation of Community goals in general. Obviously commercial exploitation is not at the forefront.

The technology transfer process, which should ideally be a continuum, is in fact more often discontinuous with a ‘development gap’ between the generators and the potential exploiters, which prevents successful exploitation. One cause is a lack of efficient communication between the academic science base and industrial scientists and managers, resulting in a failure to transfer knowledge and technology. A second, and most important cause is a funding gap. Potential industrial exploiters will wish to see evidence that new discoveries made in the academic laboratory are capable of translation into a profitable entity. On the other hand there has been a reluctance by governments and the EU to fund research which is considered to be ‘near market’. The responsibility for this was considered to lie with the industrial or commercial sectors. But the definition of ‘near market’ has been drawn too near to the academic end of the research spectrum with the result, all too often, that European-derived new knowledge and technologies have been transferred to other nations which have derived the benefits.

There is a need for a change of policy in the public funding of research to include grants for ‘proof of concept’ research in academic laboratories, or in technology incubators. There is so a need for changes in the attitude of private investors, such as the European Venture Capital sector. A better understanding of scientific and technological issues is needed, and the private investors must be more willing to provide the relatively small sums required for the ‘proof of concept’ stage in the innovation process and be more prepared to accept risk.

Dissemination of new knowledge and novel technologies is essential to the exploitation process. Dissemination occurs via a number of routes including:

- Traditional and electronic publication in the scientific literature and the presentation of data and results through national and international conferences;
- The patenting of new inventions;
- Transfer as tacit knowledge, know-how or technology through networks of individuals and organisations and through individual mobility.

8.1. Publications

Publication in the scientific literature and, more recently, in electronic versions of journals and web sites on the Internet, are important means of communication within the various scientific communities
and makes experimental results and observations widely available, also allowing the dissemination of new concepts and hypotheses.

Bibliometric analyses of the research outputs from the EU Member States show a steady increase in the output of scientific publications from all Member States over the period 1980-95, and similarly for citations between 1985 and 1993, in all major disciplines. However, there have also been increases in publication and citation rates from North America and Japan (“Second European Report on Science & Technology Indicators” 1997).

The same trend has been reported in surveys of specific areas of research of importance to the EU such as, for example, that carried out as part of the "Survey on the Current Status of Research into 'Ageing' in Europe". However, these data can only provide evidence of the quality and quantity of research being carried out within the individual Member States. They do not give any indication of the contributions and added value of EU RTD programmes to the overall European effort or to those of individual Member States. The various evaluations and external monitoring reports focus mainly on matters of process rather than on outcomes. There is little, or no attempt to collect together and enumerate the total mass of published papers resulting from EU funded research. This is partly due to the difficulties discussed in Section 7. There are catalogues of research activities which provide some indication of the activities and published outputs, but the use of the resulting databases is not clear (see Section 5.2).

It is strongly recommended that those responsible for project and programme management be given clear responsibility for the continual collection of data on the publication of research results arising out of their programmes and for reporting them clearly on an annual basis. Publications must be known and recorded, simply because of the need for accountability. In addition sight must not be lost of the longer-term outputs from Framework Programmes, which may not become evident for some years after the programme itself has ended. Mechanisms for the continuing oversight of the programme output must therefore be developed.
8.2. Patents/IPR

It is also difficult to gain any idea of the contribution of EU Framework Programmes to the patenting activity of the European science base and about the exploitation of these patents. There has been a doubling of patents published from Member States with the European Patents Office in the decade 1985-95. ("Second European Report on Science & Technology Indicators" 1997). The same trend is seen in the case of Japan whereas the North American rate of publication has trebled during this period (see Figure 8.3.a).

The situation with regards to patents filed and published in the US Patent Office is less encouraging. The number of patents published from European States has shown little change over this decade compared with either North America or Japan (see Figure 8.3.b).

Figure 8.3.a. Comparison of Patenting Activity by European Countries, North America and Japan in the European Patent Office.

Figure 8.3.b. Comparison of Patenting Activity by European Countries, North America and Japan in the US Patent Office.
However, the real measure of innovation and exploitation is not to be found in the number of patents granted but in the revenue generated by the exploitation of the patents. Some important patents are defensive and not directly exploited. And there are many totally useless patents and patent applications. There is no quality control for patents comparable to the peer review procedures used by the scientific journals. The panel recommends however that attention is given in future to the **collection of information about patents as output and a form of dissemination from EU funded RTD**.

8.3. Networks

Tacit knowledge or know-how - the scientific and technological information which is not published but exists in the heads of individuals and research teams - is the most valuable knowledge in many fields of science. In order to harness tacit knowledge, mechanisms must exist which bring together those possessing the knowledge and those who need to use it for the purposes of its exploitation. The creation of networks between parties is an effective mechanism for ensuring this. Networks are a way of breaking down barriers and bring cross-disciplinary thinking and contributions to bear on issues. Geographical breadth of networks is also important in some fields because the wider their membership, the more likelihood there is of capturing and exploiting useful knowledge and disseminating novel technologies.

Networks must ideally involve both originators of the S&T and potential users to achieve effective dissemination of outputs and successful exploitation. All parts of a network must make real contributions to the overall effort and be willing to share in building the common knowledge base. Networks that are set up largely for political expedience are the ones least likely to lead to success.

**The management of networks is of central importance.** Without a dedicated manager with clear responsibility for developing the necessary partnerships and ensuring that they work together, the value of any network will be seriously eroded and its value undermined. The network manager must create a climate of openness and transparency between players and achieve the optimal flow of information within the network. The manager must be accountable to the network and its sponsor(s) for the effective operation of the programme and for the best use of resources available to it.

Quantitative measurements of effectiveness of networks as a means of dissemination are not easy, particularly in the longer term. The patterns of participation in networks can provide indirect evidence of potential effectiveness. Their true effectiveness in the long term can only be assessed retrospectively when their place in the pathway, from new knowledge to the generation of further S&T advances or commercially useful products, will become clear. The time span required for such evaluations is almost always longer than the timeframe of programme funding.

Some indication of network effectiveness can be obtained from the participation data provided in the annual reports of the "Research and Technological Development Activities of the European Union". These also indicate the extent of participation in programmes – both shared cost and concerted action – of the industrial and commercial sectors which gives some indication of the potential effectiveness *vis-à-vis* the encouragement of exploitation.
The number of participants in programmes in the five years from 1994 to 1998 in the activities in the Life Sciences (i.e. biotechnology, biomedicine and health, and agriculture and fisheries) are shown in Figure 8.4.a, and the number of participants per project are shown in Figure 8.4.b.

These data show a good networking potential as many projects involve significant numbers of partners. Similarly the number of participants from different Member States is indicative of the effectiveness of the networking within the bioscience communities of the Member States (see Figure 8.3.c).

EU funding is a driver for the creation of research networks but as yet there is no evidence of de facto effectiveness of networks as a means of dissemination of ideas, results and technology. Within many projects use is made of instruments such as forums, workshops and conferences and, particularly, concerted actions. These will a priori enhance the capacity for the timely sharing of outputs between network participants. What value they provide in the longer term, in terms of building S&T capacity in Europe and of exploitation of the fruits of the RTD activities, is again difficult to assess without
retrospective inquiry. It is also not possible to determine the impact or synergies that these projects and programmes have with regard to contributions to Member States’ scientific efforts.

An important aspect of networks is their potential for engaging industry, and particularly the SME sector, in RTD activities. There is evidence in the data over the five years that industrial organisations are involved, with an increasing engagement of SMEs, particularly in the biomedicine and health and the agriculture and fisheries areas (see Figures 8.3 d-f). This is important because in these areas and in the field of biotechnology there is considerable potential for contributing to both competitiveness and wellbeing, and it is furthermore one in which Europe has been seriously lagging behind other nations, in particular the USA. Therefore the involvement of SMEs must be carefully monitored.

8.4. EU mechanisms to support dissemination of RTD outputs

For effective translation of basic research into the exploitation phase requires mechanisms to ensure the dissemination of the outputs between sectors; particularly between academia and industry. Within the EU Framework Programmes a number of initiatives have been developed to increase awareness of the programmes and their outputs, and to create bridges between these two communities. Two prominent
vehicles to achieve this were established under the umbrella of the Third Activity of the EU Framework Programmes - "The Dissemination of EU RTD". These are CORDIS and the Innovation Relay Centres.

8.5. CORDIS

This is a web-based information service (http://www.cordis.lu/) providing information about the EU programmes and providing access to scientific results from both the EU and national RTD programmes. It is also intended for use by researchers and consortia that had generated research results but who were unable to undertake their exploitation. By making these results known through CORDIS it was hoped that others in a better position to extract value from them could do so.

CORDIS has come to be a major information source for Community R&D, including about the initiatives described below. Although it clearly serves a useful purpose it is not known how successful it has been in creating links which have led to the exploitation of the information for the development of new products, etc.

8.6. Innovation Relay Centres (IRCs)

Innovation Relay Centres (IRCs) were created during FP3 throughout the regions of the EU to provide an infrastructure for disseminating new technologies, promoting their use to meet the needs of industry and providing access to expertise to support the transfer of technology, innovation and exploitation, particularly by SMEs.

The number of IRCs had grown to 52 by 1995 and, in a survey carried out in 1997, the majority (56%) was rated by their users as very good. In the first sixteen months of operation the centres handled:

- 120000 requests for assistance in technology transfer,
- 7500 audits of technology offers,
- 1250 transnational negotiations for technology transfer agreements, with 109 being successfully entered into. By mid-1998 the number of successful agreements achieved with assistance from IRCs had reached over 320.

This evidence suggests that IRCs are proving to be an effective mechanism for the transfer and exploitation of new technologies. However, it remains to be seen how many of these agreements that they have 'brokered' have resulted, or will result, in new products.

There is, however, more effort being directed at IRCs. Responsibility for them has been transferred to the Innovation and SMEs Programme of FP5. Hopefully the change of management has not reduced the quality of the work.

8.7. Involvement of industry

The 'development gap', already discussed, which lies at the interface between the inventor and the exploiter, has been a serious impediment to the exploitation of research efforts. A fundamental
problem, already alluded to, is the lack of resources for 'proof of concept' research required to create the confidence in a particular discovery and encourage investment in expensive development programmes by the industrial sector. One means of reducing this gap is through the involvement of industrial sectors in networks within the EU RTD programmes. This is happening. In addition to the mainstream programmes, mechanisms are also needed which will provide opportunities for industrialists to share pre-competitive generic ideas with other companies and academics and to define their S&T needs for research actions.

**Exploratory Awards and CRAFT**

The importance of the SMEs as an engine for growth in Europe, and as a source of innovation in the high technology sectors, has been recognised by the EU and these companies have been encouraged to participate in the research projects of the Framework Programmes. In addition to the main actions within the Framework Programmes two Technology Stimulation Measures (TSMs) were introduced into FP4, specifically targeted at SMEs. These were the Exploratory Awards, intended to provide information and assistance for SMEs with little or no in-house research activities, and the Co-operative Research Action for Technology (CRAFT), piloted under FP3 to enable such SMEs to have their research projects carried out by a third party. These schemes were considered to have been successful during FP4. Of the 14,500 SMEs taking part in the programme, about 20% had received support in the preparation of their proposals through Exploratory Awards and 35% had been helped through a CRAFT project.

**Demonstration Projects**

The creation of Demonstration Projects within the Life Sciences programmes in FP4 provides a potentially very effective means of closing the 'development gap' by providing for proof of concept research, and for the clarification of uncertainties and risks inherent in innovations involving a high level of novelty. These projects provide examples of real industrial involvement with almost all projects having at least one company partner. The objective of these projects is to carry out the research to establish the potential utility of particular discoveries in fields ranging from genomics to vaccines, biomaterials, imaging and manufacturing processes using biological materials. (Examples of Demonstration Projects in the Life Sciences Programmes. Volume 2 – 1998 (EUR 17784)). One potentially exploitable outcome from an EU financed programme – "Stand up and Walk" - is an electronic implantable system to restore the capacity of paralysed patients with spinal injuries to walk again. It is however important to stress that Demonstration Projects have to take place at the ‘cutting edge’ of science and technology.

**Industrial Platforms**

The creation of Industrial Platforms is another development to facilitate the exploitation of European research. These now exist in a number of fields within the biotechnology programme and are driven by industry. They are intended to bring together technology-based industrialists with academic researchers to create an environment in which research may be translated into products with the express aim of disseminating research results, enhancing the transfer from research into industry and the
provision of a forum in which industrialists can express opinions on present and future research policies.

There are presently 15 Industry Platforms which seem to be successful in engaging industry, with EU RTD activities covering a wide range of subjects from generic technology to some very specific ones. The earliest was established in 1990 and the most recent, devoted to TSEs, was founded in 1999. Their membership varies from 80 companies being involved to only two. In most cases membership is between 12 and 30 members and includes both major pharmaceutical companies and smaller biotechnology enterprises - and in some instances also venture capitalists. These platforms therefore have the potential to bring about the exploitation of research results although as yet there is little direct measure of their effectiveness. A clear indication of their value is the continued involvement of companies in the platforms, and their provision of funding for them.

Workshops

Other initiatives to encourage dialogue with industry and a greater understanding, particularly of the SME sector, have been undertaken through aspects of the Framework Programmes. In 1999 for example, a workshop was held under the aegis of the Cell Factory Key Action of FP5 on "Entrepreneurship: Networking of Biovalleys in Europe". This was designed to address the development of an environment in which new entrepreneurs could be nurtured. It was attended by 12 managers from bioincubators, biopoles and biovalleys throughout Europe. The hope was that practical initiatives will spring from the workshop, and that existing biovalleys will create a network and links with the Cell Factory Key Action and lead on to the creation of new biovalleys and similar structures in Europe.

The panel believes that there is evidence that EU programmes and initiatives are engaging industry but the effectiveness of these activities has yet to be established. The often long time scales involved in the translation of research outcomes into new products mean that it is unreasonable to expect any real data to indicate effectiveness over a five-year period. The panel suggests therefore that programme and project managers take steps to collect data on the exploitation of EU research outcomes by participating companies over the next few years in respect of the FP3, FP4 and FP5 programmes. These data should be collected for some years after the completion of the programmes and would allow a meaningful estimation of the added value of Community programmes for European industrial effectiveness. Some well-documented successes will also serve to encourage more industrialists to regard EU initiatives as worthwhile ventures.

8.8. Factors working against the development of a competitive Europe

The Framework Programmes have created the structures within which collaborative research can be encouraged and flourish. However, despite the existence of these programmes for over a decade it is still evident that Europe lags behind the USA in harnessing its S&T for the improvement of its competitive position in world markets. One of the most obvious flaws in the present arrangements is that these do not permit the rapid movement into new, or emerging, areas of science and technology and the development of the critical mass of expertise and facilities required. Some examples of this are the following:
• The slow response of the EU to establish research to the emergence of BSE and its transmission to humans. This was not a failure of the scientific community but a failure to have effective legal processes in place to make funding available to meet a crisis.

• The failure to train people in a timely way in the field of bioinformatics which is a key technology for the definition of the human genome and those of other organisms of medical importance.

• The failure to recognise and respond to the threats posed by the emergence of antibiotic resistance in pathogenic bacteria.

• The failure to embrace the concept of combinatorial chemistry as a means of producing high throughput of chemically diverse compounds for screening against biological therapeutic targets. As a consequence, Europe lost the opportunity to take a lead in developing both the technology and the instrumentation in this field.

In all of these areas a pan-European approach to R&D could and should have provided a significant lead for the EU in the development of new science and the creation of novel products, contributing to international competitiveness and to the quality of life. In part the causes of failure have been cultural, with a failure to embrace change but, as the data discussed above show, within the Framework Programmes lie the mechanisms for overcoming political and geographical barriers to develop a more collaborative approach to S&T and create added value. Other contributors to failure lie in the processes used by the Commission in managing the Framework Programmes.

This leads the panel to the following recommendations:

The application, selection and contracting mechanisms are too long to allow the flexibility and speed required in today’s world for rapid response to emerging threats and opportunities.

Advanced training courses should be organised for staff involved in research administration and policy implementation, for technology transfer officers and for patent lawyers in the biosciences throughout Europe.

8.9. The future

It is imperative that lessons of the past are learned and that European science and technology is harnessed to competitiveness. Effort is needed to create Foresight initiatives that will identify:

• the cutting edges of S&T,

• the needs of the market place and the means to supply it,

• new fields of S&T in which the S&T workforce must be trained in order to meet future challenges.
The panel believes that it is now possible to identify some areas in which action is needed as a matter of urgency:

(a) With the completion of the mapping of the human and a growing number of pathogen genomes, there is an immediate need for **research to understand the functions of important developmental and disease-associated genes**. Without this information we will be hampered in our understanding of diseases, the identification of novel therapeutic targets and the design of new medicines to affect them.

(b) "**Proteomics**" and structural chemistry are already identifiable as key areas for the development of European expertise in the post-genomic phase of research, and will be important for understanding gene products and their functions.

(c) Environmental research is needed in many fields – from gene flow in natural and genetically modified plants and other organisms, to the effects of global warming on the natural environment and new disease threats.

(d) The **need for S&T to underpin sustainable agriculture** not only within European but also in an international context.

(e) The development of the interfaces between the biosciences and the physical sciences for the development of **novel biocompatible materials, medical devices and implantable control systems**.

A Foresight programme alone, however, is not a cure to the problems that European research faces. There must then be a willingness to focus adequate resources, both human and financial, to provide an effective response. The funding response to Foresight-identified targets must be more flexible and also more timely than at present - and there must also be a greater willingness to take risks; the present peer review system used to select projects for funding may be too conservative.

There is participation of industrial organisations in the QoL Programme, with both large and small companies being involved, but they still represent on average under 50% of the participants (although this varies; for example, their representation in the Cell Factory is over 70%). The panel draws attention in particular to the low level of representation of large companies in the biomedicine and healthcare areas. Given the strength of the European pharmaceutical industry, this should be a matter of concern. **More effort will be needed to encourage company participation in future programmes.** The selection/approval process must be more efficient and speedy to ensure that it matches industrial time scales.

Finally, attention must be given to creating a greater degree of public involvement in scientific developments (see Section 14).

**The general conclusion is that the current efforts to encourage and promote co-operation between industrial research and universities and public research institutions must be continued and strengthened.**
9. CONTRIBUTIONS TO EUROPEAN POLICIES

9.1. Background

Research is required to support European Policies. Policies can be of three basic types:

(a) Information based strategies;
(b) Directive based regulations;
(c) Incentive based instruments.

These act in turn by providing accurate information, by applying common European rules and by seeking to change behaviour. Clearly the provision of factual information is a basis for all three approaches. In addition (b) and (c) frequently require specific R&D to indicate the consequences of choices between alternative regulatory measures or incentives, and may also require R&D to review the effects of regulatory measures or incentives.

Framework Programme research is important for developing the tools, methods and models that enable the consequences of regulations or incentives to be evaluated. It may also develop new ideas or identify problems that may indicate how policy needs to change.

All of the policies of the EU may require R&D and potentially draw on research conducted under the Quality of Life Framework Programme. However, for the overarching policies (e.g. industrial policy or environment policy) this will only be one of several sources of R&D. The needs for research contributions from the Quality of Life Programme are most clearly required with respect to the Common Agricultural Policy (CAP), the Common Fisheries Policy (CFP) and the Consumer Policy of the EU and these needs are included in the aims of FP3, FP4 and FP5. The requirements of policy do not always correspond directly with the needs of scientific excellence. For example, policy might require an extensive study of an under-studied but unchallenging topic. This may run counter to pure research interests. Indeed the analysis of the Commission's (DG Research) questionnaire sent to participants of finished projects of FP3 and FP4 suggests that policy-related research is often not the first concern of participants in the Framework Programme. This may explain the observation of a Policy DG official that research proposals were not always forthcoming on important policy issues, for example the appropriate size and structure of the European fishing fleet.

Under previous Framework Programmes, in addition to the criteria for scientific excellence, the Directorate General for Agriculture applied relevance (or rather non-conflict with directives) as an extra criterion for judging projects of interest. Under FP5 both the Directorate General for Agriculture and for Fisheries have requested refereeing panels to include relevance among their criteria and provided notes on topics and regulations of particular interest. (See CORDIS, http://www.cordis.lu/life/src/lib-pol).

9.2. Contributions to specific policies: Common Agricultural Policy (CAP), Common Fisheries Policy (CFP) and Consumer Policy
Both the Common Agricultural Policy (CAP) and the Common Fisheries Policy (CFP) were initially established under the Treaty of Rome but both have had to adapt to changing circumstances and problems. The traditional objectives of the CAP are to increase agricultural production, to ensure a fair standard of living for the agricultural community, to stabilise markets, to assure availability of supplies and to ensure that supplies reach consumers at reasonable prices. The CFP is concerned with conservation of resources, with markets, with structural policy aimed at the modernisation and restructuring of fishing fleets, and with fisheries agreements with other countries.

Since Consumer Policy is a pervasive topic it has also been included as a guiding principle. A European consumer policy has as a main objective the protection of consumer health. This requires:

(a) An independent scientific basis for a policy of consumer health protection, with regard to food at all stages of the production chain, as well as other products, such as animal feed or cosmetic products;
(b) Work in the field of product safety to ensure that both food and non-food products conform to high safety standards all over Europe;
(c) Activities in the field of risk evaluation, with respect to both current hazards as well as possible future developments which may have a negative impact on consumer health (for example, risks associated with mass rearing of animals).

This leads to an interest in many of the themes and activities covered by FP5.

Recent policy on agriculture and forestry stresses multi-functionality in order to place these in a larger societal context. They are envisaged as providers of essential services to the public in addition to the production function. Fisheries, based upon the harvest of commonly owned wild resources, also pose some unique problems. They suffer from the tragedy of the commons and many European fish stocks are over-exploited, some heavily over-exploited and depleted. The CFP is essentially science-based and it requires detailed routine scientific advice from international science organisations (for example, ICES) every year. Moreover, agriculture, forestry and fisheries often provide employment in remote areas and areas of industrial decline where few employment options may exist (e.g. Greek Islands, North East Coast of England, mountain areas) and hence social and economic issues are of policy concern and require research. The EU and the Member States are party to a number of international agreements and treaties, such as the Rio Conference on Biodiversity/Agenda 21, and are also members of a number of science and/or management organisations. All of these agreements may require the EU to fund relevant research inputs.

Much EU research is concerned with the provision of new information designed to improve agriculture, fisheries, forestry and rural affairs and consumer concerns. In general it is too early to see if research really has contributed as expected. Moreover, since the agenda is so wide, it will always prove very difficult to evaluate the real contributions from research. However, a number of Framework Programme projects have been identified as having had particular value to EU policy in the area of agriculture, agro-industry, fisheries and forestry. Examples are given in Appendix VI.

Agenda 2000 sets out the EU’s views of the main challenges facing the CAP and similar challenges are identified for the CFP. These can be found on the Internet, at http://europa.eu.int/comm/agenda2000/index_en.htm, and ensuing research requirements are in broad
agreement with the priorities set in FP5. But in the light of rising world population, changing consumer preferences and new scientific insights (e.g. climate change, System Theory) the panel considers that more emphasis must be given to long-term anticipatory research. An example would be the identification of the agricultural model that would be appropriate under future circumstances, such as shortage of water or fertile soil.

9.3. Conclusions

The CAP and CFP and other EU Common Policies all require research to assist with the policy development and implementation process. However, there is a need for balance between independent, policy relevant research and policy driven research. To make research too much the handmaiden of policy is likely to encourage stultification but a healthy interchange between research and policy does help administrators and scientists to see where their efforts can bear most fruit and to understand the key issues. This can give stimulus for new approaches to old problems and for the formulation of new problems. Research with relevance for policy often requires an active co-operation between social and economic scientists and scientists from the natural sciences. There is a need for a joint language and common models for those working closely together. There is also a need for fairly permanent and adequately funded research networks (like ICES and the evolving EURAGRI) to further the work.

The development seen in FP5 towards a problem solving approach and the involvement of social and economic scientists should, in principle, increase the contributions of the Framework Programme to European policy. These efforts must be continued and strengthened. The panel considers that there is an increased need to focus on long term anticipatory research to address future needs, which is addressed further in the following chapter.
10. CONTRIBUTIONS TO THE QUALITY OF LIFE AND WELLBEING

Science, technology and, therefore, RTD, represent one of the most important driving forces in our advanced society. This means that their contribution to socio-economic development is essential. The EU has grasped this aspect ever more explicitly in the formulation of the latest RTD Framework Programmes - the objects of the present five-year assessment (FP3, FP4, and especially FP5).

In fact FP5, through a kind of ‘social contract’, aims to create a real reciprocal relationship between the socio-economic development in the EU and RTD policies. Moreover, a remarkable effort has been made in order to assess the longer-term contribution of EU funded RTD to the improvement of social wellbeing in a broad sense (see the report from the independent European Technology Assessment Network (ETAN) experts, January 1999).

It is important to identify and discuss not only acute and pressing problems connected with competitiveness and economic growth but also the long-term problems facing the world and Europe as part of the world. There is, in principle, a close positive link between economic growth and quality of life and wellbeing. But the bond is only positive if long-term aspects of economic growth are taken into account.

Currently humans are destabilising the ecological and social system in a dramatic way. If this continues, it will of course result in an equally dramatic reduction in economic growth or even in economic decline. We therefore have to secure our environment and our ecological base and we have to use science-based and intelligent precautionary measures instead of relying on repair strategies.

Nowhere is this more important than in agriculture and forestry. Until now, the European Common Agricultural Policy and European agricultural research has been aimed mainly at achieving immediate competitiveness. But immediate competitiveness and long-term ecological balance and food security have to be balanced. The future will challenge us with a global shortage of food. Part of the answer will probably be a sustainable intensive production combining high output with low input and careful use of results from molecular biology. Another part will be the need to further cultivate or mobilise marginal land and careful use of the limited water resources.

However, there is no clear and generally accepted answer about which cultivation model will be appropriate in the long term. The multifunctionality of agriculture, aquaculture and forestry has to be addressed. In order to define and demonstrate a sustainable model for European agriculture the interlinking functions have to be better described, quantified and presented. Biodiversity in agriculture, aquaculture and forestry can only be achieved if diverse demands are fostered. This is especially possible through the use of low distance supply systems. Such systems, however, currently lack technological, organisational and legal scientific support. There is also a need for better methods for evaluation of agricultural policies. Such methods must include the instrument of multicriteria analysis.

It is thus necessary to perform anticipatory research concerning agriculture, aquaculture, forestry, water-management and the impact of climatic changes. This is most easily done within agriculture, whereas forestry presents a more difficult challenge because of the slow rate of adaptability in forest systems.
The increasing necessity for health promotion and preventive medicine instead of, or in addition to the medical treatment of diseases provides another example of the need for an approach to the quality of life involving more than just concern with economic growth.

Such questions are not properly addressed in the current Framework Programmes, since these programmes are focussed on short-term industrial competitiveness. But a balance must be found between short- and long-term needs.

Maybe many of the long-term problems are not mainly problems for research. Better economic and social conditions, for example, may be more important for their solution. But the problems must be discussed in a research context and taken into consideration in the planning of future Framework Programmes. It must, however, be kept in mind that here as well there must be European Added Value in EU efforts. The problems underline the need for long-term research, in obvious conflict with the present programme structure.

As a conclusion, the panel therefore wants to stress the importance of addressing major long-term problems for the 21st Century – in all areas within the Life Sciences. It is also important to stress that the problems can only be addressed through a dialogue between the scientists, the politicians and the public. Science and technology can make important contributions to the solution of our long-term problems, but only if society gives the necessary licence for this to happen. Long-term economic benefits from S&T will only accrue for Europe if S&T activities are designed in the context of their contribution to a Europe in which human rights and open discourse form the societal base.
11. CHALLENGES OF ENLARGEMENT

All the candidate countries for EU membership are associate participants in FP5 as part of their membership preparations. At present, the national research and development budgets of these countries are on a par with, or lower than the budgets of those parts of the EU where cohesion needs a major effort. This calls for strong R&D policies in the candidate countries, including increases in both public and private appropriations for research and development.

These challenges have been addressed in the Commission Communication "Towards a European Research Area". It is already necessary currently to improve the possibilities for participation, and to intensify dissemination of information about such opportunities within the universities and research institutions in the candidate countries.

The enlargement process is evidently inducing changes in the research priorities of future Framework Programmes. This is to be expected, especially in the Quality of Life area, where there will be an increasing need to intensify research, e.g. in areas such as environmental health, public health, ecotoxicology and chemical risk assessment.

The EU can take advantage of Germany's experiences of union between the country's Eastern and Western scientific communities. Keeping the differences in mind, e.g. the speed of unification in Germany in contrast to the long-planned enlargement of the EU, one can nevertheless learn from the positive results and the failures observed after German reunification. The German experience, for instance, teaches that advantages in the Eastern medical system were, for no good reason, lost after reunification.

A common denominator of science policy in the Communist countries was that research was mainly organised in various academies and other central institutions, while in the Western European countries basic research is largely a constitutional task of the universities, which contribute the major part of the total scientific effort in the public sector. The reforms to overcome the structural problems in the various candidate countries could be intensified by outside scientific evaluations co-ordinated by the EU. Common European policies and recommendations could be developed also for the optimal balancing of university and industrial research and public and private sector research appropriations.

Another difficult problem is the volume of personnel, i.e. the number of persons being employed in research, and the amount of money spent on research and development in relation to gross domestic productivity. There may be cases among the candidate countries where too many people are working with inadequate efficiency and with too scarce resources. Recommendations for optimisation of resources should be worked out.

It is important to look for specific strongholds of research in the candidate countries and to help foster their existing centres and possibilities for scientific excellence. This applies to several areas of research within the candidate countries, e.g.:

- Excellent registration for various diseases, permitting high level epidemiology.
- Identified environmental problems allowing toxicological research and preventive actions to be taken, but also providing unique research possibilities.
- High level performance in medical education and public health promotion.

Research and progress do not only depend on technological improvements and undue emphasis on high-tech programmes. Living resources and quality of life can be served with a broader and less dogmatic spectrum of approaches. With limited economic resources for research, diversification of research topics and methods and their assignment to a restricted number of research institutions becomes a necessity.

The EU should design research programmes specifically aiming at improvements of the local situations in the applicant countries. Competition in a narrow range of research topics is appropriate if the competitors are at the same level but it will not be helpful to newcomers from less favoured regions. Instead, the newcomers should be helped to develop their pre-existing strengths, in particular where these are complementary to what is already present in the EU.

There already exist several initiatives and programmes aiming at bilateral or multilateral co-operation between scientists from the candidate countries and the EU which are improving the efficiency of research in the incoming new Member States, e.g. the INCO programme and the PHARE funding have already started successful collaborations in research. A special programme for young researchers and for improvement of researcher training would speed up the closing of the gap between East European and West European science.

The most important European Added Value of the Framework Programmes probably comes from the support for the extended Europe by building a European research community in partnership, allowing cohesion and mutual benefits transnationally. There should be a clear division of the funding instruments for regional development; the community research programmes focus primarily on European and global research objectives and existing research excellence should not be compromised by the enlargement process.

The means for promoting research expertise in regions of Europe with a relatively minor research volume (essential considering the enlargement of the European Union) must be reconsidered and reshaped. The Framework Programmes should support existing strengths. Cohesion in the research area should be funded by other existing EU programmes.
12. GENDER ISSUES

The Treaty of Amsterdam set the principle for the promotion of gender equality throughout EU policies. The European Parliament’s recommendation as long ago as 1988 stated that the "under-representation of women in academic life is a highly topical problem and calls for practical incentives". The strong recommendations, originating from a conference organised by the Research Directorate General of the Commission in spring 1998, were put into effect in the Commission’s "Communication on Women and Science" (COM (1999) 76), inviting the Member States to take actions to improve the collection of gender disaggregated statistics, to review the implementation of gender equality policies and to pursue the objectives and means for gender equality in science.

A special group to monitor and implement the gender dimension in FP5 was created at the Commission’s Research Directorate in 1998. Thus FP5 is the first of the Framework Programmes to include the gender issue in a mainstream way - to promote research by women, on women and for women. Based on the available statistics and future-watch analyses, Europe needs to increase the number of researchers and cannot continue wasting a substantial amount of its research potential by intentional or unintentional discrimination of women scientists (ETAN Report on Women in Science, 2000). A significant step towards promotion of possibilities for female scientists has also been taken in the Communication of the Commission "Towards a European Research Area" (COMM (2000) 6).

The goal has been set to achieve a minimum of 30% of females on decision-making committees within the EU by year 2002 and 40% by year 2005. The statistics from previous Framework Programmes are fragmentary or lacking but, according to an estimate, the projects funded by FP4 had about 10% of female partners. The present database of experts to be used for evaluation of the project applications includes about 15% female reviewers from the different Member States. A key recommendation in the recent ETAN report is to mainstream gender equality into FP6 and also into the Member States’ programmes that fund science and technology. These objectives should be fully supported.

A special problem for young scientists might relate to maternity/paternity leave in EU funded projects. Even if the national employment legislation is to be followed in the employment contracts, young researchers and especially females might suffer discrimination in an employment situation if the research institutions signing the contracts are not told that this is against EU policy and if funds for maternity/paternity leave are not made available through the contract. It is unacceptable for female personnel, whether scientific or technical, not to be ensured full maternity leave and for the funds paying for this not to be automatically forthcoming with project acceptance. If this is only put in the form of a demand to the contractors, there is a risk that this could hinder the employment of young women and female researchers. Funding of the projects should be available to cover the full expenses in case of maternity, including the possibility of hiring additional help for the project during the leave of absence.

Present efforts to promote the possibilities for female scientists must be supported and increased.
13. ETHICAL PERSPECTIVES

The initial activities on bioethics within the Framework Programmes were conducted in the human genetics area in FP2, and in biomedical ethics in FP3. In FP4 a special advisory group on Ethical, Legal and Social Aspects (ELSA) reviewed project and co-ordinating activities, focusing on ethics with the programme committees of three programmes (BIOTECH, BIOMED and FAIR) and the Group of Advisers on the Ethical Implications on Biotechnology (GAEIB). About 60 research projects were funded in the bioethics area in FP4, accounting for about 1% of the FP4 budget. In addition, a review process was started on an ethical analysis of project proposals.

FP5 is the first Framework Programme to place a special emphasis on the ethical dimensions of the Community research priorities. The decision of the European Parliament and the Council concerning FP5 foresees that all research activities conducted and financed through Community funds shall be in compliance with "fundamental ethical principles" (Article 7). The introductory paragraph for the specific programme on Quality of Life and Management of Living Resources makes a special point about the need to respect the ethical framework, i.e. full respect of human rights and fundamental ethical principles throughout the activities of the programme. An ethical opinion on the research in FP5 was prepared, at the request of the Commission, by the GAEIB. The European Group on Ethics (EGE), the successor of GAEIB, prepared an ethical opinion, in the context of FP5, on the use of human embryos. A lengthy footnote in the decision on the specific programme Quality of Life describes forbidden research actions on human germ line and human reproductive cloning, and gives the necessary ethical principles to be followed in animal experimentation. Likewise, the promotion of biosafety, also part of the ethical principles, must be considered in every Key Action, both as part of health protection and protection of the environment.

Within the generic research part of the Life Sciences area, a special research activity on bioethics has been identified in the work programme, focusing on ethical analysis of scientific and technical developments, of legal and regulatory measures and on special studies relating to biomedical ethics and bioethics. However, it seems obvious that the realisation of generic research activities in bioethics in FP5 have been very limited so far. This is due to low visibility in the promotion of this area of research and to the handling of the proposals received, given the lack of staff in the Commission due to severe cuts in personnel and in the funding assigned to bioethics in the Quality of Life area. This reality seems to be in strong contrast to the message from the European Parliament and the Council in the decision on FP5 and the specific programme on the Quality of Life in upgrading bioethics and mainstreaming ethical principles into Community research.

An important area in ethics, i.e. research ethics, relates to good scientific practices to be followed in all research. The reliability and dignity of scientific research is based on the prerequisite that researchers follow good scientific practice throughout their work and that prevention of misconduct or fraud is recognised. This should be highlighted more strongly in the Framework Programmes. There should be a greater emphasis, as a European activity, on better training for young researchers in research ethics, for the ethical evaluation and good conduct of their scientific work. The field of Life Sciences involves respect for human life and human dignity which must be adhered to rigorously. Rapid progress in knowledge and methodologies in the Life Sciences area, which in itself has an ethical value, can never prevail over fundamental human rights.
A key challenge for the future will be to address ethical perspectives, including the ethical perspectives of ecological problems, both in general and in connection with actual funding projects.
14. PUBLIC PERCEPTION OF RESEARCH IN THE LIFE SCIENCES

A facet of science policy that can no longer be ignored is that of ensuring that advances in science and technology, which have the potential to lead to improved quality of life and creation of wealth, find acceptance with the public. This applies at the level of the Member States but is also important at the European Community level. No longer can it be assumed that new, science-driven developments will be accepted by the public, as has been largely the case in the past. Further it is clear that before new developments from R&D are introduced there must be a 'licence' for them from the public. Without this approval it is likely that the development will fail in Europe but that it will be exploited instead in other regions like the USA, Japan, and possibly also China.

The recent furore that has arisen in the context of the introduction of genetically modified (GM) crops into the European food markets should be a cautionary lesson. This situation revealed in a stark manner the power of pressure groups, with highly skilled communicators and their own agendas, to mobilise public opinion against a new development. In part the reaction against GM products in food was fuelled by the earlier Mad Cow disease episode and the various outbreaks of food poisoning. These have created in the public mind a distrust of science and scientists and led to the establishment of a climate of fear when it comes to foodstuffs. This was used by the environmental pressure groups to create an anti-GM reaction. The image of "Frankenstein Foods" provided a powerful symbolism to gain public support for their views and was widely used by them and the press and media for this end. Without this, the public reaction would probably not have been so hostile. Coupled with the climate of fear is a lack of any real understanding of the concepts of risk, hazard, harm and benefit.

In much of Europe there is now a clear anti-science attitude developing in many segments of the public and this will, if not corrected, lead to a failure of public support for new developments with some adverse effects on European competitiveness. If Europe is to benefit from the new technologies, many of which are developed by the European public and industrial science bases, and reap the rewards from their exploitation, serious consideration must be given first to understanding public positions, and then to taking steps to increase the public understanding of science and technology.

There must therefore be policies and strategies at both national and EU levels aimed at creating the public attitude that will allow European science and technology to be appreciated and accepted. Policies are also needed to assure the public that new introductions are subjected first to rigorous scrutiny and regulation. There must therefore also be public confidence in the various governmental regulatory regimes and processes.

In the past there have been attempts by the EU to gain understanding of the public attitudes to science and technology and those involved in R&D. The four Eurobarometer surveys between 1991 and 2000 is one such measure. However, the data produced as a result of the successive Eurobarometer surveys carried out from 1991 to 1996, although indicating that genetic engineering scored worst in the opinions of those surveyed, did not predict the scale of opposition to GM foods that has occurred more recently. Other opinion-based surveys carried out in 1998 and 1999 also failed to indicate the scale of public hostility that happened. The Eurobarometer surveys did, however, provide information about the level of scientific information in the population and also the sources from whence they gain it – mainly television, radio, magazines and newspapers. More effort, and thus more resource, must be put into the
building of public understanding, trust and confidence in S&T and their capacity to provide improved quality of life, new products, to open new markets and to improve European and national competitiveness.

A major deficit in this area has been the failure of the scientific community to explain and discuss its own research in public. This must be essential if trust in science and scientists is to be engendered in the public mind. Therefore funding should be made available within FP5 and future Framework Programmes to provide training and development of communications skills in scientists and technologists. In particular training directed at communicating through the press and media should be provided.

FP4 allocated grants under the Biotechnology Programme to support studies on, amongst other things, public perception, education in biotechnology and risk analysis. The outcomes of some of these studies have been published and provide useful insights into these issues; these outcomes can be built on to provide a strategy for action. One example is "Strategies for Communication on Food Biotechnology" published in 1999 which was, however, after the horse had bolted. Without putting these reports into a strategic framework that can lead to the development of effective communication to the public the money spent on these studies will have been wasted. Funding will of course be needed to implement these strategies in the field.

The biotechnology communications studies could serve as a model for developing communications in other areas of the Life Sciences programmes and in particular developing them before a crisis of public confidence occurs. Thus the panel recommend that timely and pre-emptive action is taken now through FP5 and later through FP6 to create the public climate that will be required if new developments are to be effectively translated into new products and services for the benefit of the European Community.

The panel's concern about the public perception of research is in full accord with the concerns set out in the final report of the 1999 Framework Programme Monitoring Panel.

**The efforts to promote the public understanding of, and confidence in the Life Sciences must continue. This is an important issue that demands much more attention than it has received until now.**
15. MAJOR CONCLUSIONS AND SUGGESTIONS FOR FRAMEWORK PROGRAMME 6 AND FUTURE FRAMEWORK PROGRAMMES

The panel has performed a five-year assessment of Community RTD covering the period from 1995 to 1999. Within this period the Third Framework Programme has come to an end, the Fourth Framework Programme is at its height, and the Fifth Framework Programme has been launched. The total area covered by the evaluation is great both because three Framework Programmes are included and because the activities within the Life Sciences have a large share of the total R&D efforts in the three programmes.

Because of the size and the complex nature of the area covered by the panel’s evaluation it has not been feasible for the panel to make an in-depth examination of the quality and relevance of the research carried out through support from the European Union. The panel has addressed more general questions including priority setting, relevance, exploitation, continuity and renewal and the relation between European and national efforts. Furthermore, the panel has concentrated its advice and recommendations on the future instead of just giving marks for past performance.

(Section 1. Introduction)

The panel has based its work on reports and documents from the European Commission and other sources and on a large questionnaire exercise carried out by the Commission. In addition the panel has undertaken its own questionnaire survey. The panel met a large number of employees of the European Commission, and held meetings with national representatives in France, Germany, Italy and United Kingdom. There has been a number of technical restrictions on the panel’s work. The panel therefore wants to emphasise that significant gains are possible in the quality and usefulness of evaluations by the provision of better working conditions for evaluation panels.

(Section 2. Methodology)

The panel has considered the areas and priorities chosen in the various areas of the Quality of Life and Management of Living Resources Programme and the preceding programmes. There is a reasonable continuity in programme areas and the changes implemented in FP5 have been advantageous. A number of the priorities are, however, so broadly phrased that they can only serve as vague indications about the areas of research to be covered.

The European Union’s FP5 accounts for only about 5.4% of the total public effort in research in Europe and therefore it is necessary to consider this expenditure in conjunction with national efforts. In this connection it is important to stress that there is a need for continuity as well as flexibility in a research system. Furthermore there is a need for both a short-term view and for a longer-term consideration of the future of the European research system. The recent Commission paper "Towards a European Research Area" is a welcome initiative in this direction.

The panel has studied the methods used for programme formulation and priority setting. It finds that the present programme on The Quality of Life and Management of Living Resources is too complicated. It may be worthwhile to consider simplifying the QoL programme in the future. The panel also finds it important to solicit the input of the best professional scientists in the
formulation of future Framework Programmes. The panel proposes that the European scientific societies within the Life Sciences be used to provide this input.

(Section 3, Objectives, Areas and Priorities for Research)

The panel has considered the balance between top-down and the bottom-up approaches in the definition and implementation of the programmes. The tendency over the five-year period from FP3 through FP4 to FP5 has been for an increasing proportion of the funding to be directed towards problem solving. The share of generic research in the funding has been decreasing. In FP5 the Key Actions account for 77% of the funding in the Life Sciences. This trend is the opposite of the research strategy followed by the US government.

The sequence of events from basic research to useful applications, including commercial applications, cannot be prescribed. The whole of S&T is dependent on advances in basic research and efficient mechanisms for transfer of knowledge.

Both approaches should be used in different parts of the programme. Means and measures will have to be considered in connection with the special objectives of the many different areas in the programme. The bottom-up approach must be dominant in the areas aiming at supporting the European knowledge base.

There is a general consensus among European scientists and companies that there is a serious discrepancy between the investment required in producing an application and the size of the grant, particularly as the application may or may not result in a grant. It is difficult to get the best scientists to apply if the grants are small, and it is difficult to evaluate the results of the support if the grants are small compared with the national, and maybe other international, support to the research groups.

There is general agreement that the Framework Programmes have had an important role in building up European networks in research and between academia and private enterprises. Also awards for young scientists and grants to increase mobility within Europe receive very positive commendations in evaluations and questionnaires.

There are a number of problems in the present system for evaluation of submitted proposals. There may be advantages in the present system of confidentiality where reviewers come to Brussels for the evaluation, but there are definitely also disadvantages. The quality of the reviewers is important; it is absolutely essential for the quality and reputation of the EU programmes that the refereeing procedure involves the best scientists available in Europe and abroad and that this fact is well-known. The principle of keeping the proposal applicants anonymous when the scientific content of the proposals is reviewed is problematic.

The application procedures, the long decision process, the long time before contracts are approved and delayed payment are some of the major obstacles in the implementation of EU programmes.

Furthermore the EU research programmes have a problem because of a lack of continuity in funding. Project grants are given on a short-term basis, and there will be periods without support, even if a research group continues to get support from the EU from one Framework Programme to the next.
Gaps in EU funding can lead to dismissal of key personnel followed by problems in hiring new people. There is a need for planning ahead for a period that is longer than that of a Framework Programme.

With a stop-go policy and with a lack of long-term support there is a limit to how much influence the EU can achieve through its research programmes, and there is a limit to how attractive EU grants can be. On the other hand there is also a need for flexibility, also more flexibility than at present.

European research in the Life Sciences is dependent on a strong infrastructure, and there is a need for European solutions in key areas. The problem of funding European infrastructure has to be solved in a more robust and transparent way than has been the case so far. The panel wishes to emphasise the importance of bioinformatics and, in this connection, The European Bioinformatics Institute in Cambridge.

The panel wants to stress the importance of follow-up of programmes and project grants. Follow-up procedures can with advantage be combined with dissemination of results. It is however an obstacle for the follow-up work that the Commission is understaffed in the management of research, and that the present, highly qualified, personnel is overworked.

This analysis has led the panel to a number of recommendations including proposals for a new EUROEXCELLENCE programme, for EUROEXCELLENCE CAREER AWARDS and for EUROPEAN GRADUATE SCHOOLS:

It is important to maintain the present distinction between policy-driven Key Actions and Generic Activities. The Key Actions must be defined in accordance with national programmes, i.e. in the context of the development of the European Research Area (ERA). EU funding should be considered together with national funding in each country.

Funding for generic Life Science research must be increased substantially within the next Framework Programme. One way to proceed would be to design a strategy that gives freedom to the researchers to define themes, size of teams and methods of funding. The panel suggests that this part of the Framework Programme be called EUROEXCELLENCE. The aim should be to promote excellence in Europe by networking and competition for quality, and it should encompass new developments in key and emerging areas of the Life Sciences. In order to harness European strengths and to achieve critical mass, the Commission should consider the possibility of including in the EUROEXCELLENCE programme platform proposals, to be supported by substantial block grants, and solicited from consortia of scientists defining an area for funding. The grants, which should be of at least a four-year duration, would be managed by the consortium and subjected to external mid-term evaluation. To ensure the quality of the selection process, evaluation of the EUROEXCELLENCE network and platform proposals would be best handled by outside bodies comprised of highly qualified scientists, for example, by European agencies designed for the purpose. The mechanism of sub-contracting has to be worked out, but models already exist in the Commission. By installing this new scheme for reviewing, a clear signal would be given to the life science community that the EUROEXCELLENCE programme strives for true innovation as well as scientific excellence.
Such an initiative could run in parallel with similar national programmes. It will be valuable to encourage the same form of thinking both nationally and at the EU level.

To promote excellence in the Life Sciences even further, a part of the next Framework Programme should be aimed at the career advancement of young researchers, with particular consideration given to the difficulties of young scientists in managing careers and families. EUROEXCELLENCE CAREER AWARDS should be distributed through this part of the Framework Programme, guaranteeing funding for a minimum of five years in order to support a sustained research effort. The awards given should include recognition of the needs of young researchers to take short career breaks for maternity/paternity and childcare.

The next Framework Programme must continue to fund training and mobility. A programme for EUROPEAN GRADUATE SCHOOLS should be started at Centres of Excellence in all Member States. This programme should be directed towards the encouragement and training of doctoral students in the Life Sciences to work across interdisciplinary boundaries.

The next Framework Programme must provide support for the establishment, maintenance and especially use of key infrastructure elements and major scientific facilities. The establishment and support of infrastructure or major facilities must be based on real needs, high quality and European Added Value. Areas requiring special attention are, for example, bioinformatics, DNA and protein chip technologies, proteomics, transgenic and other biological repositories, agricultural biological databanks, research in health technology assessment, electronic publishing and access to information in electronic form.

The funding application processes must be made more user-friendly by restructuring the web sites and application forms with the aim of simplicity, and by increasing the transparency of the grant reviewing process. The expertise of the review panels is of the outmost importance.

It is necessary to pay greater attention to the need for continuity in EU funding.

At the same time it is necessary to allow for more flexibility and to facilitate new initiatives within the frames provided by the Framework Programmes.

(Section 4. Means and Measures)

There is a need for close co-ordination between Community and Member States’ research policies. In this connection there is a need for a better understanding of the role of EU research programmes. EU funding constitutes only 5.4% of all public research funding in Europe. In most cases, and in most Member Countries, EU support is ‘additional’ money, it is a national responsibility that there are universities and other research institutions which can receive EU grants, and there is nearly always a need for additional national financing.

There is a need for the exchange of information on EU and Member States’ RTD programmes in all fields of research, and this exchange should result in the publication of scientific and technological audits and analyses of what is going on within the EU and the Member States.
However, **before too much effort is spent on databases, there should be a better understanding of how they can be used and who the customers for databases are.**

The panel suggest that **both in EU programmes and in national programmes a small part of the resources (say 10%) is reserved for co-operation between research teams working in the same new and important areas, or reacting to crisis situations.**

**Co-ordination and co-operation is not only a question of the formulation and implementation of European programmes but also of using the European policies as a basis for formulation of national policies. There can be large advantages for the Member States in using this input. Co-ordination can only be accomplished if there is a common need and if all partners have a real interest. Efficient co-ordination depends to a very large degree on efforts in the Member States. Co-ordination is difficult, however, because of different timetables, different institutional structures, different budget systems and different objectives.**

(Section 5. Complementarity of European and National Efforts)

The concept of European Added Value is clearly recognised in the five-year assessment of the European Community RTD Framework Programmes report by the independent expert panel chaired by Viscount E. Davignon and published early in 1997. Despite that there is in practice no common definition of European Added Value within the services of the Commission. At present the concept is used in many different contexts and there has been so many different interpretations that it can be used to justify almost anything.

EU RTD programmes have been successful in **the establishment of networks, furthering collaborations between researchers in academia and those in the private sector, and in supporting researcher training and mobility.** To a certain degree EU programmes have supported the creation of a supra-national European research infrastructure and access to large-scale facilities. EU funding has enabled **the conduct of multinational epidemiological studies and clinical trials.** EU support is of importance for **research which will serve European policies.**

The panel wants to stress the importance of a **strong European effort on standardisation depending on the Life Sciences.**

The panel proposes that a definition of European Added Value be based on the Davignon Report. The definition must take the following into account:

- **The need for a European infrastructure within the Life Sciences.**
- **The value of scientific networks across Europe and including both the public and the private sector.**
- **The importance of research which can only be done at the European level (for example in epidemiology and other health areas).**
- **The importance of efforts which will increase the qualitative level of European research within the Life Sciences and enhance the strength of the European science base.**

(Section 6. European Added Value)
European research generally and within the Life Sciences is of high and, in many cases, of outstanding quality. It is easy to compare European research with research elsewhere. It is on the other hand difficult to measure the effect of single research programmes. This is because ‘quality’ as an abstract concept is misleading. There is no such thing as absolute quality. Quality must be assessed in connection with objectives and contexts. It is also difficult to assess because nearly all research today is performed with multiple funding and because there is a time delay in publication of research results.

The panel is in no doubt that European support from the programmes in the Life Sciences has been used to sustain and create outstanding research. The Commission has provided the panel with descriptions of many successful research projects supported by the EU. However the problems of quality control must be addressed. The panel recommends that:

**The present efforts to measure the quality and quantity of European research and also research in the individual European countries, and to compare with research elsewhere in the world, must be continued and strengthened.**

**The Commission must increase efforts in following up grants, both to support and evaluate grant holders as well as to obtain feedback on impact, results and problems.**

(Section 7. Quality of Research Funded through European Programmes)

For the benefits from science and technology to be realised the outputs from the research laboratories must be taken up by those in a position to exploit them to create new processes, products or services. The Framework Programmes have created the structures within which collaborative research can be encouraged and flourish. However, despite the existence of these programmes for over a decade, it is still evident that Europe lags behind the USA in harnessing its S&T for the improvement of its competitive position in world markets. **One of the most obvious flaws in the present arrangements is that these do not permit the rapid movement into new, or emerging, areas of science and technology and the development of the critical mass of expertise and facilities required.**

The technology transfer process, which should ideally be a continuum, is in fact more often discontinuous, with a ‘development gap’ between the generators and the potential exploiters, a gap which prevents successful exploitation.

There is a need for a change of policy in the public funding of research to include grants for ‘proof of concept’ research in academic laboratories or in technology incubators. There is also a need for changes in attitude of private investors.

Dissemination of new knowledge occurs via traditional and electronic publication in the scientific literature and the presentation of data and results through national and international conferences, through patenting and through transfer of tacit knowledge. **Publications must be known and recorded, simply because of the need for accountability. Also there must be a continuous collection of the information about patents as output. Mechanisms for the continuing oversight of the programme output must be developed.**
Networks are important in the dissemination of knowledge. In this connection it must be stressed that the management of networks is of central importance.

This analysis leads the panel to the following recommendations:

The application, selection and contracting mechanisms are too rigid and long to allow the flexibility and speed required in today’s world for rapid response to emerging threats and opportunities.

Advanced training courses should be organised for staff involved in research administration and policy implementation, for technology transfer officers and for patent lawyers in the biosciences throughout Europe.

Effort is needed to create Foresight initiatives that will identify the cutting edges of S&T, the needs of the market place and the means to supply the market, and the new fields of S&T in which the S&T workforce must be trained in order to meet future challenges.

The panel has identified a number of areas in which action is needed as a matter of urgency. These include: research to understand the functions of important developmental and disease-associated genes; "proteomics" and structural chemistry; environmental research in many fields – from gene flow in natural and genetically modified plants and other organisms, to the effects of global warming on the natural environment and new disease threats; S&T needed to underpin sustainable agriculture; research on novel biocompatible materials, medical devices and implantable control systems.

The current efforts to encourage and promote co-operation between industrial research and universities and public research institutions must be continued and strengthened.

(Section 8. Impact and Contributions to European Competitiveness)

The CAP and CFP and other EU Common Policies all require research to assist with the policy development and implementation process. However there is a need for balance between independent, policy relevant research and policy driven research. Research can contribute with new approaches to old problems and with the formulation of new problems.

Research with relevance for policy requires an active co-operation between social and economic scientists, scientists from the natural sciences and semi-permanent adequately funded networks.

The present efforts in FP5 to increase the contributions from research to European policy should be continued and strengthened. There is an increased need to focus on long-term anticipatory research to address future needs.

(Section 9. Contributions to European Policies)

FP5, through a kind of ‘social contract’, aims to create a real reciprocal relationship between the socio-economic development in the EU and RTD policies. Moreover, a remarkable effort has been made in
order to assess the long-term contribution of EU funded RTD to the improvement of social wellbeing in a broad manner.

It is important to identify and discuss not only acute and pressing problems connected with competitiveness and economic growth but also the long-term problems facing the world and Europe as part of the world. There is, in principle, a close positive link between economic growth and the quality of life and wellbeing. But the bond is only positive if long-term aspects of economic growth are taken into account.

Currently humans are destabilising the ecological and social system in a dramatic way. If this continues, it will of course result in an equally dramatic reduction in economic growth or even in economic decline. We therefore have to secure our environment and our ecological base and we have to use science-based and intelligent precautionary measures instead of relying on repair strategies.

It is necessary to perform anticipatory research concerning agriculture, aquaculture, forestry, water-management and the impact of climatic changes. The increasing necessity for health promotion and preventive medicine instead of or in addition to the medical treatment of diseases provides another example of the need for an approach to the quality of life which involves more than just a concern with economic growth.

Maybe many of the long-term problems are not mainly problems for research. Better economic and social conditions, for example, may be more important for their solution. But the problems must be discussed in a research context and taken into consideration in the planning of future Framework Programmes. The problems underline the need for long-term research, in obvious conflict with the present programme structure.

As a conclusion, the panel therefore wants to stress the importance of addressing major long-term problems for the 21st Century – in all areas within the Life Sciences. The problems can only be addressed through a dialogue between the scientists, the politicians and the public.

(Section 10. Contributions to the Quality of Life and Wellbeing)

The enlargement process is inducing changes in the research priorities of future Framework Programmes. This is to be expected, especially in the Quality of Life area, where there will be an increasing need to intensify research, for example in areas such as environmental health, public health, ecotoxicology and chemical risk assessment. It is important to look for specific strongholds of research in the candidate countries and to help foster their existing centres and possibilities for scientific excellence.

The EU should design research programmes specifically aiming at improvements of the local situations in the applicant countries. The newcomers should be helped to develop their pre-existing strengths, in particular where these are complementary to what is already present in the EU.

The measures for promoting research expertise in regions of Europe with a comparatively minor research volume (essential considering the enlargement of the European Union) must be
reconsidered and reshaped. The Framework Programmes should support existing strengths. Cohesion in the research area should be funded by other existing EU programmes.

(Section 11. Challenges of Enlargement)

Efforts to promote the possibilities for female scientists must be supported and increased. In particular the panel recommends that EU grants be always sufficient to cover the full expenses in case of maternity.

(Section 12. Gender Issues)

FP5 is the first Framework Programme to place a special emphasis on the ethical dimensions of the Community research priorities, but within FP3 and FP4 a number of ethical projects were funded. There were about 60 such projects in FP4, accounting for about 1% of the total budget.

Within the generic research part of the Life Sciences area, a special research activity on bioethics has been identified in the work programme, focusing on ethical analysis of scientific and technical developments, of legal and regulatory measures and on special studies relating to biomedical ethics and bioethics. However, very limited generic research activities in bioethics have been funded in FP5 so far. This is due to low visibility in the promotion of this area of research and to the handling of the proposals received in the Quality of Life area. This reality is in strong contrast to the message from the European Parliament and the Council in the decision on FP5 and the specific programme on the Quality of Life in upgrading bioethics and mainstreaming ethical principles into Community research.

A key challenge in the future will be to address ethical perspectives, including the ethical perspectives of ecological problems, both in general and in connection with actual funding of projects.

(Section 13. Ethical Perspectives)

A facet of science policy that can no longer be ignored is that of ensuring that advances in science and technology, which have the potential to lead to improved quality of life and creation of wealth, find acceptance with the public. It is also important to maintain a positive image of science so that bright young scientists from the new generation will choose a career in science. This applies especially at the level of the Member States but is important at the European Community level as well.

In much of Europe there is now a clear anti-science attitude developing in many segments of the public and this will, if not corrected, lead to a failure of public support for new developments and to reduced recruitment with adverse effects on European competitiveness. If Europe is to benefit from the new technologies, many of which are developed by the European public and industrial science bases, and reap the rewards from their exploitation, serious consideration must be given first to understanding public positions, and then to taking steps to increase public understanding of, and confidence in science and technology.

A major deficit has been the failure of the scientific community to explain and discuss its own research in public. This must be essential if trust in science and scientists is to be engendered in the public mind. Therefore, funding should be made available within FP5 and future Framework Programmes to provide
training and development of communications skills in scientists and technologists. In particular training
directed at communicating through the press and media should be provided.

Thus the panel recommends that timely and pre-emptive action is taken now through FP5 and later
through FP6 to create the public climate that will be required if new developments are to be effectively
translated into new products for the benefit of the European Community.

The efforts to promote the public understanding of, and confidence in the Life Sciences must
continue. This is an important issue that demands much more attention than it has received until
now.

(Section 14. Public Perception of Research in the Life Sciences)
Appendix I

THE QUESTIONNAIRE SENT OUT BY THE PANEL, THE RESPONDENTS AND SUMMARIES OF THE RESULTING ANSWERS

1. Introduction

The panel sought to obtain the views of leading Life Scientists in academia, industry and government about the research programmes of FP3, FP4 and FP5 by means of a questionnaire. The panel e-mailed/faxed 85 questionnaires to companies, of which 16 (18.7%) sent a response and a total of 200 questionnaires to scientists in academia, of whom 122 (61%) replied. This Appendix includes:

- A copy of the questionnaire that was used.
- A summary of the main points to emerge from all the completed questionnaires.
- A list of all those who replied.
- A more detailed summary of the answers, by sector.

2. The panel's questionnaire

The questionnaire was sent to leading life scientists in both academia and industry. It was amended slightly for the respondents in the agriculture, fisheries and forestry sectors.

QUESTIONS TO LEADING LIFE SCIENTISTS

YOUR AREA OF RESEARCH: ........................................................................................................................................

\[\begin{array}{ccc}
\text{d) HAS YOUR INSTITUTE/DEPARTMENT/COMPANY RECEIVED EU FUNDING FROM EU FRAMEWORK PROGRAMS 1994-1999?} \\
\hline
\boxed{\text{YES}} & \boxed{\text{NO}}
\end{array}\]

\[\begin{array}{ccc}
\text{e) SUMMARIZE THE MAJOR ADDED VALUE OF EU FUNDING FOR YOUR RESEARCH, PARTICULARLY AS COMPARED TO NATIONAL FUNDING?} \\
\hline
\boxed{\text{YES}} & \boxed{\text{NO}}
\end{array}\]

\[\begin{array}{ccc}
\text{f) SUMMARIZE ANY POSSIBLE DRAWBACKS OF EU FUNDING.} \\
\hline
\boxed{\text{NO}}
\end{array}\]

\[\begin{array}{ccc}
\text{g) THE FIFTH FRAMEWORK IS MAINLY DIRECTED TOWARDS PROBLEM SOLVING. IS IT YOUR IMPRESSION THAT THE BALANCE OF BASIC RESEARCH / APPLIED RESEARCH / COMMERCIAL RESEARCH IN THE FUNDING PROGRAMMES FOR THE LIFE SCIENCES HAS BEEN CORRECT?} \\
\hline
\boxed{\text{NO}}
\end{array}\]
If no, specify with respect to the Third, Fourth and Fifth Framework programs. What balance do you think is desirable?

h) What is your experience with the quality of the expert panels evaluating EU research proposals?

i) Is the quality of EU grant reviewing higher, lower, or similar than for national funding in your country?

j) The quality of life funding for the Fifth Framework strives to focus EU research under selected key actions in order to meet the primary needs of society. What is your evaluation of this strategy for funding research?

k) One major goal of EU research funding is to improve the commercial exploitation of European research efforts. From your viewpoint, comment on whether the EU Framework programs have been successful in this respect.

l) A pre-requisite to commercial exploitation of research results is to secure intellectual property rights. Has the EU had an impact regarding the critical issue of technology transfer?

m) Training and mobility have been essential components of the Framework programmes. Your comments on the impact of these programmes.

n) Summarize the EU funding programmes 1994-1999 that you have found most useful.

o) Summarize the EU funding programmes 1994-1999 that you have found misdirected.

p) One important recent element of EU Community Research Policy has been the contribution of research to Quality of Life in areas such as conservation of the environment, measures to combat natural and man-made hazards, health and food. Your comments on the impact of this strategy?

q) The EU framework programs have helped less favoured regions to catch up in science and technology. Your comments on these efforts?

r) There are too few women scientists in leading positions. Have the EU framework programs been helpful in solving this problem?
3. Summary of the main points to emerge from the completed questionnaires

3.1. *The perceived value of EU research funding*

Although spanning such a broad range of interests the responses from the academic and the research institution sectors were surprisingly consistent. In general, the value of European funding was the broadening of the range of collaborations and, particularly for companies, providing access to new knowledge and the strengthening of in-house core competencies. Networking across national boundaries brought together researchers who would otherwise not have collaborated and this element of European strengthening was felt to be of decisive importance. For industry an additional aspect was the opportunity such funding provides to carry out fundamental research and ‘proof of concept’ studies with academics which they could not fully fund or carry out themselves.

Another element of the FPs that received general praise was the funding of pre-doctoral and post-doctoral fellowships. This funding is valued because it has dramatically contributed to increasing the mobility of young researchers in both academia and industry in Europe. This feature is of decisive importance for training as well as for innovation.

In the academic molecular life science community there seemed to be more support for funding of programmes such as BIOTECH and BIOMED than for the Key Actions of FP5. There was an overwhelming majority that felt that the policies are going too far towards problem solving and towards prescribing which areas are fundable and which are not. It is felt that these top-down approaches leave too little room for the researchers themselves to decide what are or are not innovative themes. Many scientists perceive the funding programmes as too restrictive and unimaginative to capture the best research in Europe. Industry on the other hand was less clear on this matter. Some companies expressed
the view that the funding should be directed more at the fundamental or generic end of the spectrum, leaving companies to fund applied research from their own budgets. However the opposite view, that there should be a more applied or commercial emphasis, was also expressed. One company pointed out that the balance between basic and applied research must depend upon the area of R&D and also on Europe’s competitive/technological position in a worldwide context. Most companies welcomed the greater emphasis on exploitation in FP5 although there was also some cynicism about this with one company suggesting that it is too early to know if this is \textit{“more a matter of rhetoric rather than one of substance”}.

3.2. The application and evaluation procedure

Both academics and industrialist were critical of the application and evaluation procedures. The instructions are considered too complicated and the whole procedure too protracted. Some would-be applicants consider the efforts that are required to submit an application too time-consuming and costly to justify the returns. The rate of success and the size of the grants are too small. One opinion voiced is that the EU programmes try to do too much with too little money.

The reviewing process also received considerable criticism. An apparent lack of competent reviewers on the boards and complicated and unusual reviewing practices contributed to this perception. Some respondents believe that evaluation may be based on real understanding of the applications but some showed \textit{“shocking misunderstandings (or incompetence)”}. The view was also expressed that, whilst the science and technology evaluation phase was mostly convincing and expert, the second phase of evaluation based on socio-economic value was not clear. One industrial respondent was emphatic that some poor decisions are made with good projects being rejected whilst poor ones are funded.

3.3. Support for less favoured regions

The efforts to promote research in less favoured regions are met with overall support from academics but a majority find the measures used so far to be insufficient and should be given much more careful consideration. However, these efforts are met with less enthusiasm from companies. Several companies expressed the view that it is not in the EU’s interest to try to develop less favoured regions using Framework Programme R&D funds. It may lead to \textit{“catching up”} being at the expense of holding back others, and that other EU R&D funds should be used to support and maintain centres of excellence in research. It was suggested that other structural funds should be used to help less favoured regions and that there should be a strategy for creating a separate budget line for \textit{“catching-up”} objectives.

3.4. EU funding to meet the needs of society

Most industrial respondents felt that the strategy underlying the Quality of Life Programmes in FP5 aimed at meeting the primary needs of society was good in principle but may fail in practice. The academic community was divided in its opinion but the majority did not believe that the goals could be achieved with the means given. The strategy needs to be made understandable to applicants. There should also be good complementarity with Member States’ policies otherwise there is likely to be an uneven development of Life Sciences research across the EU. Respondents pointed out that the needs
of society are constantly changing and so FP strategies should be adjusted from time to time to keep up with change. However, the FP approach was seen as being impervious to change, leading to intended focus being lost. It should allow for versatility of funding over the four-year period. The response to the question whether EU Key Action programmes in areas such as conservation of the environment, measures to combat natural and man-made hazards, health and food are successful was non-committal. The majority sees the goals as admirable but difficult to achieve with the funding available.

3.5. Improving exploitation and technology transfer

In general companies and the academic respondents did not believe that EU research funding was successful in improving the commercial exploitation of European research efforts. However, one company pointed out that it was now more successful than before because of the involvement of more SMEs in the networks. Companies also said that although FP5 emphasises and encourages exploitation, this should not be to the detriment of the quality of science. The panel was given no examples of commercialisation or significant industrial gains arising from FP research, and it was suggested by one respondent that commercialisation had not succeeded because of the term ‘pre-competitive research’ and its use as a merit for funding – “pre-competitive and commercial appear as concepts difficult to match”.

Companies were clear in their view that the EU has had an impact on improving technology transfer and securing intellectual property rights. There was a view however that the EU has attempted to face problems caused by technology transfer but that it has not been a driver for the creation or development of instruments to protect IPR. Some companies indicated that the provisions for the ownership and protection of IP in FP5 was better and clearer than before. One company also said that the current technology implementation plans and consortium arrangements in FP5 are subject to clear-cut contractual arrangements and that this served to highlight transfer of technology.

3.6. Training, mobility and developing the European scientific workforce

The training and mobility components of the Framework Programmes received support from companies and most were very positive in their views about the mobility schemes such as the Marie Curie Fellowships. One large organisation expressed the view that the schemes foster the “desirable European R&D attributes”, which include training in centres of excellence, mobility and cultural diversity. Others agreed that the schemes were the main assets of EU R&D Programmes and that they fostered European mobility, counteracted the attraction of the USA, and enhanced collaboration. These positive appraisals were shared by the academic respondents. The highlight of the EU research programmes is the support for training and mobility in Europe.

Two questions addressed the development of the European science and technology workforce, these concerned the development of women scientists for leadership roles and the other, more generally the encouragement of young researchers.

The unanimous view of companies on the first question was that the EU has not been successful and doubts were expressed about whether the FP funding should be used for this purpose. There was broad agreement that excellence should be the first priority and there should be no sex discrimination measures to correct the situation.
On the question of supporting and assisting young investigators to overcome the difficulties they face in establishing themselves as independent scientists most industrial respondents considered that EU funding programmes had not been helpful. However, some suggested that the EU’s training and mobility initiatives have helped to a degree. It was suggested by some respondents that the peer review system worked against young researchers because of the emphasis placed on track records, established labs and the big names. Various suggestions were made to solve the problem, most of which involve the creation of new schemes aimed specifically at young researchers. In contrast, the academic community was supportive of measures to promote careers of young investigators in general and of women in particular. Most considered that this is an area where EU funding could play a more important role than until now.

3.7. Framework Programme 6

A wide range of suggestions and recommendations for FP6 were proposed by both the academic and the industrial communities (see under paragraph 5 later).

Overall, from the replies received, it seems that one real and important issue of concern is that so many leading life scientists, in both academia and industry, perceive the Framework Programmes as not yet mature enough to serve the real needs of the scientific community and also of society. It is apparent to the panel that the scientific community, although not unanimous, would welcome dramatic changes in the future FP to correct the present deficiencies. The principle of European Added Value in EU funding is perceived as real and therefore the programmes could do much more for Europe if they were able to build on and harness the existing and emerging strengths of European Life Science research.

4. List of questionnaire respondents

4.1. Environmental Health/Public Health (12 replies (70.6%) of 17 questionnaires sent)

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANISATION / LOCATION</th>
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<tbody>
<tr>
<td>Dr. Ilse-Dore Adler</td>
<td>GSF, Neuherberg, Germany</td>
</tr>
<tr>
<td>Prof. Helmut Bartsch</td>
<td>German Cancer Research Centre, Heidelberg, German</td>
</tr>
<tr>
<td>Dr. Paolo Boffetta</td>
<td>IARC, Lyon, France</td>
</tr>
<tr>
<td>Prof. P.H.M. Lohman</td>
<td>Rijksuniversiteit, Leiden, The Netherlands</td>
</tr>
<tr>
<td>Dr. Peter Farmer</td>
<td>MRC, Leicester, UK</td>
</tr>
<tr>
<td>Prof. Kari Hemminki</td>
<td>CNT, Novum, Huddinge, Sweden</td>
</tr>
<tr>
<td>Prof. Jussi Huttunen</td>
<td>National Public Health Institute, Helsinki, Finland</td>
</tr>
<tr>
<td>Prof. Manolis Kogevinas</td>
<td>University of Barcelona, Spain</td>
</tr>
<tr>
<td>Dr. Marianne Minkowski</td>
<td>European Science Foundation, Strasbourg, France</td>
</tr>
<tr>
<td>Dr. Godfried Thiers</td>
<td>Institute of Public Health Louis Pasteur, Brussels, Belgium</td>
</tr>
<tr>
<td>Prof. Harri Vainio</td>
<td>Karolinska Institute, Stockholm, Sweden</td>
</tr>
<tr>
<td>Dr. Paolo Vineis</td>
<td>University of Turin, Turin, Italy</td>
</tr>
</tbody>
</table>
### 4.2. Agriculture, Fisheries and Forestry (18 replies (64.3%) of 28 questionnaires sent)

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANISATION / LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. R. Biston</td>
<td>Ministere des Classes Moyennes et de l’Agriculture, Centre de Recherches Agronomiques (CRA), Gembloux, Belgium</td>
</tr>
<tr>
<td>Prof. Dr. Winfried E. H. Blum</td>
<td>University of Agricultural Sciences, c/o Institute of Soil Research, Vienna, Austria</td>
</tr>
<tr>
<td>Dr. Steen Bonde</td>
<td>Department of Research and Development Directorate of Agricultural and Fishery Development, Copenhagen, Denmark</td>
</tr>
<tr>
<td>Prof. Dr. Ettore Bove</td>
<td>Università degli Studi della Basilicata, Facolta di Agraria, Potenza, Italy</td>
</tr>
<tr>
<td>Prof. Dr. W. Diepenbrock</td>
<td>Institute for Plant Cultivation, University of Halle, Germany</td>
</tr>
<tr>
<td>Dipl.-Ing. Elfriede Fuhrmann</td>
<td>Federal Ministry of Agriculture, Forestry, Environment and Water, Vienna, Austria</td>
</tr>
<tr>
<td>Prof. Dr. Markus F. Hofreither</td>
<td>University of Agricultural Sciences, Institute of Economics, Politics and Law, Vienna, Austria</td>
</tr>
<tr>
<td>Prof. Dr. Herbert Hager</td>
<td>University of Agricultural Sciences, Institute of Forest Ecology, Vienna, Austria</td>
</tr>
<tr>
<td>Prof. Dr. Dietrich Knorr</td>
<td>Berlin University of Technology, Department of Food Biotechnology &amp; Food Process Engineering, Berlin, Germany</td>
</tr>
<tr>
<td>Prof. Dr. phil. Margit Laimer da Camara Machado</td>
<td>University of Agricultural Sciences, Institute of Microbiology, Vienna, Austria and University of the Azores, Terceira, Portugal</td>
</tr>
<tr>
<td>Prof. Dr. Bernd Marin</td>
<td>European Centre for Welfare Politics and Social Research, Vienna, Austria</td>
</tr>
<tr>
<td>Dr. Klaus Osterrieder</td>
<td>BFAV, Friedrich-Loeffler-Institute, Institute of Molecular Biology, Insel Riems, Germany</td>
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<tr>
<td>Prof. Dr. Otto Rechlin</td>
<td>Institute for Fisheries in the Baltic Sea, Rostock, Germany</td>
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<tr>
<td>Dr. Wolfgang Ritter</td>
<td>Bureau for International Agricultural Research, Senate of the German Federal Agricultural Research Institutes, Bonn, Germany</td>
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<tr>
<td>Prof. Dr. P.A.Th.J. Werry</td>
<td>Agricultural Research Department, Wageningen, The Netherlands</td>
</tr>
<tr>
<td>Dr. Monique van Wordragen</td>
<td>Agrotechnological Research Institute (ATO), Business Unit Agro-Industrial Product Chains, Department Post-Harvest Quality of Fresh Products, Wageningen, The Netherlands</td>
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<tr>
<td>Unnamed</td>
<td>ID-Lelystad-Wageningen, Lelystad, The Netherlands</td>
</tr>
<tr>
<td>Unnamed</td>
<td>Directorate of Science and Promotion of Knowledge, University of Wageningen, The Netherlands</td>
</tr>
</tbody>
</table>
4.3. Marine/Fisheries/Aquaculture (16 replies (57.1%) of 28 questionnaires sent)

**NAME**                  **ORGANISATION / LOCATION**

Dr. Eero Aro                University of Helsinki, Finland
Dr. Geir Bloom              University of Bergen, Norway
J. De Boer                  Netherland Institute for Fisheries Research RIVO, Wageningen, The Netherlands
Prof. Peter Boyle           University of Aberdeen, UK
Alexis J. Conides           National Centre for Marine Research, Athens, Greece
Jacques Fuchs               Institut Francais de Recherche pour l'Exploitation de la Mer, Issy-les-Moulineaux, France
Otello Giovanardi           ICRAM, Chioggia, Italy
Prof. Henrik Gislason       University of Copenhagen, Denmark
Hillel Gordin               National Centre for Mariculture, Department of Fisheries Aquaculture, Tel Aviv, Israel
Bernard Jalabert            Institut National de la Recherche Agronomique, Rennes, France
A. Kamstra                  Netherland Institute for Fisheries Research RIVO, Wageningen, The Netherlands
S. Kaushik                  Institut National de la Recherche Agronomique, Saint-Pee-sur Nivelle, France
Prof. Katherine Richardson  University of Aarhus, Denmark
Dr. Kevin Stokes            CEFAS, MAFF, UK
Josiane Stottrup            Danish Institute for Fisheries Research, Lyngby, Denmark
Marcelo de Sousa Vasconcelos Instituto de Investigacao des Pescas e do Mar, Lisbon, Portugal

4.4. Molecular Life Sciences/Infectious Diseases/Medicine (76 replies (48.1%) of 158 questionnaires sent)

**NAME**                  **ORGANISATION / DEPARTMENT**                          **TOWN /COUNTRY**

Prof Dr. Guenther Kreil    Institut fuer Molekularbiologie Oesterreichische Akademie der Wissenschaften Salzburg Austria
Prof. Dr. Erwin Wagner     I.M.p. Institute for Molecular Pathology Vienna Austria
Prof. Dr. Georg Wick       Institute for General and Experimental Pathology University of Innsbruck, Medical School Innsbruck Austria
<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Location</th>
<th>Country</th>
</tr>
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<tbody>
<tr>
<td>Prof. Dr. Georg Stingl</td>
<td>Division of Immunology, Allergy &amp; Infectious Diseases</td>
<td>Vienna</td>
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</tr>
<tr>
<td>Prof. Dr. Heinz Huber</td>
<td>Internal Medicine I, Oncology</td>
<td>Vienna</td>
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<tr>
<td>Prof. Staffan Normark</td>
<td>Dept. Microbiology and Tumor Biology Center</td>
<td>Stockholm</td>
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<tr>
<td>Prof. Jan-Ake Gustafsson</td>
<td>Dept. Department of Medical Nutrition</td>
<td>Huddinge</td>
<td>Sweden</td>
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<tr>
<td>Prof. Olle Stendahl, Secretary General</td>
<td>Dept. Swedish Medical Research Council</td>
<td>Stockholm</td>
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<tr>
<td>Prof. Ulf G. Pettersson</td>
<td>Dept. Department of Medical Genetics</td>
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<tr>
<td>Prof. Kenneth Nilsson</td>
<td>Dept. Department of Pathology</td>
<td>Uppsala</td>
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<td>Prof. Bertil Daneholt</td>
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<td>Prof. Claudio Sunkel</td>
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<td>Prof. José Feijo</td>
<td>Instituto Gulbenkian de Ciência</td>
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<td>Prof. Dr. Maria João Saraiva</td>
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<tr>
<td>Prof. Manuel Sobrinho Simoes</td>
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<tr>
<td>Dr. P. Borst</td>
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<tr>
<td>Prof. Dr. F.G. Grosveld</td>
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<tr>
<td>Prof. Dr. H.J. Geuze</td>
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<tr>
<td>Dr. Rudy Dekeyser</td>
<td>Vice-director at the Headquarters of the Flanders Interuniversity Institute for Biotechnology</td>
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<tr>
<td>Prof. Dr. Thierry Boon</td>
<td>Director of The Ludwig Institute for Cancer Research - Brussels Branch</td>
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<tr>
<td>Name</td>
<td>Position/Department</td>
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<tr>
<td>Prof. Dr. Christine Van Broeckhoven</td>
<td>Department Neurogenetics</td>
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<td>Prof. Detlev Ganten</td>
<td>Max-Delbrück-Centrum Medizin Berlin-Buch</td>
<td>für Molekulare Medizin Berlin-Buch</td>
<td>Berlin-Buch, Germany</td>
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<tr>
<td>Prof. Harald zur Hausen</td>
<td>DKFZ</td>
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<td>Heidelberg, Germany</td>
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<tr>
<td>Prof. Dr. Peter Gruss</td>
<td>MPI für Biophysikalische Chemie</td>
<td></td>
<td>Göttingen, Germany</td>
</tr>
<tr>
<td>Prof. Dr. Heinrich Betz</td>
<td>Abt. Neurochemie</td>
<td>MPI für Hirnforschung</td>
<td>Frankfurt/Mann, Germany</td>
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<td>Prof. Dr. Detlef Schlöndorff</td>
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4.5. Pharmaceutical/Biotechnology/Biosciences Companies (16 replies (18.7%) of 85 questionnaires sent)

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<th>COMPANY</th>
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<tr>
<td>Aventis Pharmaceuticals</td>
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<td>BASF</td>
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<td>Glaxo Wellcome plc</td>
<td>Greenford, UK</td>
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<td>Knoll AG</td>
<td>Ludwigshafen, Germany</td>
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<td>Laborratorios Del Dr. Esteve SA</td>
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5. **Summary, by sector, of the main points of the questionnaire answers (numbers refer to questions in the questionnaire)**

### 5.1. *Environmental Health/Public Health Scientists (12 replies)*

**Q1.** All respondents have received funding, most have been involved in proposal evaluation panels and are generally well aware of the EU systems.

**Q2.** Increasing collaboration, possibility to multicentre projects, increase of funding in launching new projects also from national sources considered as major added value.

**Q3.** Drawbacks include mainly:
* enormous administrative efforts and delays in contracts and payments
* discontinuity of different FPs and too short duration of programmes
* too rigid structures to follow really new innovations during the course of the contract
* some improvement seen in FP5.

**Q4.** Too little emphasis on basic research. Less commercialism, more social goals.
* "Basic research is the engine of new developments in Europe".

**Q5.** Expertise has disappeared from the panels, too few good experts, too many civil servants. Worries about what happens after the expert panels. Need of anonymity of the reviewing process is questioned. Inadequate comments reveal the lack of scientific competence.
* "The evaluation process in FP5 was disastrous".
* "July 1999 evaluation was the most frustrating experience in my scientific career".

**Q6.** Many still consider the evaluation process better than in their own countries.

**Q7.** "Needs of society" ill defined, less ad hoc problems but better science. Innovative research is often outside the predetermined priority areas.

**Q8.** Quality and relevance must come before commercialisation. Results in research have been generally successful.
* "Bureaucracy in Brussels prevents adequate dissemination of results".

**Q9.** The efficient use and display of the findings is absent. Not relevant for the area.

**Q10.** Training and mobility programmes have been successful, should be better when coupled with excellent local training programmes. Better co-ordination with other European fellowship programmes. Mobility programmes insufficient.

**Q11.** Various programmes mentioned.

**Q12.** Management satisfactory. Loss of continuity in too frequent shift of personnel at EC. Lack of funds in BIOMED 2 slowed down research.
Q13. Less ad hoc changes in policies.
Q14. In principle works well, but poorer quality prevents their "taking aboard".
Q15. The problem with women scientists has to be solved locally. Not enough has been done. Not an issue in FPs.
Q16. Mobility of scientists is too low. Special granting possibilities for young scientists. European Graduate School System is needed. Pilot projects for young scientists required.
Q17. There should be a greater involvement of scientists also in planning. The evaluation system is not working as it should - study section approach individually, followed by scientific plenary assessment by true experts. Research should be focused in areas where Europe is good or what can only be done in Europe. Topic suggestions include:

* ageing technologies
* AIDS
* unhealthy behaviour
* methodological improvements (cheaper analytical methods)
* efficacy and safety of alternative medicine and food supplements
* chemoprevention of diseases
* individual susceptibility
* genetic risk assessment.

5.2. Agriculture, Fisheries & Forestry Scientists (18 replies)

a) Administrative issues:

- There is an imbalance between the administrative efforts required and the funds granted.
- The long delays in payments and great tardiness of final payments result in grave financial difficulties for smaller and young research units.
- The narrowing of the offered scope (i.e. clearer targeting) in the agricultural field increased the probability of acceptance of proposals and was judged positive.
- The objectivity of the EU administration sometimes brings more discipline to national research.
- There are problems with the evaluation of interdisciplinary projects as regards where to apply and who is able to evaluate properly. The attitudes are split about EU evaluation procedures. Those involved in generic research dislike the lack of transparency but those in problem-oriented research have only minor criticisms and do not question the overall process.
- The possibility of obtaining funding for knowledge protection in FP5 was much welcomed.

b) Material issues and decisions:

- There is need for precautionary and anticipatory research (not only immediate competitiveness).
- There is too much focus on immediate application; agricultural and forestry research need longer time frames.
- Less favoured regions also need a longer-term incentive (building up of appropriate structures).
- The scientific and long term value of research proposals in the agricultural area are often under-estimated in relation to actual political dimensions.
- FAIR was considered a very good programme for addressing crop husbandry, crop physiology and quality of primary products.
- In contrast, the Key Actions of FP5 are well targeted but do not address vital long-term questions; longer-term basic research is also necessary in agriculture and forestry.
- The food chain should be enriched by relying on new varieties instead of manipulating the genomes of the few species under cultivation, and new conservation techniques and combinations of them should be applied.
- Social sciences are undervalued but they are important for addressing social problems as well as for aiding the acceptance of science in general.
- Due to the multifunctional character of agriculture and forestry; higher interdisciplinarity and flexibility between Key Actions should be made possible; the restructuring of landscapes and agroforestral ecosystems is not addressed properly.
- The wood chain should encompass the whole supply system, including soil physiology and biodiversity, cascading use and recycling.
- This should be the case as well for the food chain. The ideal long-term sustainable design should be circular. It should include sustainable primary production systems and a nature-compatible recycling of by-products and faecal matter.
- The fact that the problems of the ageing population are no longer considered to be solely a medical technology issue was welcomed. Conditions, institutional systems and instruments to enable an active, participatory ageing are all key areas of research. Active ageing can lead to lower health service costs and thus a high indirect pay-back.

5.3. Aquaculture Scientists (10 replies)

Q1. All respondents had experience of EU FP’s.
Q2. EU funds represent a significant part of the budget of the research institutions coming from sources other than national funding (up to 95% in one case). National funds are too low, or decreasing. EU funded activities include FP’s RTD projects and DG14 studies in connection with Common Fisheries Policy. Encouragement of international co-operation with new European partners. Better transparency for the selection of projects. Mid-term duration of projects (3 years). Respect of contractual dates for granting (delays may be due to national organisations). Facilitate exchanges of researchers within the EU, completion of costly experiments. Allow an evaluation at EU level of national laboratories. CRAFT gives valuable contacts with commercial enterprises in different EU countries. In short, invaluable support in both funding and close interaction between the EU and associated countries improving scientific quality. In the longer term, the latter is probably more important than the former.
Q3. Complexity of the management of EU RTD projects is a major constraint for the co-ordinator. The administration cost is significant. A tendency to select same research objectives at both European and national level, with a danger of loss of true innovation. Intellectual property issue, but in common with any international research organisation. Developing projects is time-consuming; the low success rate of acceptance makes this task a risky and expensive business. A lack of adjustment mechanisms to changing project situations. A rather long delay between
project submission and contract signature. In short, too much bureaucratic work, too long delays and low success rate.

Q4. Five answers "yes", three answers "no", with a demand for a slight shift towards more basic research. The remaining two do not know the actual balance in FP5 and cannot answer the question.

Q5/6. Eight respondents consider that EU evaluation is of a sufficiently good quality, of whom four assume that it is of a higher quality than national evaluations. One respondent raises the question of the complete neutrality of evaluators who are often direct competitors for EU funds. The last respondent has the worst impression of the EU evaluation system, and states that every scientist around 40 years old with a PhD can be entitled to evaluate proposals that they do not even understand (because they do not speak fluent English); surprisingly, this answer states that the EU evaluation system is of a higher quality than that of the national funding system. In summary, the EU evaluation is considered to be good quality, and generally higher than the national evaluation systems.

Q7. Most respondents agree with greater or lesser enthusiasm with the strategy of FP5. One person underlines the need for a slight shift towards basic research (same as above) and another states that he does not understand the explanation on Key Actions, technological issues and supporting initiatives given by the EC. There is rarely originality in the description of the "primary needs of the society"; as mentioned above, there is a general trend to standardisation of research projects and potential loss of innovation. In summary, no real problems with the new strategy of FP5.

Q8. Most respondents state that due to the long delay between the scientific results and the development of a new activity and product, the time scale of an RTD project is not appropriate to a stronger link between research and commercial ventures. Research results should also be disseminated more actively by the Commission. SME's are also afraid, more than the scientific institutions, of the EU bureaucracy and payment delays.

Q9. Most respondents show a real difficulty in understanding the question. Contradiction between public money and the utilisation of results by a given private company is underlined. Respondents are probably not aware of the way it works. Too long delays complicate the transfer process.

Q10. For a majority of respondents, it is probably the most important positive aspect of EU funding, even if not exploited to the same extent by all Member States. Still, some respondents state that the calls for proposals for the Training and Mobility Programme are not very clear, and the long delays for selection (6 months) is also criticised.

Q11. Generally, RTD projects and CRAFT procedures are appreciated. Several respondents had insufficient time to answer in more detail.

Q12. The Training and Mobility Programme is considered misdirected. Again, several respondents had insufficient time to answer in detail.

Q13. Most respondents agree on the fact that there is a real contribution to environmental issues, especially on food safety and environment. Anthropogenic long-term effects and natural hazards are not really taken into account in the QoL Programme.

Q14. A generally controversial issue. For some respondents from less favoured countries, this is a very important point, even a 'cornerstone' of the EU programme. In this group, one respondent expresses scepticism due to national fraud and bad management of funds received from the EU by the national government to help in developing research. Another group thinks it is a good
point from a theoretical point of view, but considers that it should concentrate on training through mobility, and the new 'return grants' are strongly recommended. Others think it can be useful for infrastructure. It is not clear whether all respondents know the difference between FP funds and Structural Funds.

Q15. Again a controversial question. Three respondents consider that the proportion of women working in research is acceptable, and the opportunities equal. For one respondent, this is generally a "false problem". For another one, there is no special mention of this question in the information package. Another group of five respondents agree that there are too few women in leading positions. Some consider that the question should be solved at national level. Others make suggestions, such as special grants for pregnant or working mother scientists or preferential choice of women in expertise committees by the EC.

Q16. More opportunities should be given in terms of grants. Several respondents are not in favour of independent scientists, because they will not be very efficient by themselves. Some suggest an increase in national positions so as to respond to the demand. Others propose that it is better to help the young scientists find positions in private companies (those are against the idea of developing a large pool of post-docs working all their lives in non-permanent positions). In contrast, two respondents ask for up to five-year post-doc grants to help better young scientists find positions in scientific institutions. More mobility within the national recruitment systems is also advocated.

Q17. Two respondents do not tackle this question or consider that it is too early to make conclusions about the orientation of FP5. Two others are satisfied with a continuation along the present lines. The remainder makes proposals in the field of both themes and organisational areas. For instance, water management, food safety, are cited several times. Evaluation of the administrative task, reducing bureaucracy, increasing transparency and reducing delays and changing the 'mental attitude' of the EC staff is also recommended. Several respondents agree about the need to maintain a strong effort on EU research, increase the available funds, facilitate exchange of scientists, keep to a given strategy (and why not the FP5 strategy?) on a long term basis (five years). Individual answers underline the need for a better co-ordination between EU research orientation and national ones, while others want to separate academic research projects from applied research and commercial ones, in different calls for proposals. FP6 should not be too commercial, some more basic research is needed, with a greater emphasis on environmental research. One respondent welcomes an evaluation of the evolution of national research communities (gain or loss of competencies induced by the programme).

5.4. Marine/Fisheries Scientists (6 replies)

Q1. All had experience with EU grants.
Q2. Only one definitely preferred national funding. Main positive points were: extra funding, closer collaboration with other countries’ scientists, encouragement of interdisciplinary research, complementary usage of large resources (research vessels), scientific exchange.
Q3. The main negative points were: inadequate funding, too slavish an insistence on deliverables, burden of formal reporting, forced collaboration, risk of homogenising of European research effort, work lost in EU reports, reduced emphasis on basic research.
Q4. Respondents were divided but the responses suggest that (a) basic research is desirable, and (b) that the EU is probably best suited to funding practical research (particularly under FP5).

Q5. Answers were variable on the evaluation process. Some respondents seemed happy, others not. The main points mentioned were: panels are under too much pressure, science evaluation is OK but relevance evaluation is doubtful, expert evaluation is patchy and idiosyncratic, expert boards might be a better idea - perhaps co-opted for limited terms.

Q6. Lower or similar were the typical replies.

Q7. Generally positive responses about this but Key Actions were felt to be loose in the marine area, so probably not a serious constraint on many proposals.

Q8. Not a very relevant question in the marine science area.

Q9. Not relevant again - no comments.

Q10. Replies were generally positive - seen as a positive help to young researchers.

Q11. Comments very varied so not helpful, but FAIR often received a positive mention.

Q12. Few replies. One suggestion that MAST and FAIR should have been combined.

Q13. Generally positive responses (not surprising in a field where this is the main goal of research) but impacts at present seem to be seen more in terms of greater knowledge and publication rather than in direct improvements to QoL.

Q14. Responses mainly positive though tempered with a feeling that "those that already have the ability in less favoured regions receive the most”.

Q15. Four said "no" and one "yes" (last one no response). One respondent had a strong suggestion for an affirmative action response.

Q16. Most respondents seem negative or doubtful that it has been helpful but several feel that it is a national rather than an EU problem. The main suggestion is to make some proportion of money exclusive to young researchers.

Q17. Variety of answers, from basic science to institutional changes, and suggestions for themes.

5.5. Molecular Life Scientists (68 replies)

Q1. The overwhelming majority has had experience with EU grants.

Q2. Network funding allows for European collaborators otherwise not fundable; increased value for training and mobility.

Q3. Main drawbacks are: enormous bureaucracy; application forms too complicated; delay in payments; too little funding to justify the effort; funding is too specific to allow for creativity and innovation; continuity of funding is a problem

- A lot of time is spent filling out forms rather than improving the research proposal.

Q4. More than 80 % feel that problem-solving has been given too much emphasis; more room for bottom-up projects;

- More high quality research!
- Far more basic science and no “pretend to be industrial” contracts.
- FP5: A killer for basic research!

Q5. The evaluation process receives poor feedback; one week is too long for a review; anonymous reviewing makes little sense; complaints that the reviews are not sent to the evaluators – this makes reviewing unprofessional due to the lack of facilities for background information e.g. Pubmed etc. The FP5 evaluation panels have too many non-experts; complaints that potential
evaluators have to fill out long application forms in order to be considered for the review panels: many highly qualified scientists never answer.

- **Top scientists do not participate in reviewing because of frustration.**
- **Unfocused – can the best be mixed with the worst.**
- **The quality level of panels progressively decreasing.**

**Q6.** The majority feels that the evaluation process is of a similar or lower quality than in the Member States; a minority states that EU reviewing is of higher quality but these scientists usually come from less favoured regions.

**Q7.** A majority considers Key Actions not a successful strategy for capturing the best research; difficult to define the needs of society; scientific excellence should be the driving force.
- **Nice for politicians bad for science.**
- **Naive and misguided – does not understand the driving force behind science and will fail to meet society’s needs.**

**Q8.** Few believe that commercial exploitation is aided by EU funding; the network strategies are too complicated and do not follow the rules of how biotech companies work.

**Q9.** Most think not or do not know.

**Q10.** Fellowships, workshops and training programmes receive almost unanimous support and praise.

**Q11.** See Q10; BIOTECH and BIOMED of FP 3 and FP4 receive support; shared cost RTD actions.

**Q12.** FP5 received little support: too many restrictions to provide funding for honest proposals; in general the Key Action strategy is criticised; clustering is specifically criticised.
- **Improve FP4 programmes – never again FP5.**

**Q13.** In general, this strategy received support. Otherwise the intentions of these programmes are honourable and justified. However, few think that the Key Actions as now drawn up will have any real effect.

**Q14.** The efforts to help less favoured regions to catch up are generally considered successful. But many, especially scientists in the less favoured regions, feel that the efforts have not been successful yet and that more should be done.

**Q15.** The majority feels that this is an important issue where EU funding could do more; specific actions should be initiated; EU funding for maternity leave should be obligatory.

**Q16.** A majority considers that the issue of young investigators is important and neglected. EU funding could contribute to improve the situation but so far too little has been done for the post-doc phase.

**Q17.** Suggestions for Framework Programme 6:

- EU investigatorships with full research funding for young scientists to start their independent research.
- Involvement of the best life scientists to formulate the programmes.
- Network funding should be more flexible so that the participating scientists can propose in each case what they really want to do. There are too many artificial networks presently. There will be more European Added Value if the networks are driven by the real interests of the scientists and not by their desire to get more funding.
- National centres of excellence should get European funding, for instance to initiate European graduate schools.
- Fund European infrastructure facilities serving the life science community.
• Better evaluation procedures. One suggestion is to outsource the review process to European agencies or national research councils. Reviewing process should be transparent. Composition of panels should be known to the applicants.
• More EU activities to promote a better public understanding of ethical and health issues in biotechnology.
• Training programmes for students from the Third World.
• Finally less top down and MORE BOTTOM-UP STRATEGIES FOR EU funding in the Life Sciences.

5.6. Medicine/Infectious Diseases Scientists (8 replies)

Q1. All except one have had EU funding experience.
Q2. The value of EU funding was considered high (one respondent), 20% of the total funding (one respondent) and not so important in quantitative terms yet of major help for solving complex funding problems and for stimulation of European co-operation.
Q3. Bureaucracy, delay in funding, too low a success rate for applications, non-transparent reviewing system.
Q4. The answer was one in favour but six against, with the additional comment that there was not enough basic research (3x), clinical research (1x) and that there should be less commercial impact.
Q5. The reviewing system was considered poor or of variable quality; only one respondent considered it acceptable.
Q6. The EU reviewing rated higher (1x), similar (1x) and lower (5x).
Q7. Key Actions were considered adequate but there was some query as to their selection.
Q8. There was only limited experience among those that answered. Individual comments related to the view that large companies are not interested in the funding and EU funding is unrealistically low for costly projects.
Q9. With little experience of all, one suggested legal standards for transfer of materials.
Q10. Unanimous praise for this part.
Q11. Marie Curie named by many; individuals cited network programmes, BIOMED, BIOTECH, fostering of public awareness of science.
Q12. Most authors abstained; one criticised the preponderance of basic science over RTD, the handling of the clusters and the electronic handling of applications.
Q13. While most answers were in favour, two considered the point of minor scientific importance.
Q14. Most respondents did not have experience, though one considers it important to evaluate the strengths and weaknesses of new members.
Q15. A split answer was given; a specific programme was recommended.
Q16. All answers were negative. A special programme for young research group leaders was recommended.
Q17. The long list included: more mobility, five-year funding for independent young scientists, a rare diseases programme, also less administrative effort, better preparation of programmes and less overbooking for the latter.
5.7. Pharmaceuticals, Biotechnology, Biosciences Companies (16 replies)

Of those replying 8 were large pharmaceutical/chemical companies and 8 were SMEs.

In some cases the replies were far from complete and a number of questions were not addressed. Replies to the questionnaire were, for most questions, very varied and the main points raised by the companies are summarised below to give the general flavour of the responses.

Q1. Of the 8 large companies all but one had received EU funding from the Framework Programmes. Of the smaller companies five had received funding. Each of the four non-recipient companies provided their views of the FPs including the reasons why they did not apply.

Q2. In general the most valuable aspect of EU funding was the access it gave to a wider basic science base for the companies. This was felt by some to be useful in broadening their range of collaborators. Other widely cited benefits were that it provided access to sources of new knowledge to build on the core in-house competencies, and also to new developments as they emerged.

Some companies used FP projects as a means of exploring basic enabling research which could not be funded internally, or to carry out ‘proof of concept’ research in areas in which the company had little or no expertise.

A number of companies considered that the Fellowship programmes – such as the Marie Curie Industry Host Fellowship Scheme - were of value in creating opportunities for companies to take on, and learn from scientists from other countries.

In a number of responses, particularly from large companies, the value of having their own research subjected to peer review and endorsed was regarded as a benefit of FP funding. The point was also made by a Spanish company that FP funding provided a substantial contribution to the national research spend because internal funding was scarce. This company also made the point that acceptance for FP funding served to give them credibility internally which provided the prospect of better funding for them at the national level.

One of the less cited benefits, but also a real one, was the opportunity that participation in FP research gave for the development of management skills of young researchers.

Q3. The almost unanimous drawback to EU funding for companies is the heavy bureaucracy which the application, approval and implementation processes involved. Most respondents complain of the over-complicated and tardy nature of EU processes, and the excessive administrative load it puts on potential applicants. Those not participating in EU FPs gave these as the main reasons why they did not get involved. For example:

“After balancing the likelihood of obtaining funding and the workload to complete the application, we have always decided not to apply”
The amount of money available and the high rejection rate, with the consequent perceived low likelihood of success, is a barrier to applications particularly among the SME sector.

Other disadvantages cited include a lack of flexibility in the rules applying to funding, and the tardiness of payments being made from Brussels. In the former case two issues were raised. One is the requirement for a number of companies to be engaged in the project which is seen by some companies as not workable - or not desirable - particularly where confidentiality or competitiveness is important. The other issue cited is the lack of flexibility of funding beyond the project’s official end date. The problems of recruitment of researchers to projects may be slow and result in late starts. However, the lack of flexibility results in an inability to extend the project and use the funding after the official end dates after delayed starts.

Q4. Companies expressing a view on this issue are equally divided between “yes” and “no”. Some expressed the view that the funding should be directed more at the basic or generic end of the spectrum, and leave companies to do what they do better and fund applied research from their own budgets. Another view was that there was too tight a linkage to political targets which “can be sold at the next election”. The opposite view was however also expressed, i.e. that there should be a more applied or commercial emphasis. However, one company pointed out that the balance between basic and applied research must depend upon the area of R&D and also on Europe’s competitive/technological position in a worldwide context.

One company was clear that although the FP3 and FP4 purported to aim at the fostering of research with industrial and commercial objectives, these were not achieved. There was however some recognition in the responses that FP5 is better than FP4 in emphasising exploitation. One respondent was cynical about this and added the caveat that it is too early to know if this is “more a matter of rhetoric rather than one of substance”.

Other points made under this question were as follows:

- Any attempt of EU funding for overtly commercialisable R&D “is largely delusional and will prompt unrealistic expectations in the political community and in the EU population.”

- Some concern was expressed that the evaluators may not have a clear understanding of the commercialisation potential and may avoid recommending projects where there is some risk in the commercialisation process.

- EU funding should aim to support the best quality science rather than attempting to be “even-handed”, or to cover every area regardless of the EU’s competitive potential.

- EU funding should be used to promote investigator mobility across Member States and between academia and industry.

- EU funding should not be used to support research with “no realistic chance of (eventual) application.”
Q5. Again there were mixed responses to this question. In general the feeling is that the quality of evaluation by expert panels is generally “good” or “OK”. However, there are some who draw attention to problems. Some respondents point out that sometimes evaluation may be good and based on real understanding of the applications, whilst at other times there are “shocking misunderstandings (or incompetence)”. The view was also expressed that, whilst the phase in which the science and technology was evaluated was mostly convincing and expert, the second phase of evaluation based on socio-economic value was not clear. One respondent was emphatic that some poor decisions are made with good projects being rejected whilst poor ones are funded.

The method of evaluation which brings panels to ‘locked-door’ meetings in Brussels comes in for criticism and this and other aspects of the Commission’s process were seen as creating artificial constraints.

Another point made was that it seemed that newcomers to the EU Funding process did not do well until they had “established their credentials by demonstrating a longer-term commitments to the EU Programmes”, and that there was an arbitrary preference for known participants. Yet another comment was that there is a certain bias with “the North of Europe imposing its weight to the South”.

Q6. The answers to this question ranged from “higher” to “lower”, with some inconsistency. Thus two German companies’ experience was that it was higher than the national quality, whilst another company from the same country regarded the quality as lower. The answers were also different between companies in different Member States.

Q7. Most respondents felt that the strategy was good in principle but there was a widespread feeling that it can fail in practice. One small company said simply that it was “good in theory but bad in practice”. Whilst others agreed that the strategy was alright they said it needs to be made understandable to applicants. Furthermore, there should be good complementarity with Member States’ policies. Without this there is likely to be an uneven development of Life Sciences research across EU.

The question was raised by respondents of what are the needs of European society and who defines them? It was pointed out that the needs of society are changing and thus FP strategy should be periodically rectified to keep up with change. The FP approach is impervious to change and thus concepts, and thus the intended focus is lost. It is driven by politics and does not allow for versatility of funding over the four years.

Other views expressed include the following:

- FP5 is confused and tries to cover all bases. There should be more selectivity for emphasising areas of EU strength: failure to do this is likely to result in EU research being mediocre.
- “Key Areas” and “Generic Activities” are concepts which are reasonable in theory but garbled in practice, and the two seem to be are unrelated instead of being complementary.
- In the short term the strategy is not particularly successful; but may in the longer term create effective European “research constellations”.

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- Industry finds it difficult to fit into areas of activity in the FP. Company research scientists do not find it easy to identify areas of participation and, where topics of interest to them extend over several Key Actions, proposals are perceived to have practically no chance of support.
- There are timing problems for companies trying to fit into the FPs.

Q8. The general response to this question is “no it has not been successful”; although one company points to “moderate success” in Sweden. Another said that it was more successful than before because more SMEs are involved in the networks.

One respondent points out that the EU is not an effective mediator of commercial exploitation and it should recognise this. Exploitation is best left to direct contact between R&D consortia and industry and the EU should not interpose its bureaucracy. It should not spoon-feed companies “lacking the sense to look for new opportunities to exploit R&D themselves”. Such spoon-feeding is doomed to failure and encourages a dependency culture.

No examples are given of where there have been commercialisation or significant industrial gains arising from FP research. It was suggested by one respondent that commercialisation had not succeeded because of the term ‘pre-competitive research’ and its use as a merit for funding – “pre-competitive and commercial appear as concepts difficult to match”.

It was pointed out that although FP5 emphasises and encourages exploitation, it this should not influence funding decisions to the detriment of quality of science.

Q9. Seven companies expressed no view on this subject; some had had no relevant experience on which to base a view. Others were clear that the EU had made no impact on this matter. However, it was pointed out that the provisions for the ownership and protection of IPR in FP5 was better and clearer than before, with the IPR being vested in industrial partners where there were any. It is not clear that there has been an increase in awareness of the need to protect IP where there was no industrial partner; although one company felt that there has been an increased awareness of IP issues by universities and that the EU has had some impact on technology transfer. Others said that there had been impact but that obtaining funding for IP protection is difficult. The EU has attempted to face problems caused by technology transfer but has not been a driver for the creation or development of instruments to protect IPR. (Probably this means they have done nothing to make patenting simpler and cheaper). Another view was that the current technology implementation plans and consortium arrangements are subject to clear-cut contractual arrangements and this served to highlight transfer of technology.

Q10. This was the one issue in the questionnaire which received considerable support from most companies. Three had no views. One large company felt the failure rate was too high and that the funding achieved was low compared to the cost of putting in proposals and so they no longer apply. One was not sure about the impact. However, most companies were very positive in their views about the mobility schemes such as the Marie Curie Fellowships. One large company was glowing in its praise, and regarded these schemes as the most effective part of Framework Programmes. They also said that the responsiveness of EC staff in this area was exemplary, with the process being relatively
non-bureaucratic. They felt that the schemes foster the “desirable European R&D attributes”, which include training in centres of excellence, mobility and cultural diversity.

Others agreed that the schemes were the main assets of EU R&D programmes, that they fostered European mobility and counteracted the attraction of the USA, were essential for the improvement of the skills and values of post-docs and were beneficial as they enhanced collaboration.

**Q11.** Most companies did not provide an answer to this question. Those that did listed various programmes, including: FP4 and FP5, IMT, ESPRIT, SMT, FAIR, JOULE, BRIDGE, Marie Curie Industry Host Fellowships, Cell Factories, BIOMED, BIOTECH (ethical, legal and social aspects), programmes on the brain or ageing. All views were different and there was no consensus.

**Q12.** Again most companies declined to provide any answer. Of those that did, each had a different complaint. One said that the Life Sciences Programmes were overbooked or not up to international research standards. Another pointed to the many were areas included in programmes in order to maintain an unnecessary degree of comprehensiveness. Another view was that there was a paucity of coverage of chemistry, particularly medicinal chemistry and allied fields, in which Europe has strengths. This they said was a persistent flaw that the EU has refused to address. A third cited the Development Fellowships in the TMR programme specifically for less favoured regions.

Finally one company mentioned the lack of co-ordination between EUREKA and other EU programmes, and the lack of co-ordination between the different programmes involving Life Sciences.

**Q13.** In general those companies responding to this question felt that the these issues had little impact on their activities and interests, and had little commercial value. Some however considered it a good thing that the FP did have some emphasis on these issues. One large company cautioned against the EU “choosing its R&D foci primarily on the basis of popular mythology (or demonology)”. They suggest that “some other foci in FP4/5 have been far less justifiable “soft” options”.

**Q14.** In general most of those answering this question were doubtful.

The point is made by several companies that it is not in the EU’s interest to try to develop less favoured regions using Framework R&D funds. It may lead to ‘catching up’ being at the expense of holding back others. A number of respondents make the point that EU R&D funds should be used to support and maintain centres of excellence in research, and another that the EU’s main competitor – the USA – would not divert funds away from their centres of excellence to develop less favoured regions. “The EU should favour areas (geographic and technological) with a realistic chance of becoming or staying competitive on a global scale.” This implies making hard choices and abandoning some areas of technology and leaving some regions to be net importers of technology. Another view, along the same lines, was that we “should like to have the best groups work together“.

Others tended to echo the same sentiments albeit in less strong terms. One company believes that it is “futile to try to bring whole EU to some common level of technological capability”. Another suggested that “these efforts (are) overestimated and constructed which is not in favour of any party”. Another
said that efforts in this direction are “interesting for the development of these (less favoured) regions but of relatively low interest for short-term competitiveness”.

On the more positive side, one company thought these efforts were “reasonable”, and another believed that the one significant technology transfer in this respect is the transfer of people and skills within the EU, which is hard to quantify. One respondent suggested that FPs had helped to a minor extent, but that traditional peer review based methods of allocation of funds make this difficult. They consider that other structural funds have done this better, and propose that there should be a strategy which creates a separate budget line for “catching-up” objectives.

One Spanish company considered that EU FPs had reduced the gap in R&D in Spain, and they now have some centres of excellence but not many in areas of close interest to industry. Spain however still lacked a critical mass of research groups of excellence in areas not covered by FPs.

Q15. The unanimous response to this question was that the EU has not been successful. However, there are doubts expressed about whether the FPs should be used for this purpose, and certainly there was broad agreement that there should be no sex discrimination measures to correct the situation. Excellence should be the first priority and the FPs are not the best way to tackle these problems.

One company agreed that there should be equal access to funding for women but that there should be no social engineering, i.e. no quotas. They suggest that the “EU’s reputation for attending to special interests groups, and its traditional lack of transparency, hinders it from acting effectively in this difficult and controversial area”.

Another respondent suggests that there are now far more women than men PhDs coming through, although there are some very mediocre women with poor leadership qualities. They advocate not doing anything in an attempt to correct the situation quickly - it will do so itself in 10 years!

Among the causes/solutions suggested or proposed by those offering answers are:

- The perceived difficulty of women competing against men in later professional development;
- which puts girls off science;
- The lack of special awards for women;
- The lack of mentors;
- There should be funding grants for women with young children;
- There is a lack of higher academic positions for women;
- It will take time to produce these scientists.

Q16. All but two respondents answered “no”; one did not answer and only one gave a positive response.

It was suggested that the EU’s training & mobility initiatives have helped but there is evidence that FP funded post-docs then expect the EU to help find permanent positions. One respondent suggested that
the problems lie within the national systems and particularly in those countries with an autocratic academic system.

There were other suggestions to account for the present situation, a number of which centres around the problems of getting accepted into the system through the peer review process. Thus funding mechanisms are needed that are not excessively reliant on “track record”, or which favour established labs and big names. It was also suggested that the programmes are too small (presumably with respect to the level of funding), but another suggestion was that young scientists were put off by the “big” nature of FPs - meaning that they will profit less than they would in typical national programmes.

Suggestions for bringing about improvement include:

- Putting a major effort into supporting SMEs - more than is presently defined in FP5;
- Providing more funds for start-up academic positions – i.e. assistant and associate professors within the FPs;
- Providing new “starter” awards;
- Creating a line of action to promote leader roles for young scientists.

Q17. A wide range of views was expressed in response to this question which falls into two broad divisions, structural administrative and scientific. Only one respondent suggested that things should “continue in the same way”. Others suggested that the EU builds on the results of earlier Framework Programmes and uses part of the funding to support good long-term research efforts. Some of the more general remarks include proposals that:

- Successful programmes should be continued and unsuccessful ones discontinued;
- EU Framework funding should be more reactive to new opportunities;
- Funding must be selective and do less, not more. It should be accepted that technological and geographic selectivity will sometimes be painful;
- New science and inventiveness should be encouraged, and funding should be directed towards the best quality science and the best investigators;
- The huge potential for Europe in the Life Sciences should be recognised and preferentially supported;
- Programmes should be more technology-push related than political target-pull related.

Other comments made relate more specifically to issues of Framework Programme structure, administration and science.

Structural issues:

- Develop a better complementarity with national programmes and the identification of specific "niches" for European action;
- Recognition of the value of infrastructures to reach some European goals (e.g. critical mass, catching-up of less favoured regions, development of basic technologies, building up of technological platforms);
• Improvement of co-ordination between programmes dealing with, or targeting, different sectors of socio-economy (agriculture, fisheries, health) and Life Sciences as horizontal instruments;
• Development of scientific and technological “open” discussion in order to identify the industrial use of the information, and an integrated multidisciplinary approach to biomedical activities;
• The EU should do more to seek the advice of industry rather than rely on that of the (academic) scientific community in order to learn about industrially interesting research areas. Scientists in public research institutions are closer to the governments than industrialists, and thus recommendations from Member States are already biased to perpetuate the existing structures of publicly funded research. Under the current structure, there is the danger that the most promising and commercially relevant projects will be performed outside the Framework Programme;
• Recognition that many areas in Life Sciences research are highly competitive between companies, and so do not lend themselves to execution as EU projects (confidentiality risks, exploitation rights of the other partners in the consortium). This cannot be changed by the Commission. However, there are interesting areas of industrially relevant research which are well suited for co-operative research projects, e.g. research on bio-catalysts, development of new methods and tools, etc. These are research areas which will be decisive for the competitiveness of the European biotechnology industry. Unfortunately, for this type of project, no simple and immediately visible advantage for the citizen can be demonstrated;
• The EU should make it possible for one company to have a grant for collaboration with one or a few university groups;
• Emphasise the needs for the projects so that their results reach the market;
• Provision of five-year grants by the EU to encourage more young scientists.

Administrative issues:

• Overhaul contracts and finance departments in the Commission to improve efficiency;
• Provision of guideline documents on administration, and especially finances, for all organisations involved in Framework Programmes;
• Provide guideline documents on project management for research co-ordinators;
• The concept of meetings for research groups is excellent as is the ability to exchange PhD/post-doc researchers for visits;
• Technologically aware industries should be allowed to reap the “commercialisation harvest” unencumbered by bureaucracy, or by the EU’s attempts to intervene, mediate, regulate or control.

Areas of science for future support:

• Applied genomics, proteomics, and follow up of proteomic and functional genomics generated knowledge;
• Chemoinformatics, bioinformatics and structural biology;
• Drug and vaccine delivery mechanisms;
• Role of carbohydrates in cell biology;
• The analysis of environmental consequences of genomic projects;
• Interdisciplinary projects that cross boundaries - such as nanotechnology;
• Support for clinical research programmes, including clinical trials, to support European biomedical SMEs;
• Provision of funding to contribute to the development of new drugs for diseases in developing countries;
• Support for high quality research without focusing so much on “concrete” areas;
• There should be more applied/industry relevant programmes, with more demonstration programmes, and less basic science programmes which are mostly covered by national programmes.
Appendix II

THE VISITS AND MEETINGS ARRANGED BY THE PANEL AND THE PARTICIPANTS AT THESE MEETINGS

A small delegation (composition varied by country) of panel members met national representatives/science policy makers in France, Germany, Italy and the UK. The discussions were wide-ranging and centred on a prepared list of relevant topics, a copy of which is included at the end of this Appendix. A list of the representatives who met the panel members follows under paragraph A below.

In addition, individual panel members held discussions with a few other representatives, as shown under paragraph B.

The views expressed by the representatives at these meetings have been incorporated in the main body of the panel’s report.

A. Meetings with national representatives/science policy makers

1. ITALY - on March 10, 2000, at two locations: Assobiotec, Milan and MURST (Ministero dell’Università e della Ricerca Scientifica e Tecnologica), Rome

<table>
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<tr>
<th>NAME</th>
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<tr>
<td>Dr. M. Agostini</td>
<td>FARMINDUSTRIA</td>
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<td>Dr. G. Caruso</td>
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<td>Prof. S. Cataudella</td>
<td>Dipartimento di Biologia, Universita di Tor Vergata</td>
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<tr>
<td>Prof. A. De Flora</td>
<td>Istituto Chimica Biologica</td>
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<td>Dr. S. Dompè</td>
<td>Dompè Farmaceutici SpA</td>
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<tr>
<td>Dr. G. Fonti</td>
<td>Dirigente Ufficio VI - MURST</td>
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<tr>
<td>Dr. A. Moroni</td>
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<tr>
<td>Prof. E. Porceddu</td>
<td>Facolta Di Agraria, Universita della Tuscia</td>
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<tr>
<td>Dr. U. Rosa</td>
<td>SNIA BPD</td>
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<tr>
<td>Prof. G.T. Scarascia Mugnozza</td>
<td>Facolta di Agraria, Universita della Tuscia</td>
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<td>Dr. I. Turco</td>
<td>FARMINDUSTRIA</td>
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2. GERMANY - on April 6, 2000, at the BMBF (Bundesministerium für Bildung und Forschung) in Bonn.

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<th>NAME</th>
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<tr>
<td>D. Baroke</td>
<td>Deutsche Gesellschaft Luftfahrt &amp; Raumforschung (DLR-PT) (national contact point BIOMED)</td>
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</table>
Dr. W. Diekmann  
BMBF (adviser/expert - retired)

Dr. J. Hornung  
Bundesministerium für Landwirtschaft (BML) (adviser/expert)

K.-H. Jasch  
Senate für Wissenschaft und Kultur, Berlin (representative for the Länder/regions)

Dr. J. Johnsens  
Forschungszentrum Jülich (national contact point FAIR)

Dr. P. Lange  
BMBF (head of German delegation QoL)

Dr. U. Lange  
BMBF (adviser/expert)

Dr. H. Lehmann  
DLR-PT (programme co-ordinator QoL)

M. Maes-Baer  
Bundesministerium für Wirtschaft (representative)

Dr. Schäffler  
BMBF (representative)

Dr. S. van Ingersleben  
Bundesministerium für Gesundheit (representative)

Dr. M. Verfondern  
Forschungszentrum Jülich (national contact point BIOTECH)

Dr. J. Vetter  
BMBF (representative)

Dr. J. Zachgo  
BMBF (representative EU QoL)

### 3. UK - on April 7, 2000 in London.

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<tr>
<th>NAME</th>
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<tr>
<td>Tony Burne</td>
<td>Ministry of Agriculture, Fisheries and Food (MAFF)</td>
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<td>Fiona Clouder-Richards</td>
<td>Biotechnology and Biological Sciences Research Council</td>
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<td>Dr. D. Coates</td>
<td>Office of Science and Technology (OST)</td>
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<td>Peter Greenaway</td>
<td>Department of Health</td>
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<td>Sir Robert May</td>
<td>Chief Scientific Officer to the Government</td>
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<tr>
<td>Anne Mogg</td>
<td>Ministry of Agriculture, Fisheries and Food (MAFF)</td>
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<td>Carthage Smith</td>
<td>Medical Research Council</td>
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<tr>
<td>Dr. J. Taylor</td>
<td>Director General of the Research Councils, OST</td>
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<tr>
<td>Jacky Wood</td>
<td>Department of Trade and Industry (DTI)</td>
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### 4. FRANCE - on April 17, 2000 at INRA (Institut National de la Recherche Agronomique) in Paris.

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<tr>
<th>NAME</th>
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<tr>
<td>Dr. M. Bariteau</td>
<td>INRA, Unité de Recherches Forestière Méditerranéennes, France</td>
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<tr>
<td>Jean-Pierre Broyart</td>
<td>CNRS-DRI, Paris, France</td>
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<tr>
<td>Jacques Fuchs</td>
<td>IFREMER, Affaires Européennes, Issy-les-Moulineaux, France</td>
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<tr>
<td>Paul Jamet</td>
<td>INRA-DRI (national contact point QoL), Paris, France</td>
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<tr>
<td>Paul Janiaud</td>
<td>INSERM-DRI at CLORA, Brussels, Belgium</td>
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B. Meetings with representatives of other organisations

- Dr. Claude Kordon, Institut de Recherche Necker, Paris, France / EMRC (European Medical Research Councils) representative (in Copenhagen, on April 15, 2000).

- Dr. M. Minkowski, EMRC, Head of Unit at the ESF (in Strasbourg, on March 29, 2000).

- Mrs. E. M. McNally, Member of the European Parliament (telephone conversation only, on April 14, 2000).

INITIAL LIST OF TOPICS TO BE DISCUSSED WITH RELEVANT NATIONAL REPRESENTATIVES (France, Germany, Italy, UK)

- Added value and complementarity of the past Framework Programmes. National needs.
- Focussing/ key actions/ structure of FP5.
- Exploitation, and intellectual property.
- Training and mobility.
- Help to young scientists and women.
- Role of industrial research in the Framework Programmes.
- European research and ‘Quality of Life’ / ‘wellbeing’.
- Your suggestions.
- The issue of top-down, bottom-up research.
- Why is the balance so heavily biased towards problem-solving research?
- Are there any concerns with the evaluation procedures for framework proposals?
- Where should basic research be done - Europe or member states?
- What opportunities and what organisational problems are foreseen with enlargement?
- Contributions to European policy? Objectives, areas and priorities.
- Quality and efficiency of EU research programmes.
- Correspondence and complementarity with national research policy + with national policies on programme related issues.
- National system for receiving EU grants. Means and measures.
Appendix III

SELECTED LIST OF THE MAIN REPORTS, DOCUMENTS, ETC.
MADE AVAILABLE TO THE PANEL BY THE EUROPEAN COMMISSION

The Commission made available to the panel a very large amount of data, duly studied by the panel members, in the form of reports, lists, statistics, communication papers, brochures, publicity material, books, lists of personnel, etc. It is impossible to list every item but the more major or useful information sources that were used are indicated in random order in the following list.

A. General background to the Five – Year Assessment

For general information about the European Institutions including links to official documents, please consult the Website: http://europa.eu.int/
Press releases concerning the Life Sciences Programmes from 1998 to 2000, can be found on the Website: http://europa.eu.int/comm/research/
FP5 RTD Programme Web Services (much background information on the different research programmes of FP5 can be found on this site): http://www.cordis.lu/

- Decision n° 182/1999/EC of European Parliament & Council (22/12/1998) on the Fifth Framework Programme
- Decision n° 1999/167/EC of Council (25/01/1999) on the Quality of Life Programme and Management of Living Resources
- Council Decision of the 22 December 1998 concerning the rules for the participation of undertakings, research centres and universities and for the dissemination of research results for the implementation of the fifth framework programme of the European Community (1998 – 2002)
- Consolidated version of the Treaty establishing the European Community as amended by the Treaty of Amsterdam (in force 1/05/1999)
- Calls for RTD Proposals in the EC Life Sciences Programmes since 1994.
- Information Package for the FP5 Specific Programme: Quality of Life & Management of Living Resources:
- The FP5 Evaluation Manual (http://cordis.lu/FP5/src/evalman.htm)
- Information leaflet for FP5 contractors : “Intellectual Property Rights Issues within the Community Research and Technological Development Model Contract (Cost Reimbursement)”
- Quality of Life and Management of Living Resources. Papers on : “Relevance of other EU policies to Research” (http://www.cordis.lu/life/src/lib-pol.htm)
• Annual External Monitoring Reports for the three Life Sciences Programmes of FP4: FAIR (Agriculture, Fisheries, Forestry and Agro-Industry), BIOTECH (Biotechnology) and BIOMED (Bio-Medicine and Health) 1995-1998 (twelve documents)
• 1999 External Monitoring Report on the FP5 Specific Programme for Research & Technological Development in the Field of “Quality of Life and Management of Living Resources”
• Annual monitoring reports for the RTD Framework Programmes 1995-1998 (five documents)
• Annual reports on the Research and Technological Development Activities of the European Union 1995-1999 (five documents).
  • 1999: ISSN 0254-1475
• Five-Year Assessment of the European Community RTD Framework Programmes. Report of the independent expert panel chaired by Viscount E. Davignon 1997 (EUR 17644 EN)
• Five-Year Assessment of the Specific Programme "Agriculture, Fisheries, Forestry and Agro-Industry" (1997). EUR 17593 EN
• Five-Year Assessment of the Specific Programme "Bio-Medicine and Health" (1997). EUR 17592 EN
• Report on Options and Limits for Assessing the Socio-Economic Impact of European RTD Programmes (ETAN working group). January, 1999
• Inventing Tomorrow. Europe’s research at the service of its people. Preliminary guidelines for the Fifth Framework Programme. EUR 16961
• CORDIS : RTD Results Supplements. A Quality of Life Special Edition. N° 22 April 2000. ISSN 1022-6559
• Quality of Life Programme Bulletin: http://cordis.lu/life/src/newslet.htm
• Press release (21 December 1999) announcing the funding of the first 307 projects to be funded under the QoL programme

B. A selection of other documents

• Study to evaluate the efficiency and outcomes of the exploratory awards scheme in the 4th Framework Programme, in the frame of the EU Biotechnology Programme. Study made by Essor Europe. October 1999
• External Advisory Group Workshop reports: http://europa.eu.int/comm/research/fp5/eag.html
  (a) Entrepreneurship: Networking of Biovalleys in Europe. Report of a workshop organised under EAG of the Cell Factory Key Action
  (b) GMO Research in Perspective, report of a workshop held by EAG QoL and Management of Living Resources, 9-10 September
• Assessing EU RTD Programme Impact: “Collecting Quantitative and Qualitative Data at Project Level: Designing Suitable Questionnaire for Measurement of EU RTD Programme Impact”. Report by Technopolis Ltd (UK) and VTT Group for Technology Studies (Finland)
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(b) “New possibilities for accessing the capital markets for small and medium-sized Biotech enterprises”. EUR 18908
(c) “The industrial use of genome resources in Europe” EUR 18850
(d) Academic/Industry interface: Optinet “Optimizing European Networks in Biotechnology”. EUR 19068 EN
(e) ”Looking at the biotechnology consumer” EUR 18492 EN
(f) “Communicating Genetic Engineering in the Agro-food Sector to the Public”. EUR 18358 EN
(g) “Cultural and social attitudes to biotechnology; analysis of the arguments, with special references to the views of young people”. EUR 18491 EN

- Projects catalogues for the Life Sciences RTD Programmes of FP3 & FP4 (AIR, FAIR, BIOMED I, BIOMED II, BIOTECH I, BIOTECH II)
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- Lactic Acid Bacteria Brochure “Strategic & Applied Research”
- Reports on Food Research in the FAIR Programme: FLAIR-FLOW EUROPE. F-FE: http://www.exp.ie/flair.html
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• Second Conference of the Biotech & Finance Forum “summary report”. Lyon, Palais des Congrès. 26 to 29 March, 1999
• Press release “EC supports training to help scientists launch biotechnology companies”. Brussels, 21 February 2000
• Peer review evaluation of proposals in the biotechnology programme of the EU (A. Aguilar et al.). Research Evaluation (1998) 7: 141-146
• Industrial platforms – a unique feature of the EC’s biotechnology R&D programme by A. Aguilar et al. (1998) Trends in Biotechnology 16: 365-368
• The Joint Research Centre activities on Environment, Health and Consumer Protection (information leaflets):
  (a) General Catalogue
  (b) “Serving the EU Policies “
  (c) Supporting the Management of Change
Appendix IV

LIST OF EC OFFICERS MEETING WITH THE PANEL

The panel met with several officials of the European Commission, principally in DG Research, who were very helpful in aiding the panel in their work. The following is a list of all those met, mostly by all the panel members, although a few had discussions only or also with particular members of the panel.

<table>
<thead>
<tr>
<th>NAME</th>
<th>RESPONSIBILITIES (only those responsibilities relevant to discussions with panel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Aguilar</td>
<td>Head of Unit, Key Action 3: Cell Factory (FP5 Quality of Life Programme); former Head of the Life Sciences Demonstration Unit (FP4)</td>
</tr>
<tr>
<td>U. Bertazzoni</td>
<td>Head of Unit, Key Action 2: Infectious Diseases (FP5 Quality of Life Programme); former Head of the Medical Research Unit (FP4)</td>
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<td>L. Breslin</td>
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<tr>
<td>M. Cantley</td>
<td>Advisor to Director, Life Sciences Directorate B.I (FP5 Quality of Life Programme)</td>
</tr>
<tr>
<td>P. de Taxis du Poët</td>
<td>Scientific Officer, Key Action 3: Cell Factory (FP5 Quality of Life Programme); Biotechnology Unit (FP4)</td>
</tr>
<tr>
<td>L. Durieux</td>
<td>Representing the DG Research Evaluation Unit</td>
</tr>
<tr>
<td>J. Elizalde</td>
<td>Former Head of Unit, Ethical, Legal Social Affairs (FP4)</td>
</tr>
<tr>
<td>T. Garcia Azcarate</td>
<td>Head of Unit, DG Agriculture: Economic Analysis, Forward Studies and Evaluation</td>
</tr>
<tr>
<td>R. Gerold</td>
<td>Director, Life Sciences Directorate B.I (FP5 Quality of Life Programme)</td>
</tr>
<tr>
<td>X. Goenaga</td>
<td>Head of Unit, Key Action 5: Sustainable Agriculture, Fisheries &amp; Forestry… (FP5 Quality of Life Programme)</td>
</tr>
<tr>
<td>T. Hall</td>
<td>Head of Unit, Secretariat of Committees &amp; Advisory Groups (FP5 Quality of Life Programme)</td>
</tr>
</tbody>
</table>
B. Hansen  Director, Life Sciences Co-ordination Directorate B.0 (FP5 Quality of Life Programme); former Director of Life Sciences & Technologies Programmes (FP4)

F. Heidekamp National Expert, Key Action 3: Cell Factory (FP5 Quality of Life Programme); Biotechnology Unit (FP4)

M. Kavanagh Scientific Officer, Secretariat of Committees & Advisory Groups (FP5 Quality of Life Programme)

P. Kind  Director, Life Sciences Directorate B.II (FP5 Quality of Life Programme)

E. Magnien Head of Unit, Life Sciences Co-ordination; former Head of the Biotechnology Unit (FP4)

B. Mulligan Panel secretariat (scientific officer, FP5 Quality of Life Programme)

C. Patermann Director, Preserving the Ecosystem Directorate D.I (FP5 Energy & Environment Programme)

B. Schmitz  Adviser to Director, Life Sciences Directorate B.II (FP5 Quality of Life Programme)

G. Stroud Assistant to acting Director General

**Meetings were also held with:**

- FP Five-Year Assessment Panel
- 1999 QoL Monitoring Panel
Appendix V

EXAMPLES OF SUCCESSFUL EU FUNDED RESEARCH PROJECTS

This Appendix provides a number of examples of successful projects funded by the EU Framework Programmes, and as described by project managers at the Commission. Some of these are also mentioned as examples of European Added Value in the main body of the report.

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5.1. BIOMED PROGRAMME SUCCESS STORIES

- STAND UP AND WALK (SUAW)
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- CONTROL OF METASTATIC GROWTH BY THE C-MET ONCOGENE.
- IDENTIFYING GENES INVOLVED IN DIABETES
- GENE THERAPY FOR CARDIOVASCULAR DISORDERS

5.2. BIOTECHNOLOGY PROGRAMME SUCCESS STORIES

- EUROPEAN SEQUENCING PROJECTS
- CELL FACTORY PROJECTS
- TREE BIODIVERSITY
- BASIS AND DEVELOPMENT OF MOLECULAR APPROACHES TO NEMATODE RESISTANCE “RENA”

5.3. FAIR PROGRAMME SUCCESS STORIES

- FUNCTIONAL FOOD SCIENCE IN EUROPE (FUFOSE)
- HIGH PRESSURE TREATMENT OF LIQUID FOODS AND DERIVED PRODUCTS
- GENETIC ENGINEERING OF CAROTENOID METABOLISM
- “STORM”: SILVICULTURAL STRATEGIES FOR PREDICTING DAMAGE TO FORESTS FROM WIND, FIRE AND SNOW
- FRACTIONATION OF LUCERNE JUICE TO CREATE NUTRITIONAL AND FUNCTIONAL PROTEIN INGREDIENTS FOR THE FOOD AND NON-FOOD INDUSTRY (FRALUPRO)
5.1. Biomed programme success stories

5.1. (a) Stand Up and Walk (SUAW)

The project started in 1996 as a demonstration project of the BIOMED 2 Programme. The general objective was to restore some locomotion in paraplegic patients, still having below the spinal cord lesion, some muscles that could be electrically stimulated. Presently the number of paralysed patients in Europe can be estimated at 300,000 with a mean age of 31: 65% due to road accidents and 15% to sport accidents.

Scientific achievements:
Based on the scientific literature on the use of functional electrical stimulation to reactivate muscles, the goal of the SUAW project was to create, from the beginning, an interactive multidisciplinary team, mixing the two major mandatory research streams, clinical and technical. An European Clinical Network was created in 1992 grouping in six European Countries (France, United Kingdom, The Netherlands, Germany, Italy and Denmark) a Rehabilitation Team with a competent MD and a physiotherapist and a Surgical Team with an experience surgeon belonging to orthopaedic surgery or neurosurgery. A Rehabilitation Centre, preferably a spinal cord injury unit, which was considered as the reference centre for the country. At the same time, a Technical Consortium was created in the field of microelectronics, computer sciences, implant and electrodes technology and functional evaluation of motor handicap.

After some meetings a common protocol was established, which was the basis of what has to be considered as the main contribution of the project: The SUAW concept of spinal cord rehabilitation. The first phase is devoted to the selection of patients, based mainly on the level of the spinal cord lesion (T4/T11 with a preference of T9, due to the good balance of the trunk), the quality of muscles (volume, excitability, spasticity) and the motivation of the patient, which has to be realistic without any false hope or illusion. The second phase has to be done at home, with the use of stimulation and cutaneous electrodes two hours per day for 2 to 3 months, in order to reinforce the muscles. The third phase has to be made in a referent centre of rehabilitation and consists in a procedure called EXOSTIM. Placing electrodes on the skin in front of the main functional muscles of lower limbs (quadriceps, hamstrings, glutei, dorsiflexors of the foot) connected to the eight-channel stimulator, computer-controlled, which was developed in the framework of the project. The patient can stand up and walk with the help of a walking frame, according to the great difficulty to restore the dynamic stabilisation process, which is permanently needed in a succession of unstable states during gait. The last phase is the surgical implantation. A long training of the surgical group took place on cadavers and living animals in Montpellier and Clermont-Ferrand (France), in order to define very carefully the minimal invasive procedure to put into place the two types of electrodes: neural on an isolated part of the femoral and ischiatic nerves to activate extension of the knee and dorsiflexion of the foot, and epimysial, placed directly on the surface of the muscles close to the motor points to activate flexion and extension of the hips and lateral stabilisation of the pelvis during the stance phase.

The implant itself was made with a chip designed by IBM France and encapsulated by MXM in France. For the first time, was used the combination of neural electrodes stimulated at 2milliA and epimysial electrodes at 25 milliA.

The first selected patient was operated in September 1999, but due to an interference between neural and epimysial electrodes caused by a component failure, he was re-operated in February 2000 in order to put into place the new modified implant. All the
electrodes were tested on living animals models (pigs and monkeys) in order to check the fibrosis around the electrodes, which normally occurs, changing a little bit the stimulation parameters. Special software introduced in a prototype version of the portable programmer is connected to the external antennae transferring power and signals to the implant. The first operated patient is in a training phase and makes substantial progress. The two selected Italian patients have to be operated before the end of the project. The demonstration of the feasibility of a restoration of locomotion by implanted electrostimulation was achieved and in the near future, the major effort has to be done on the miniaturisation of the portable programmer, which plays the role of the brain in storing complex motor programs and in allowing the patient to use them according to his own wishes and needs.

Policy implications:
It seems clear that the multidisciplinary approach was the major aspect of this demonstration project. The enlargement of the clinical network to other European Countries has to be strongly encouraged in order, first of all, to allow any paraplegic patients in any European Country to go into a referent Rehabilitation Centre, to be tested and evaluated and to know, as soon as possible, after the spinal cord lesion, if he/she can enter the program and secondly to create a real telematic link between all the referent centres, in order to facilitate the exchanges of clinical and technical data. Therefore, a financial support has to be found to continue the technical development and to avoid that some patients may not benefit from the program for financial reasons. A European Social Fund based on sponsoring could be a solution, to buy implants and equipment and deliver them to the selected patients. In fact, the critical economical problems of the control of health care costs in all the European Countries has to be taken into consideration for a general policy of promotion of high-tech to improve the quality of life of handicapped persons.

EU Added-Value:
The SUAW project is a success mainly due to the support of Europe and the real existence of a European Research Network, which combines the great variety of cultures of the different countries. If compared with what is done in America and in Japan for electrostimulation, the SUAW project really has a European dimension, which will be improved very soon by the introduction in the Clinical Network of Spain, Portugal, Belgium and Finland. It is a truly unique opportunity for the European Technology to be spread largely and for the handicapped persons to improve their quality of life even if miracles are not possible like the name of the project could lead to believe.

5.1. (b) EuroSIDA

Clinical and virological outcome of European patients infected with HIV.

Scientific achievements:
As of 2000, the EuroSIDA study is the largest, multinational (20 countries, including Poland, the Czech Republic and Hungary), prospective, cohort study of HIV-infected individuals in the world. Over 8,000 patients from 63 clinical sites has been followed for up to 6 years. The geographical diversity allows the EuroSIDA to compare epidemiological trends in progression of the HIV infection and its complications between these countries and regions, and studying long-term outcome. Implementation of new therapeutic strategies in routine clinical management is usually based on controlled clinical trials. In the last few
years, it has been increasingly difficult to evaluate new antiretroviral compounds. Only short-term (up to 48 weeks) randomised studies with virological endpoints has been conducted. This only provides a snapshot of what benefit (or lack of such) the patient may potentially experience from a therapy. The EuroSIDA study is an important supplement to these studies by addressing the longer-term virological outcome of these new interventions, possible late-onset side effects (not detected in the controlled trials for natural reasons) and the extend of clinical benefit – also in patient populations not included in the randomised trials (eg +40% of European HIV-infected individuals are injecting drug users, but very few are included in randomised trials).

Data from EuroSIDA has been extensively published in peer-reviewed medical journals with high impact factors, such as Lancet and Annals of Internal Medicine.

Policy implications
The EuroSIDA study focuses on an important aspect of public health in Europe, where at least 800,000 individuals are already infected and continued active spread of the infection occurs, especially in the southern and eastern regions. The management (personnel and medicine) of HIV-infected persons is very costly, but few measures are available to address the extent to which clinical outcome is affected by these efforts. Further, the EuroSIDA study has provided information on pattern of resistance across Europe to the European Resistance Guidelines Initiative, which is a collaborative group under the auspices of the European AIDS Clinical Society (EACS), and which is linked with patient community group “European AIDS Treatment Group (EATG)”. EuroSIDA has also provided key information to US Public Health policy makers at the National Institutes of Health and the Center for Disease Control and Prevention on the safety of discontinuing disease-specific prophylaxis of HIV-infected individuals. This has resulted in revisions of official treatment guidelines in the USA. Other organisations, such as UNAIDS, has also used data from EuroSIDA in their policy development.

EU added value
EuroSIDA provides access to data from across Europe on: i) the durability of antiretroviral therapy – overall and in different regions of the continent, ii) the pattern of HIV-related clinical events (including drug-related toxicities), new emerging morbidities, HIV drug-resistance and HIV subtypes. Up-dated information on these issues is of major importance to health-care policy makers, for the professionals involved in patient management and the patient community. Further, no study performed on a national level will be able to accomplish the objectives and deliverables that EuroSIDA can provide. Finally, the EuroSIDA study provides a forum for scientists from all parts of Europe interested in clinical aspects of the HIV infection to collaborate and exchange ideas.

Further information on the study is provided on www.chip.suite.dk

5.1. (c) Control of metastatic growth by the c-MET oncogene

The primary cancer can often be treated and cured; the most harmful outcome is metastasis, i.e. the spread of cancer cells that detach from the original tumour site and invade the organism.

Scientific achievements:
The objective of this project is to elucidate the molecular mechanisms by which the activation of an oncogene (MET) leads to tumour metastasis. This is being tackled through
the development of mouse models for Met-mediated metastasis and by the identification of the cellular processes controlled by Met whose deregulation leads to metastasization. MET, the oncogene studied, encodes the hepatocyte growth factor (HGF) receptor, also known as "scatter factor", a mesenchymal cytokine which triggers a unique biological program leading to "invasive-growth". This phenotype results from the integration of apparently independent biological responses to HGF, among which are cell proliferation, survival, motility, invasion of surrounding extracellular matrices and induction of cell polarity. In physiological conditions, the co-ordinated accomplishment of the underlayed genetic programs leads to the formation of tubular structures by epithelial organs (the so-called branched morphogenesis). Deregulated activation of the "invasive-growth" phenotype by MET confers to cancer cells invasive and metastatic properties. The oncogene MET, is the prototype of a family of tyrosine kinase receptors which includes the genes RON and SEA. The three receptors feature unique signal transduction properties as their cytoplasmic tails contain a two-tyrosine multi functional docking site that binds multiple SH2-containing intracellular signal transducers, triggering cell growth, motility and invasion. "Invasive growth" can be inhibited by using genetically engineered molecules to mimic the amino acid sequence of the multifunctional docking site of the MET receptor tail. These results identify a genetic program controlling cell invasion and provide proof of concept about the possibility of exploiting biotechnological methods for building active molecules to inhibit cancer cell invasion and spread.

Policy implications
Cancer is a major human disease that affects one in every three individuals in the western world.

EU added value:
The development of mouse models of Met-induced metastasis required the joint activity of the four partners, from Italy, Germany, England and Switzerland, bringing complementary expertise: structural biology, biochemistry, cell biology and molecular oncology. In addition, the co-operation offers training opportunities to the graduate students and research associates involved. Finally, this European project allows transfer of technology among the laboratories involved.

5.1. (d) Identifying genes involved in diabetes

The primary aim of the project was to understand the molecular bases and the genetics of non-insulin-dependent diabetes mellitus (NIDDM), which is a highly familial trait, to help define targets for innovative drugs.

Scientific achievements:
Defining the nature of the NIDDM genes will allow early identification of high-risk individuals who may benefit from early medical intervention and thereby the prevention of NIDDM in many cases. Knowledge of the genetics of NIDDM will also provide the basis for the development of specifically targeted anti-diabetic drugs and/or gene therapy in some cases.

In this respect this was a particularly successful project, making possible, through the genetic dissection of diabetes among the world's largest cohorts of diabetic families, the identification in late 1996 and later of totally new mechanisms of diabetes (i.e. the role of nuclear transcription factors in a metabolic disease), thus opening new doors to understand and cure diabetes. This discovery is probably the most important breakthrough in the diabetes field for 20 years.
Beside the study of diabetes, the secondary aim was to build the tools to better understand complex traits and complex pathologies, which may be useful for any commonly occurring disease. This means the development of common databases, the improvement of statistical genetic analyses specific to complex traits, and the definition of quality standards of genetic studies. The next step was to pool and analyse data obtained in different European countries. The final step was to suggest to American counterparts the establishment of an international consortium for the genetic study of diabetes, which led to identification of a major diabetes locus on chromosome 20, as originally suggested by the Biomed programme-sponsored studies.

A new project was approved by the EC in December 1999 to pursue work in this field. The consortium, named GIFT (Genomics Integrated Force on Type 2 diabetes) is made up of the same partners plus 5 new ones.

Policy implications
Non-insulin-dependent diabetes mellitus (NIDDM) is the most predominant form of diabetes (type 2). It is an increasingly prevalent disease, affecting 100 million people worldwide. About 8% of medical costs are due to diabetes and complications. Present treatments are unable to avoid the development of blindness, renal failure, neuronal degeneration and early onset cardiovascular diseases, which are directly linked to diabetes.

EU added value:
There has been growing interest from the EU pharmaceutical industry to become involved in the project, including several biotech companies developing technologies for genomics. One goal is to develop new biotech companies at the EU level rather than only on a national basis, based on the knowledge generated and patented.

5.1. (e) Gene therapy for cardiovascular disorders

Scientific Excellence
A major discovery from this project was that Vascular Endothelial Growth Factor (VEGF), which previously had been thought to be only an angiogenic growth factor in ischaemic tissue, was an important factor which protected the arterial wall against damage or inflammation. VEGF is produced from the smooth muscle cells in the arterial wall in response to growth factors or inflammatory cytokines. It then acts as an agonist of the KDR receptor on the endothelium to produce nitric oxide and prostacyclin into the arterial wall which inhibit inappropriate smooth muscle cell division and into the blood where they inhibit thrombosis. This was confirmed in vivo by gene transfection from the exterior of arteries using a gene delivery reservoir developed by the group. This work generated many joint publications, including papers in Human Gene Therapy and The Lancet. The group has established a new school of thought about the pathophysiology of the vessel.

Policy Implications
These discoveries will have important implications on health care. Diseases of arteries cause more deaths in the European Union than Cancer and AIDS combined. The discoveries will reduce this death rate and reduce complications after surgery for diseases of blood vessels like coronary artery bypass graft, femoro popliteal graft and organ transplantation.

European added Value
The group performing this research funded by Biomed II consisted of groups from University of Kuopio, Finland; The Max Planck Institute, Bad Nauheim, Germany; The University of Milan, Italy;
and University College London, UK. A concerted action was followed by shared costs funding. The research success could not have been achieved by any one of the four groups alone. There is complementarity of the skills in each group which add up to a whole that is greater than the parts. The discoveries led to two patents, one on the use of the gene for VEGF, and agonists of the KDR receptor, which will protect human arteries against damage. The second patent was for a novel reservoir to deliver genes from the outside of arteries in surgery. Based upon this intellectual property the company Eurogene was founded on 1 July 1997 with 3 million pounds funding from Merlin Ventures, a venture capital company in London. By the end of 1999 the company employed 27 people in London and Finland and had expanded its intellectual property to many more new patents. The second round of funding for Eurogene was successfully completed in April 2000 by the raising of 15 million pounds from international investors. A phase I clinical trial of gene transfection in human arteries has so far been successful. A phase II trial will start at the end of 2000 in patients undergoing arterial surgery. The company has several other clinical trials that will start in the near future. The name Eurogene was chosen because of the company’s origin from Biomed. Thus not only did the Biomed funding allow the foundation of a European research group that could move rapidly to new discoveries, it also created a biotech company which is increasing EU wealth and creating new solutions to healthcare problems.
5.2. Biotechnology programme success stories

5.2. (a) European sequencing projects

Several genome sequencing projects were initiated and funded by the EC: Yeast, Bacillus, Arabidopsis, Listeria, etc.

Scientific achievement:
On 24 April 1996 the full sequence of the yeast genome was completed. At the time it was by far the most complex living organism to have its genome fully sequenced - 12.06 million bases, revealing some 6100 potential genes. The sequence data provided a wealth of information, allowing considerable advances in the understanding the basic mechanisms of life in higher cells. This, in tum, is useful not only to companies utilising yeast in food processes or for the production of industrial enzymes and therapeutic agents, but also for research into human health. A number of yeast genes turn out to be quite similar to human genes. The availability of these fully sequenced genes in yeast opens new leads for research into human health disorders such as colon cancer, adrenoleukodystrophy, cystic fibrosis, ataxia talangiectasia, amyotrophic lateral sclerosis, achondroplasia, Duchenne muscular dystrophy, early onset breast and ovarian cancer. A special issue of Nature published the full results. The analysis of the sequenced follows through the EUROFAN project.

On 18 July 1997 the completion of the project to determine the 4.2 million bases of the genome of the industrially important bacterium Bacillus subtilis was announced. Knowledge of this sequence is of medical importance, since for instance it enables the identification of potential targets for the development of new antibiotics active against newly emerging diseases. Already several genes involved in the production of proteins with antibiotic properties have been discovered in this genome, and B. subtilis might become a source for producing new antibiotics from engineered genes. A number of gene products of potential commercial importance have also been identified. To facilitate contacts between project participants and European biotechnology companies, and to exploit potential commercial applications of the discovered genes, an industrial platform was set up involving several companies.

On 14 December 1999, a major milestone in the sequencing of a plant genome was announced with the completion of sequencing of two chromosomes from the small annual weed Arabidopsis thaliana. The international collaboration has accumulated 103 million base pairs of DNA sequence, representing nearly 75% of the genome. Work on the remaining 3 chromosomes is proceeding rapidly towards an expected completion date of late summer 2000. Determining the complete sequence of a plant genome is a major milestone in biological sciences. It provides the foundation for many other areas of plant-related research, and permit comparisons between different organisms. Perhaps surprisingly, plant genes have more in common with human genes than any other sequenced organism (except other plants). Understanding how a gene functions in humans can then help understand how plant genes work, and vice versa.

On 18 April 2000 the Commission announced the completion of the genome of Listeria by a consortium of 10 European research laboratories co-ordinated by the Pasteur Institute. This bacteria causes a potentially lethal form of food-poisoning. The availability of this sequence will allow comparative analysis with other bacteria and should help identify the genes involved in pathogenicity, and will improve research on the mode of action of Listeria. A follow-up project has been launched to understand how listeria infects and survives, both in the environment and in infected patients.
Policy Implication
First of all it should be stressed how the above sequencing project have been instrumental in the building of strong networks of European laboratories with high level and wide range competence’s and a very high international profile. Many spin-offs are directly connected:

- The establishment of very much interactive industrial platforms (for yeast: YIP; Bacillus: BACIP; Arabidopsis: PIP) with several dozen companies participating;
- The creation of new SME’s: not only (service) sequencing companies but also in bioinformatics and pharmacogenomics;
- The launching of European and National follow-up function search projects (with for instance in EUROPAN I as many as 140 labs);
- Solid/mutually advantageous international agreements and exchanges of information and resources.

In general the above projects have and will continue contributing to the awareness and competitiveness of the European agrochemical, food and health Industries, which were able to establish closer and stronger links with public funded research across the EU.

European dimension
The Yeast genome project was a truly international achievement was largely the result of a European Commission led and funded project, which has involved close to 100 European laboratories co-ordinated at UMIST, UK working in a highly co-ordinated manner together with laboratories from the US, Canada and Japan.

The Bacillus genome project also adopted a network approach, finally becoming a consortium of twenty-eight laboratories in six European countries co-ordinated at the Institut Pasteur, Paris. A consortium of seven Japanese laboratories, co-ordinated at the Nara Institute of Life Sciences, Japan, and two US and one Korean laboratory also contributed to this project.

The Arabidopsis genome project was carried out in laboratories in the EU and the US as part of a publicly-funded project that aims to complete the 134 million base-pair of the genome. The project is funded mainly by the European Union (EU), the National Science Foundation (NSF) in the United States, and the Kazusa Institute in Japan. According to Commissioner Busquin, “this breakthrough confirms the ‘added value’ of European research and its key contribution to maintain and reinforce Europe’s leading position in plant biotechnology.”

The Listeria genome project was fully determined by a consortium of 10 laboratories from France, Germany and Spain, co-ordinated by the Pasteur Institute. The availability of this sequence will allow comparative analyses with other bacteria and should help identify the genes involved in pathogenicity. It will also improve research on Listeria’s mode of action.

5.2. (b) Cell factory projects

In the context of FP 4 the Biotech programme funded 70 projects in the cell factory area on a wide range of topics. Particular achievements can be highlighted in areas such as
mucosal vaccines from lactic acid bacteria, new industrial enzymes from extremophiles and biopesticides from fungi.

Scientific achievements:
STARLAB federates 9 projects in the lactic acid bacteria (LAB) area. One of these has targeted the development of LAB, that are GRAS (generally recognised as safe by regulatory authorities) and normally used as food starters, for use as mucosal vaccines.
For more see: http://europa.eu.int/comm/research/biotech/project/project2-en.html

A major concerted action project on extremophiles brought together over 50 participating laboratories and specific research projects led to the identification and cloning of more than 15 new enzymes, that are able to withstand high temperatures and harsh pH, or that are cold-active. These offer novel, environmentally safe, cost-effective applications (including thermostable enzymes) for various industrial sectors (see below).
For more see: http://europa.eu.int/comm/research/biotech/project/project3-en.html

Fungi research was also co-ordinated into a large cluster of projects. A number of scientific advances were made, including the first understanding the pH signalling pathway of a micro-organism. One particular achievement stemming from a research project which was followed by a Demonstration project, was to show that some fungi can be grown and used to replace conventional pesticides for crop protection, as environmentally-friendly natural biopesticides and to develop bioreactors for solid-state fermentation of these fungi.
For more see: http://europa.eu.int/comm/research/biotech/project/project5-en.html

Policy Implication
In all these areas active industrial platforms helped insures the development of commercial applications. The applications of research stemming from the Cell factory area have clear relevance to major industrial sectors and for the provision of improved quality of life.

Mucosal vaccines from lactic acid bacteria evidently contributes to healthcare by providing cheaper, safer and more easily administered vaccines (incl. oral, nasal, vaginal).
Extremophiles can bring environmental and economic benefits to a wide variety of industrial fields such as the chemical, food, pharmaceutical, detergent, textile and paper sectors.
Biopesticides have obvious environmental benefits in crop management in the framework of sustainable agriculture. Their use may also provide economic benefits and better safety for the health of farm workers.

European dimension
The critical mass of research expertise collaborating at European level resulted in Europe taking the global lead in extremophiles, filamentous fungi and lactic acid bacteria. An additional European strength is the prevailing trans-European co-operation and willingness to work in multidisciplinary teams.
A number of accompanying measures were used to promote this expertise on other continents, develop training and exchanges between laboratories and also raise awareness of researchers to IPR, communication and commercial issues.

5.2. (c) Tree Biodiversity

Development, optimisation and validation of molecular tools for assessment of biodiversity in forest trees.
EU contribution: 1.500.000 EURO Duration: 01/11/1996 – 31/10/1999
Partnership: total 14 industries, and 2 end-users (trading forest seed companies)

Scientific and technological excellence:

Publications: 48 (joint: 20)
- Construction of the first genetic linkage map in oak
- cDNA libraries for oak and Norway spruce
- Paternity analysis with a so far not achieved exclusion of >98% in oaks
- Highly reliable estimates of gene flow via pollen and seeds
- First tools for controlling the commercial seed material for maternal descent/contaminations
- Deeper insights into the glacial/postglacial history of European forest tree populations with relevance to conservation
- Data for updating the infrageneric molecular phylogeny of Pinus
- Development of EST and SSR markers on the basis of cDNA libraries
- “one for all” plant DNA minipreparation industrial kit: “DNeasy 96 Plant kit” a high throughput DNA isolation extraction and purification procedure
- AFLP - Technology adapted for model tree species oak, Norway spruce: broad applicability
- Generation of several unique software programs e.g.: inheritance analysis, genetic variation and simulation of the evolution of diversity programs

Policy implications
- Development of commercial products: - DNeasy 96 Plant Kit (Qiagen)
  - software packages (Keygene)
- Creating of network structures
  Link with other projects on a common scientific theme: Molecular tools for Biodiversity. The network integrates plant and animal investigations, RTD research and Demonstration projects and has common communications channels like a newsletter, a web page, contacts to extended audiences via platforms and meetings.
- Generation of information used to make decisions about conservation or sustainable use of genetic resources for forest trees
- Initiating a dialog
  Final compendium: internet book on concepts of a genetic marker and recommendations for end-users on the use of “Which DNA for which purpose?”

European added value
- Expended scope and extended scale, e.g. diversity data on forest trees across Europe
- Validation and standardisation of «universal tools» in molecular technology, in software programs and in data analysis methods

- Transferability of technologies to end-users, e.g. from molecular biology laboratories to companies trading with forest reproduction material
- Hand in hand partnership of technology developers and providers and end-users like forestry husbandry, botanical gardens, regulatory authorities, conservation agencies etc.
5.2. (d) Basis and development of molecular approaches to nematode resistance “Arena”

Scientific excellence
The aim of this project is to control nematode infection in crop plants in a more efficient and less harmful way than it is possible by today’s means. For this purpose the team applied several approaches in which it made considerable progress:

1. **Identification of salivary protein genes from nematodes**
For the first time, genes have been isolated and characterised encoding nematode secretion proteins thought to play a crucial role during the infection process. These molecules represent potential targets for the future suppression of infection.

2. **Identification, cloning and exploitation of anti-nematode genes**
Transgenic *A. thaliana* plants expressing several potential anti-nematode proteins have been produced and tested in nematode infection trials. Preliminary data indicate a reduction of nematode infection in some of these plants. This is an important step towards the development of nematode resistant plants.

3. **Isolation and characterisation of DNA regulatory sequences induced in nematode infection sites of plant roots**
Nematodes activate specific plant genes that cause the redifferentiation of root cells into a nematode feeding site (NFSs). Several (14) regulatory sequences activated in the NFSs have been cloned and analysed. A putative nematode responsive element was identified and two *A. thaliana* promoters have been shown to be activated in response to nematode infection in crops. These regulatory sequences will be useful in the specific expression of anti-nematode products at the infection sites of transgenic plants.

4. **Functional characterisation of nematode induced plant genes**
One gene activated in nematode feeding sites was demonstrated to be important in giant cell formation. Inactivation of a nematode induced gene in transgenic plants led to the significant inhibition of NFS formation proving the importance of this gene in the infection process and the possibility of suppressing nematode infection by this approach.

Policy Implications
These achievements represent a considerable step forward in the development of nematode resistant crop plants. Such plants with durable resistance to nematodes will reduce the need for the chemical protection methods that are applied today and harmful not only to the environment but also to human beings. As nematicides are also expensive, nematode resistant plants will reduce farmers’ overall costs. The availability of engineered resistant crop plants will result in better export perspectives for European breeding companies as compared to countries that are already producing genetically modified plants. In particular, this has the potential to support development in European regions that are mainly dependent on agriculture. Of course this potential can only be realised when GM plants will be grown in the field and accepted by the consumer. This project, aiming to reduce environmental stress caused by intensive agriculture, might serve as an example of a GMO that should be welcomed by concerned citizens.

EU added value
This project has arisen from a Concerted Action financed in FP3. Plant parasitic nematodes represent a severe problem that affects crop plants cultivation all over Europe and is addressed by the combined forces of 12 groups from seven European countries within this project. The creation and funding of this project has facilitated an open-minded and extensive exchange of information and material between the most important European research groups in this field. The production of results with such speed and efficiency would have been impossible without the Europe-wide co-operation. The integration of
partners from Southern Europe ensures that techniques evolved in this project will be transferred to these regions and contribute to their development.
5.3. FAIR programme success stories

5.3. (a) Functional Food Science in Europe (FUFOSE)

This Concerted Action aimed to establish a science-based approach for concepts in functional food science. The goal was to set up a multidisciplinary European network to assess critically the science base required to provide evidence that specific nutrients and food components positively affect target functions in the body. Other tasks were to examine the available science from a function-driven perspective rather than a product driven one and to reach consensus on targeted modifications of food and food constituents, and options for their application.

Scientific excellence

Six major areas in human physiology were selected and corresponding individual theme groups were set up and charged with producing theme papers to review critically the science base of the concept: growth, development and differentiation; substrate metabolism; defence against reactive oxidative species; cardiovascular system; gastrointestinal physiology; behaviour and psychological functions. Each expert group reviewed the published literature to define the state-of-the-art with respect to specific body systems. They assessed critically methodologies to characterise and quantify specific related functions, identified and reviewed nutritional options modulating these functions, and evaluated potential safety implications related to these nutritional options. Furthermore, the groups identified the role of food technology on nutritional and safety aspects, assessed critically the science-base required for providing evidence that specific nutrients positively affect functions, and identified areas where further research is required. The final reports of these panels were published in a special issue of the British Journal of Nutrition.

An expert group on food technology was also established to examine the impact and feasibility of food technology on functional food development in the following areas: microorganisms; bioactive proteins and peptides; bioavailability of minerals; carbohydrates; and antioxidants in vegetable oils, fruits, and vegetables. These five papers were published in Trends in Food Science and Technology.

The main points of all theme groups together with a well-acclaimed working definition were summarised in a consensus document published in the British Journal of Nutrition. This is the first time in the world that the scientific basis of functional foods has been clearly defined. This is now being taken as the gold standard throughout the world and has been adopted by institutions like Codex Alimentarius.

European added value

The Concerted Action was lead by The International Life Sciences Institute - ILSI Europe, which brought together prominent experts from Europe’s food and agricultural industry, governmental and intergovernmental bodies and the scientific community. This project provided them with an opportunity to exchange ideas and to interact on a neutral platform. The European food industry has unique opportunities to develop products that are not only nutritional in the traditional sense, but which have additional activity that can lead to an improved state of health and wellbeing and/or reduction in risk of disease.

Policy implications

The scientific basis of functional foods should be linked to the communication of their benefits to the public. The ability to communicate these benefits is essential for the successful development of functional foods and their role in improving public health.
Markers should be developed that could register the impact of the new food products and could be used in their safety assessment. Evidence from human studies based on markers relating to biological response or on intermediate endpoint markers of disease could thus provide a sound scientific basis for messages and claims about the functional food products. Two types of claims are proposed that would relate directly to these two categories of markers: enhanced functional claims, and reduced risk of disease claims. These claims could be included into the European labelling directive.

5.3. (b) High pressure treatment of liquid foods and derived products

High pressure is an emerging technology with considerable potential as a new unit operation in the processing and preservation of a wide range of food systems with minimal loss of colour, flavour, or nutritional quality. In its present state of development, high-pressure technology is most cost effective for the processing of liquids. Therefore, the most likely applications in the near future will be shelf life extension of high value products and novel product development using liquid foods as the starting material. However, nutritional safety and consumer acceptance of the technology must be assured, and the uniformity and repeatability of the high-pressure technology must be demonstrated.

Scientific excellence
The overall objectives of this research project were to develop a scientific basis for the optimisation of high-pressure processes, with special reference to milk and fruit juices, and to examine consumer attitudes to the process.

The ability of high pressure to increase the catalytic ability of many enzymes has lead to the possibility of using it to accelerate the proteolytic ripening of cheeses. Especially soft cheeses with higher water content are significantly affected to a point where it may be possible to exploit the process commercially.

A semi-continuous system employing two or more pressure vessels in parallel operating at different phases of the pressurisation/depressurisation cycle has been constructed and successfully tested for liquids that may contain suspensions of particles, such as fruit juice. When final modifications have been made, the system should be ready for commercial use.

Process parameters for the production of microbiologically stable orange juice that completely retains its original nutritional quality and fresh taste throughout its thirty days shelf life at 4°C have been determined. These conditions have allowed one of the industrial partners to start commercial production of high pressure-treated orange juice and to distribute it through major retail outlets.

European added value
Since consumers in different member states of the EU may exhibit markedly different attitudes to new technologies adopted by the food industry, a pan-European assessment of consumer acceptability has been found necessary. A survey of 3000 consumers from the UK, France and Germany was carried out, which clearly shows that attitudes differ between countries, among other factors. However, the general level of acceptance of foods processed by high pressure has been found very high and bodes well for the future of the technology.
Policy implication

There are a number of scientific and technological questions that need to be addressed before high-pressure technology can satisfy legislative requirements, especially the European regulations on novel foods and processes, and be widely used by the food industry. Extensive studies have shown that under the most extreme conditions of temperature, time and pressure that are likely to be used in a commercial process, there is little or no loss of nutritional quality of a range of food systems or the generation of unpleasant or harmful compounds. Vitamins, antioxidants and anti-mutagenic substances are largely unaffected by the process. The acceptance of high-pressure treatment as a novel process can thus be expected.

5.3. (c) Genetic engineering of carotenoid metabolism

- a novel route to vitamins, colours and aromas for the European market

Scientific excellence

The FAIR project "CAROTENE PLUS" (FAIR-CT96-1633) has bred a strain of rice containing beta carotene, which is converted into the vital vitamin A in the human body.

The project has achieved so far the following results.
- Genes encoding novel, specialised steps in carotenoid metabolism have been cloned
- All gene constructs planned have been introduced in transgenic plants and fungi
- Modification of the carotenoid metabolism has been obtained in rice.
- Data on the bioavailability of B-carotene have been obtained.

The results of the "Carotene Plus" project could be extended to other crops, including cereals, and is the subject of further research.

Relevance to Community policies and added value

Realising the potential of biotechnology in the development of new products and processes in the agro-industrial sector, the FAIR programme has placed particular emphasis on applications of biotechnology for the development of (food and non-food) raw materials with attractive characteristics during transformation or during end-product formulation. In line with the evolving Common Agricultural Policy, the project’s aim is to diversify primary agricultural production along with the development of improved products.

Vitamin A deficiency is a major public health problem in 118 countries. In socio-economic terms, it should be noted that according to the World Health Organisation, between 140 and 150 million pre-school children are deficient in vitamin A worldwide. Increasing the vitamin A intake of young children could cut mortality by 23 percent, measles mortality by 50 percent and deaths from diarrhoea-related illnesses by 33 percent. It is estimated that improving vitamin A intake would prevent as much as 3.5 million of the eight million deaths among young children in the highest-risk developing countries every year.

The Commission, whose regulatory role has placed it in the eye of the storm over GMO foods, stresses that the project had been carried out in contained facilities and in full compliance with EU laws. The rice had not yet been tested for its safety for human consumption, and no application had yet been made to grow the plants commercially. No transfer of the technology to developing countries will be made until full compliance with all European safety legislation has been assured.
5.3. (d) “STORM”: Silvicultural strategies for predicting damage to forests from wind, fire and snow

Scientific excellence

The STORM project tackled the problem of forest damages caused by abiotic factors (wind, snow and fire) which is the most serious economic and ecological problem facing the forestry sector within the EU.

While some of the causes of forest damage by abiotic factors are well understood, no management tools for providing decision support are available in Europe. Several models have been developed which can give some information about the likelihood of damage, but these are rather crude, provide no quantitative indication of risk and can not be used in a spatial way.

The project which brought together research groups from Finland, Sweden, UK, Ireland and Portugal, has achieved the following results:

- Development of models to predict the occurrence of damage to individual trees from wind and snow and integration of the above models with Geographic Information Systems (GIS) to allow spatial modelling (stand level)
- Development of a method of calculating objective risk estimates for trees in various locations within Europe.

The above results (decision support tools for forest management) are currently being used in practice by the Forest Services of Finland, Sweden, UK and Portugal.

Relevance to Community policies and added value

In line with the Community Forestry Strategy the protection and sustainable management of forests is a central theme in Community research programmes.

The results of the project will contribute to improve current management methods in Europe and the methodology developed in the project could be used and applied to other regions within the EU. The protection of forest against abiotic factors is a pan-European issue as it is indicated in the European forestry strategy adopted in 1998.

5.3. (e) Fractionation of lucerne juice to create nutritional and functional protein ingredients for the food and non-food industry (FRALUPRO)

Scientific achievements:

This demonstration project funded under the FAIR programme validated, on an industrial scale, the technical and economic feasibility of the extraction of the Lucerne protein (RubisCo).

Three years of research based around a demonstration pilot unit have revealed that the interesting foaming, emulsifying and gelifying properties of this novel protein can be produced on an industrial level. Moreover, in the nutritional context, the amino acids of the protein ingredient answers to the standard norms imposed by the FAO. The tests carried out by the industrial partners have also revealed new and innovative applications of the protein within the commodity sectors of detergents, adhesives and cement.
The main challenge was the extraction of the chlorophyll fraction of the juice, which is responsible for the quality variations in the protein ingredient. This extraction, which requires a liquid-solid separation is difficult to optimise on an industrial scale, and thus needed to be tested first on a large demonstration pilot plant. Additionally, unlike grain proteins (such as soya), obtaining proteins from leaves poses difficulties which are linked to the myriad of biochemical reactions taking place in the juice. A major achievement was to gain control of these reactions and to allow high yield extraction of the active protein containing the functional and nutritional properties demanded by the market.

Relevance to Community policies and European added value

Lucerne is a leguminous plant with a high protein yield contained mostly in the leaf and the exploitation of this crop could have important implications for European agriculture. The results have demonstrated the first utilisation of the lucerne leaf as a source of protein on an industrial basis. The technology developed has wider implications for the fractionation of other sensitive plant components in industry. There is great scope for its use in the food and animal feed industry due to its interesting nutritional properties, and also in non-food industries due to its high foaming and emulsifying properties.

The final product thus allows Europe to offer strong competition to soya protein importation for animal feed and allows other non-food industries to exploit its natural properties as a renewable industrial feedstock thus complying with increasingly strict environmental regulations. Being a leguminous plant also allows for reduced chemical inputs. The technology transfer options are substantial and already significant interest in the fractionation process has been shown by global industries who now see for the first time a valid way of extracting this rich protein source in a stable and high yielding manner.
Much research is concerned with the provision of new information designed to improve agriculture, fisheries, forestry and rural affairs. In general it is too early to see if research really has contributed as expected. Moreover, since the agenda is so wide, it will always prove very difficult to evaluate the real contributions from research. However, a number of Framework Programme projects have been identified as having had particular value to EU policy in the area of agriculture, agro-industry, fisheries and forestry. The following are examples of this.

- **AIR-3CT94-2143 (ENOF):** "The European Network for Scientific Research Co-ordination in Organic Farming".
  The general objective of the project is the creation of a forum of research centres involved in the development of organic farming as a way to achieve a sustainable agricultural development. DG Agriculture (Unit FI.3) and DG Health and Consumer Protection (Unit D.4) were interested in the updated information provided by the project in the formulation of new legislation on organic agriculture and husbandry.

- **AIR-3CT92-0262:** "Methods of improving pig welfare and meat quality by reducing stress and discomfort before slaughter".
  The results obtained within this project have been used for the preparation of the report on "Standards for the Microclimate inside Animal Transport Road Vehicles" by the Scientific Committee on Animal Health and Welfare, adopted 8 December 1999.

- **AIR3-CT94-0885:** "Development of new humane stunning and related methods for poultry to improve product quality and consumer acceptability".
  The results obtained within this project were used for the preparation of the report on "The use of mixtures of gases carbon dioxide, oxygen and nitrogen for stunning or killing poultry" by the Scientific Committee on Animal Health and Welfare, adopted 23 June 1998.

- **FAIR-98-3952:** Standardisation of biofuels.
  The market and trade of solid biofuels is not developed and a main barrier is the absence of standards for solid biofuels. The projects main objective was to promote the work for standardisation. CEN (European body for standardisation) was involved in an early stage and, through CEN, the European national standard bodies became involved in the project. In its first year the project has succeeded in allowing the Commission to mandate CEN to standardise solid biofuels. The country reports have been used to create the work programme for CEN and the creation of a CEN Technical Committee. This is very rapid progress and it is hoped that that as a result of the project, standards for solid biofuels will be a reality in a few years.

- **FAIR-98-3826 (SAPARD):** “Development of a Bioenergy Market Development Plan for Central Europe”.
  This project is aiming at developing a market plan for the central European countries where there is a potential to produce biofuels at a commercial level. The objective of SAPARD (DG Agriculture) is to develop the agriculture of the applicant countries. For example, this project
has been able to influence the plans of Estonia and Latvia so they now have biofuels from agriculture as a main priority.

- **FAIR1 CT95-0766: "Policy Analysis of "Timber Certification" as a Market-based Instrument of Forestry Policy to Promote Sustainable Multifunctional Management of Forests".**

  The objective was to provide the Commission’s services with decision support data for decision on/formulation of policies related to "Timber Certification". The project provided the "Pan-European Operational Level Guidelines for Sustainable Forest Management (SFM)". These Guidelines were endorsed by the Ministerial Conference on the Protection of Forests in Europe, representing 36 ministers responsible for forests in Europe and the European Community. The guidelines form part of the Resolution L2 of the Ministerial Conference on the Protection of Forests in Europe (Lisbon 1998). The project results provide useful tools for governments, the EU and all the relevant and interested bodies for the implementation of SFM-certification systems.

- **FAIR1-CT95-0029: “Agricultural Implication of CEEC Accession to the EU”.**

  The project aimed particularly at clarifying some of the assumptions made in earlier studies related to future agricultural developments in CEEC and at an analysis of central issues involved in preparing Bulgaria, the Czech Republic, Hungary, Poland, Rumania, the Slovak Republic and, where possible, Slovenia to future accession in the field of agriculture and food.

  The project created a lasting base of knowledge and analytical tools, which can be used by the EU Commission and others, to support future policy decisions in the CAP and in CEEC agricultural policies with regards to the enlargement perspective.

- **FAIR3-CT96-1849 (CAPRI):"Common Agricultural Policy Regional Impact Analysis".**

  The main objective of the project is to monitor and analyse the economic, social and environmental impacts of the CAP for both the 1992 reform and a set of alternative policy scenarios for further reform steps. This will improve the basis of future EU policy measures and decisions. For the analysis of these impacts, a Common Agricultural Policy Regional Impact Model has been developed: the CAPRI-Model. This has been based on a regional agricultural/environmental sector model and allowed forecasts of impacts of CAP and of future changes of CAP. The database resulting from the project has been installed at DG Agriculture which is using it together with DG Environment in order to evaluate mainly the impact of agriculture on environment.

- **FAIR3-CT96-1766 (RUREMPO): "Agriculture and Employment in the Rural Regions of the EU".**

  The project focused on the comparison of case studies taken in leading and lagging EU regions after an analysis of all the rural regions along rurality and employment criteria. The final stage of the research aimed at isolating the determinant elements explaining the differences in performance of these regions related to employment. The project helped with the preparation of the Agenda 2000. The methodology used was also of great interest for the Regional policy DG and the OECD. In particular, it allowed reinforcement and further development of the work of the OECD on the growth of employment in the rural regions.
• FAIR5-CT97-3448 (ELISA): "Environmental Indicators for Sustainable Agriculture in the EU".
The ELISA project aimed to synthesise existing scientific information on the role of indicators to arrive at an operational framework for integrating sustainable and ecological principles into agricultural land use practices at the European level. The results of the project were valuable in establishing landscapes in the environmental catalogue of OECD as being one of the key policy issues and establishing criteria for assessments as a basis for future WTO negotiations [International workshop organised by the OECD Secretariat York, September 1998]. ELISA research also provided major Commission inputs on environment and integration indicators at the European Council in December 1999, to the Helsinki European Council and to an Agricultural Council request for a report on agro-environmental indicators from the Commission. (COM(2000) 20 (26.01.2000) "Indicators for the integration of environmental concerns into the Common Agricultural Policy".)

• FAIR PL98 4122 (STEREO): "An Operational Model of the Effects of Stock structure and Spatial Temporal Factors on RECRUITMENT.
This project is aimed at improving knowledge of factors affecting the relationship between the size of the sexually mature components of fish stocks and the subsequent numbers of their offspring. Because of the high fecundity of many fish species and the variability of the marine environment, this relationship is seldom obvious but some knowledge of it is critical for the management of fish stocks. Since fisheries management is routinely based upon scientific advice this project is likely to have immediate implications, particularly with respect to a proper setting of limit reference points. These are required for fisheries managed in accordance with the precautionary approach proposed by the FAO code of conduct for responsible fishing.