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Evaluation of the BRIDGE Programme
(1990-1994)

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Evaluation of the BRIDGE Programme (1990-1994)

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Commission of the European Communities

Evaluation of the Programme for Biotechnology Research, Innovation, Development and Growth in Europe, (BRIDGE)

1990-1994

PART 1

ACKNOWLEDGEMENTS

The Panel expresses its thanks and appreciation to all those who agreed to be interviewed and to all those who responded in writing to the questionnaires and other requests for information. This includes the Programme Managers, members of CAN-BRIDGE, Project Co-ordinators and Participants, Industrialists, representatives of other Commission services, of national authorities and Members of the European Parliament. We also thank Mr M. Donato, Head of the Evaluation Unit and Mr. E. Magnien, Head of the Biotechnology Unit for valuable guidance at the outset and at various points during the evaluation.

The Panel has a special vote of thanks to our Secretary Mr. Brian Sloan whose professionalism and enthusiasm assisted us in many ways. His knowledge of Commission procedures skilfully guided us through a number of issues. When he became unavailable, Mr. I. Karatzas gave equally valuable support.

Two individual panel members deserve special recognition. Dr. Norman Carey, in his role as Rapporteur played a key role in assembling the questionnaires and the interim report and in drafting editing and assembling the documents that comprised the final report.

Professor Bernard Witholt arranged for analyses of all three questionnaires. This involved the preparation of specialised data bases into which all responses were entered. these data were analysed and communicated to the Panel for their interpretation. Without this contribution by several staff members of the Institute of Biotechnology (ETH, Zurich), most of the Panel's conclusions would have been based on anecdote and much effort would have been wasted.

The Panel has received information and opinions from a wide variety of sources. Many of these views are quoted in the report, but only in respect of interest groups. They are not attributed to individuals. All other opinions conclusions and recommendations are those of the whole Panel and we take joint responsibility for the report in its entirety.

INTRODUCTION TO THE EVALUATION REPORT AND GUIDE TO THE ANNEXES

Introduction

This report is presented in two volumes. The first volume contains the Executive Summary and the Principal Recommendations. Part 1 is designed for people who want to assimilate the main results of the review and is presented in this slim document for the benefit of those who are already overburdened with paper.

The Executive Summary gives, in five pages, the main findings and conclusions of the review conducted by the Panel. The Pricipal Recommendations comprise one page of the seven main recommendations derived from the Executive Summary. Subsidiary recommendations are given at the end of some of the sections in the Annexes.

Part 2 gives full details of the main work of the evaluation in a series of Annexes. The remainder of this chapter is a guide to those Annexes.

Annex I Programme Description

This Annex gives a description of the BRIDGE Programme, its budget and its relationship to preceding Biotechnology programmes. It indicates the areas covered by the programme, their expenditures and the history of its main events.

Annex II Methodology

Annex II and its sub-annexes describe the methods that the Panel used to conduct the review. It indicates the main groups of people that were interviewed, the projects areas that were selected for interview and the main topics that were discussed with interviewees. It also describes the use of the questionnaires that were devised to gather information from Participants and others.

Annex III Evaluation of the Project Selection Process

This Annex and its sub-annexes present the Panel's views on the project selection process, which has been one of the most criticised elements of the Programme in the interviews that were conducted. The main Annex is a narrative evaluation with recommendations for improvement, some of which are repeated in the Executive Summary. The sub-annexes consist of a more detailed analysis of the process with representative documents, figures and a typical evaluation. Information from the Project Managers is included by way of further clarification.

Annex IV Evaluation of Projects by Programme Area

This Annex reports the evaluation of projects grouped by Programme Area. The evaluation was based on the published project reports, publications from the Commission, a brief analysis of the publication record attached to these reports together with relevant information from the questionnaires and discussions at interview with selected participants and non-participants.

Annex V Impact of the Programme on the EU Biotechnology Industry

Since one of the main objectives of the EU R&D Programmes is to improve the competitiveness of EU industry, the Panel has canvassed the views of industry concerning the Programme. These views were obtained from discussions at interview and from the findings of a small questionnaire survey addressed mainly to industrialists whose companies had not participated in the Programme. Annex V presents these views and an assessment of the impact of the Programme on the EU Biotechnology industry in general.

Annex VI Main findings of the Questionnaire Surveys

This Annex highlights the main conclusions that can be drawn from the responses to the questionnaires that the Panel sent to Project Co-ordinators and Partners. The sub-annexes include the questionnaires with the summation of the responses received in each case.

Annex VII Evaluation of Programme Management.

The trans-national, multi-party, collaborative nature of the projects within the Programme produces a need for careful, sensitive and professional management at a number of levels. This Annex presents an evaluation of both the scientific and administrative management of the Programme provided by the Biotechnology Unit of DG XII. Some comments on the scientific management provided by the project co-ordinators are given in Annex VI.

Annex VIII Evaluation of the Training Activities

Training has been recognised as an important element of earlier Biotechnology Programmes. Evaluation of those programmes included specific recommendations for the future support of training activities. The Panel has therefore spent a significant proportion of its time considering these activities. The BRIDGE Training Programmes have been analysed in the context of the Programmes that preceded and those that followed. This evaluation is the subject of Annex VIII.

Annex IX Evaluation of Concertation Actions

Concertation was identified as an important aspect of the early Biotechnology Programmes. It was also included as an important function of BRIDGE, but during the Programme, the mechanism for taking Concertation actions was changed. Annex IX presents the result of the evaluation of this activity and makes suggestions for the main focus of Concertation actions in the future.

Annex X A Survey of R&D spending by National Governments and the EU

During its deliberations, the Panel frequently came up against the question of the importance of EU funding of Biotechnology compared to that of the National Goverments. The Panel obtained the views of a number of groups on this question. One of the important pieces of evidence when considering what the proportion of spending by the EU or the National Governments should be, is the knowledge of what it is now and has been in the past. The figures that are presented in Annex X were obtained and calculated by the Panel and have informed the discusion on this and related issues.

Annex XI Evaluation of the relationship of COST actions to BRIDGE

COST, as probably the earliest paradigm of trans-national scientific collaboration, has made an important contribution to the development of other Programmes. Annex XI presents an evaluation of its relationship to BRIDGE.

EXECUTIVE SUMMARY

1. BRIDGE and the European Scientific Community

One of the most noticeable impacts of the BRIDGE Programme is the continued development of a truly transnational scientific community in European biotechnology, the beginnings of which were apparent in the earlier BEP and BAP programmes. Transnational collaborations are seen to be mainly positive and a good way to expand the effectiveness of national resources.

We could find no evidence to support the belief that the participation of laboratories from different countries is often at the expense of the overall scientific quality and productivity of projects. It is recognised that transnational projects are a good way of spreading expertise to scientifically less favoured regions. Perhaps for this reason some projects included participants that would not, in isolation, have achieved fundable ratings for their contributions. We are convinced that the scientific standards of projects did not suffer as a result of this inclusion but obviously close attention must be paid to the overall quality of proposals to ensure that high quality is spread rather than eroded by this mechanism.

We conclude that, along with the transnational component of the projects, the training programmes, exchanges of personnel and project meetings all contribute to fostering the development of a community spirit that is open to wider international developments, more open to industry and its scientists and able to overcome the limitations of nationalistic approaches.

2. Training

Training of young scientists in countries other than their own is particularly important in developing the community. It is also important in ensuring a supply of talented scientists for industry, (see section 3 of this summary). The training aspects of the programme should therefore be developed. Short term (3 month) fellowships would greatly facilitate transfer of skills between laboratories. A system of such fellowships should be devised and introduced. We have seen evidence that the publication criteria used in the selection of fellows are excluding talented young people in the early phase of their careers. New PhD's who have just completed a thesis rarely have many publications. We add our voice to those of previous Review Panels who have requested that the training budget be increased to 15% of the expenditure and that the number of fellowships be increased. This has not yet been achieved.

3. The involvement of Industry

Industry played a central role in the design of the Programme and the selection of the target areas and participated directly in 10% of the BRIDGE projects. This involvement was not equally distributed in Europe. A number of indicators show that interactions were best developed in the Netherlands and the United Kingdom, rather less developed in France and Germany and were sporadic in other European countries. This pattern is still seen today, although project participants were often optimistic about post BRIDGE activities with industry. Many developed links with industry as a result of being involved in a BRIDGE project and felt that their opportunities for future industrial collaboration were increased while not impairing access to National funding.

Since only 10% of the projects involved direct industrial participation, it is clear that a very large number of potentially eligible industries did not participate. The Panel therefore conducted a limited and informal survey of 37 leaders of European biotechnology industries thoughout Europe to determine how they valued European and National biotechnology programmes. The general feeling is that European programmes are indirectly important to their industries by creating a European scientific community. Industry did not regard these programmes as the right place to access specific results such as patentable knowledge nor have they been designed to support new industrial appoaches and strategies. National biotechnology programmes were seen as somewhat more appropriate for this latter purpose. Despite this perception of the indirect relevance of National and European biotechnology programmes, virtually all felt that both National and European funding should be expanded and that at least 20% of the available government funds for biotechnology should be distributed via European programmes.

Industrialists have made it clear that they do not wish to see academic laboratories attempting to do the job of industrial laboratories in developing new products and processes. Industry needs access to experts who are at the forefront of advances in basic science and to a stream of highly trained, talented and skilled young scientists.

We therefore conclude the best way to increase industrial competitiveness is first, to identify the needs of industry and the bottlenecks that impede its progress and to give priority to fundamental research projects that address these areas and second to intensify the development of training programmes. There is also evidence that Industrial Platforms generate valuable interactions and can therefore help to improve industrial access to academic research. In these circumstances, we believe that industrial participation at 10% of the contractors is more than adequate to confirm the industrial relevance of the Programme.

4. European and National Scientific Programmes.

There is clear evidence of an interaction between National and EU programmes. The Bridge Programme has succeeded in identifying and supporting key areas in Biotechnology research and has thus played an important role in complementing National research programmes. Most respondents agree that there is complementarity between the objectives of these sources of research support, although it appears that some National

programmes tend to reflect the European objectives.

The overlap between the scientific goals of the European and National programmes has led to confusion about their relative objectives and contributions. National civil servants have recently been referring fund-seeking scientists to Europe on the grounds that National governments contribute increasingly to European programmes and that such funds should be repatriated as efficiently as possible.

The BRIDGE Programme represented about 2% of the total National funding for biotechnology. In the FPIII Biotech Programme this had increased to about 3.5% and for FPIV it will amount to about 10%, based on data extracted from the European Report on Science and Technology indicators 1994[1] as described in Annex X. These numbers show that the European contribution has brought added value mainly through co-ordination and networking and not by massive funding.

The 10% of total biotechnology funding that will be disbursed through FPIV will be quite acceptable to most participants of the BRIDGE Programme. At least half felt that EU funding should be increased to more than 20% of the total. The wishes of the scientists who did not participate in BRIDGE are unknown; it is unlikely that they would favour such high percentages. However, our informal survey of 37 industrial leaders, mentioned above, most from companies that did not participate in BRIDGE, showed that 32 favoured spending more than 20% of government funds for biotechnology research in Europe via EU programmes, without lowering National funding. Only one favoured increasing European funding at the expense of National funding.

The panel concludes from this information that the European programmes in biotechnology are admirably meeting the needs of academic researchers and industry alike by steadily increasing the support of biotechnology R&D and that there is scope for further increase in the EU contribution.

We have observed that there is strong emphasis made by DG XII staff and committees on the need for direct industrial participation in European biotechnology programmes. This is based on the perception that such participation is necessary for the development of a strong and competitive biotechnology industry. As a result, current Call for Proposals are highly prescriptive and leave little room for flexibility. Our evaluation indicates that this concern may be misplaced. As mentioned above, the major effect of the programmes appear to be indirect. They do not, on the whole, solve specific problems in product or process development nor do they lead to strong patent positions. Instead, they bring together European researchers who formerly operated in relative isolation.

[1]Report EUR 15897 EN, October 1994 produced by the EC, DGXII

This is in accord with the view, shared by most of the surveyed industry leaders, that basic (curiosity driven) research is an important source of progress and new ideas in biotechnology. There is support for basic science at the National level but as the EU programmes continue to expand it will be necessary to ensure that funding of basic science in Europe remains at a level necessary for the development of a competitive biotechnology industry. This is likely to require flexibility in programme design. A relaxation of the present prescriptive system would be in accord with the stated wishes of industry in preferring to see academics concentrating on leading-edge science, thereby supporting industrial competitiveness.

5. Project evaluation and selection procedure

There is considerable criticism from the scientific community and a number of national agencies concerning the process of project evaluation and selection. We conclude that the process suffers from a lack of transparency, inadequate feedback particularly to unsuccessful applicants and some misunderstanding about the use of the term "peer review" that is more than merely semantic.

We are aware that Panels reviewing other programmes have reached the same conclusion but that there have been no changes in the process partly because it is used across all EU programmes. However, this topic is so important that the Panel made a special study that is reported in a later chapter. This analysis led to a number of specific recommendations that are reported in detail in that chapter and repeated in abbreviated form in the Principal Recommendations.

In our view the Framework Programmes are now sufficiently large that it is not necessary that they are all administered in an identical way. We believe that it will improve the standing of the European Programmes if careful note is taken of our recommendations that the total time of the award process should be shortened, that the system should be more transparent and that feedback should be improved.

6. Interdependence and collaboration of Partner laboratories

The aim of developing a European scientific community will be served more effectively if projects demonstrate real interdependence between contracting laboratories. This may result from a need for interdisciplinary work but interdisciplinarity is not an essential component of interdependence. However, we observed that some projects seemed to comprise a collection of independent pieces of work held together only by their relationship to the field. It is also apparent that many projects resulted in only a few joint publications which are key indicators of true co-operation and partnership. One aim of the selection process is to choose projects that involve true interdependence. It is possible that this indicator is more difficult to assess than it might appear or perhaps it is sometimes less important than other considerations. We feel that the methods of assessing this indicator and the weighting it receives should be reviewed to ensure the interdependence of the contributions of all partners to a project.

7. Management and administration

The administration and management of the programme has been the subject of mixed reports in various respects.

The Programme Managers have received approving comments from a number of quarters and we agree that they are competent, professional and enthusiastic. Furthermore, criticisms of excessive bureaucracy do not apply to the administration of the financial management of projects once awarded. Indeed, DG XII showed admirable flexibility in the disposition of funds to achieve project objectives.

However, there are three areas where we observe that bureaucratic procedures hinder effective management of the process and execution of the science. First, a significant minority even of successful applicants found the documents in the Call for Proposals complex, obscure and full of Commission jargon. Second, the inter-service review of proposals is unreasonably long in view of the tight deadlines imposed on the proposers. Third, the procedures of contract negotiation, once projects have received scientific approval, are complex, bureaucratic and drawn out. They compare poorly with similar procedures at the National level and are thus a source of great frustration even to successful applicants.

Our surveys show that, in a rapidly advancing field, the delays in starting projects that result from these deficiencies have a serious detrimental effect on scientific progress and international competitiveness, reducing the value of the research to industry. Thus some of the bureaucratic procedures of the Commission are frustrating the Council's aim of improving industrial competitiveness and they have also been given to us as reasons for the non-participation of some industrial laboratories in the programme.

8. Quality of the Programme output

Overall, the quality of the work resulting from the Programme was high and the publication record is creditable. Of course a few projects did not fulfil, or had over-ambitious objectives and some had a poor publication output. We conclude that the objective of supporting high quality science has been met and that the impact of the successful projects far outweighs that of the few that were less successful.

9. Concertation

Most of the people we interviewed feel that the concertation activities of Biotechnology programmes need to be fully co-ordinated and integrated across all the fields of application of Biotechnology, because many of the aspects of concertation are similar across a number of industrial sectors. These activities were formerly the responsibility of CUBE.

Within the overall concertation activity the Panel has observed a strong need for particular attention to be paid to methods of proactively informing certain audiences, such as Members of the European Parliament, public bodies and pressure groups. It is not easy to make good judgements when accurate information is lacking. New methods of easy information transfer should be explored, appropriate to the groups being addressed. Methods of achieving this have not been successful in the past and new methods should be considered.

PRINCIPAL RECOMMENDATIONS

1. We recommend that the fostering of a European scientific community should continue to be a major objective of future Programmes.

2. We recommend that there should be no explicit or implicit requirement for industry participation in specific projects. The development of a European scientific community and the promotion of industrial competitiveness does not require such participation, provided that industry continues to be actively involved in the design of Programmes. Our analysis shows that industry is highly interested in Biotechnology Programmes despite the fact that it is generally not able to profit directly from such Programmes. Instead industry profits from indirect effects and therefore supports further increases in Programme funding.

3. We recommend that the training aspects of the future programmes should be expanded and developed. We recommend that 15% of the budget be allocated to training; that the number of fellowships be increased; that a system of short term, (three month) fellowships be developed; that the publication criteria for selection of fellows be revised to permit the entry of new PhD's whose thesis work is not yet published in full.

4. Our findings show that the project selection procedure needs to be revised to make it quicker, more transparent and to provide better feedback, particularly to unsuccessful applicants. We recommend: that reviewers are sent copies of the projects they are to review two to three weeks before the meetings; that applicants are given a one page analysis and critique of their applications; that the total list of reviewers from which individual review panels are drawn be published, if necessary after the process is complete. Anonymity of reviewers must continue to be protected. More detailed recommendations and the analysis on which they are based are given in a later chapter of the Report.

5. We have observed that internal Commission procedures, such as the inter-service review, contribute substantially to the wasteful delays that diminish the competitiveness of the output of programmes. We recommend that these procedures be revised. We also recommend that the time taken for contract negotiation be shortened. This can be achieved by simplifying and streamlining the procedure.

6. We have found that some projects were not truly collaborative. We therefore recommend that the evaluation procedure put more emphasis on the requirement for interdependence of the contributions of individual project participants and less on the requirement for interdisciplinarity.

7. We recommend that particular attention be paid to methods of informing certain audiences, such as Members of the European Parliament, public bodies and pressure groups. New proactive mechanisms should be devised. Particular attention should be paid to informing these groups about scientific regulatory matters and their social impact and about intellectual property matters relating to biotechnology.

Commission of the European Communities

Evaluation of the Programme for Biotechnology Research, Innovation, Development and Growth in Europe, (BRIDGE)

1990-1994

PART 2

Annex I
Programme Description

Introduction

The BRIDGE programme (acronym for Biotechnology Research, Innovation, Development and Growth in Europe) covered EU supported biotechnology-related activities over the four years between 1990-1994. It was the direct successor of two earlier programmes specifically designed to reinforce the scientific and technological basis of agriculture, industry, healthcare and environmental protection in Europe. These were the Biomolecular Engineering Programme (BEP) from 1982-1986, and the Biotechnology Action Programme (BAP) from 1985-1989. A dramatic increase in budget allocation is indicative of the commitment of the EU to Biotechnology. BEP supported 91 training contracts and 103 shared-cost research contracts with public and private laboratories with a budget of 15 MECU. BAP included 376 laboratories with a budget of 75 MECU. In the framework of the BRIDGE programme 100 MECU supported 579 laboratories throughout Europe, engaged in high quality research in the following fields:

N-Projects

Area A: Information infrastructure

Processing and analysis of biotechnological data (3.9 MECU)
Culture collections (0.9 MECU)

Area B: Enabling technologies

Protein design/molecular modelling
(3.3 MECU)
Biotransformation (3.8 MECU)
DNA sequencing (0.5 MECU)

Area C: Cellular Biology

Physiology and molecular genetics of industrial microorganisms (5.1 MECU)
Basic biotechnology of plants and associated microorganisms (9.5 MECU)
Biotechnology of animal cells (7.8 MECU)

Area D: Pre-Normative Research

In vitro evaluation of the toxicity of pharmacological activity of molecules (4.5 MECU)
Biosafety (6.5 MECU)

T-Projects

* Sequencing of the Yeast Genome (5.1 MECU)
* Molecular identification of new plant genes (3.0 MECU)
* Lipases (4.3 MECU)
* Lactic acid bacteria (4.9 MECU)
* High resolution automated microbial identification (HRAMI) (2.1 MECU)
* Animal cell biotechnology (2.5 MECU)
* Plant regeneration (3.9 MECU)

The four areas (A-D) comprise N-projects, including on average 5-6 laboratories from 3-4 different member States. The aim of these projects was to remove gaps in knowledge and know-how through complementary approaches. The remaining areas were addressed by T-projects, which were much larger in terms of participating laboratories. These were targeted towards the elimination of specific bottlenecks resulting from structural or scale constraints. On average 30 laboratories and 100 staff researchers from all over Europe participated in these projects. T-projects were very complex in management structure and interactions amongst the participants. A monitoring unit with representatives of contractors, programme committee "CAN-BRIDGE" (Committee of Advisory Nature) and the Commission was attached to each of the T-projects. Reasons for this included to aid in the implementation of the programmes and to facilitate communication both internally, within the project, and externally with industrial platforms and other entities within the EU.

Three successive calls for proposals in 1989 and 1990, resulted in the launching of 69 N-projects and 7 T-projects, encompassing 387 and 192 participating organizations for N- and T- projects, respectively. Eleven member states and 5 EFTA countries were represented. The table below gives a summary of the selection results. Some of the figures are different from those given above due to the inclusion of Concerted Actions

BRIDGE calls for proposals/funding

	Proposals	Partners	Funds requested MECU	Funds allocated MECU
Entire call	461	2189	596	430
projects selected	112	581	164	114
Projects funded	91	579		70

DGXII has gone to considerable lengths to ensure that the needs of industry received strong priority in the selection of the Programme areas within the framework of precompetitive research. In addition, in the project selection phase, the policy was to favour the selection of projects that had a direct industrial participation, other things being equal.

Annex II

Methodology of the Evaluation Process

This chapter delineates the methodology, procedures and criteria that the Panel used to evaluate the BRIDGE Programme. Our terms of reference are listed in Sub-annex IIa and the composition of the evaluation panel is shown in Sub-annex IIb

The panel was assembled in accordance with Council decision of 9 December 1989 (Official Journal L360/32), and met in Brussels on seven occasions between December 22, 1994 and July 11th, 1995. Following extensive in depth discussions the Panel decided against holding any meetings outside Brussels in order to make better use of available resources. All members were familiar with laboratory facilities and unless there was something special to see, it was felt preferable to organize discussions at the main meetings. The Panel felt initially that some interviews could be conducted with 2-3 of their members, but the value of the joint experience and the elimination of the need to report back, convinced the Panel that wherever possible meetings should take place with all members present.

The major instruments for the evaluation methodology were a series of questionnaires and of personal interviews. The questionnaires were addressed to participants, coordinators and industrial biotechnology leaders from non-participating companies. The interviews involved coordinators, participants and industrialists (participating and non-participating); DGXII programme managers; Members of the CAN-BRIDGE; Members of the European parliament; Mr. de Nettancourt, former head of Biotechnology, Mr. van Hoeck, former Director of Life Sciences, and Mr. Cantley, the former head of CUBE; National experts in science policy related to biotechnology; Dr. Ganguly, the Chairman of IRDAC; representatives of other Commission Services, namely Mr. Gitzinger of VALUE, Mr. Sourmelis, formerly responsible for DGXII relations with the European Parliament and Mme Soares, Head of Administration of DGXII Life Sciences.

Individuals to be interviewed from the project teams were selected according to the following procedures. Four N-Programme areas and 2-T projects were selected. Panel members with primary drafting responsibilities for these areas proposed names of individuals to be invited to interview. For each area, 10 names were selected, i.e. 4 participants, academic or industrial, 2 industrial non-participants, 4 reserves in any of these categories. The panel thus hoped to meet the target of 24 participants and 12 non-participant industrial interviewees. The participants could be either coordinators or partners.

The project areas selected were:

N-projects-	Information databases Biotransformation Biosafety Animal Cells	T-Projects-	Lactic acid bacteria Arabidopsis

The Evaluation Unit wrote to the Biotechnology Regulatory Committee comprising the 12 countries constituting CAN-BRIDGE asking them each to nominate one person to attend the third meeting of the Panel. The Evaluation Unit, following requests from the Panel, consulted with appropriate Bodies to ascertain which MEPs from among those interested in Biotechnology could be interviewed. Panel members nominated National experts in science policy related to biotechnology. The Evaluation Unit in consultation with the Panel, issued invitations to these individuals. The names of all individuals who were able to accept the invitation are listed in Sub annex IIc.

Typical interview sessions lasted 2-3 hours with the entire Panel present. Three to six individuals were interviewed in one session. All interviewees were given in advance a short outline of specific points and questions the Panel felt would be important to address during the interviews (Sub-annex IId). This gave meetings a structure which was easy to manage in terms of time and interaction between Panel members and interviewees. We recommend this method to future evaluation panels. We felt that we were able to derive valuable information in a relatively short period of time which we found invaluable in synthesizing our final report.

This procedure was not used to guide the presentation from the DGXII managers. The presentations were structured by the managers themselves. They were competent and summarized the area objectives well and demonstrated the managers' grasp of their areas and their enthusiasm. However, much of the information they gave us was summarized in documents that were available. These professionals have a vast body of experience and information that would emerge more readily if they focused their presentation on their impressions, problems they experienced and their own aspirations for future programmes. In future, Panels should prepare a list of the questions they would like the managers to address, as this panel did with its other interviewees. This could include: what problems did you have in managing your areas? Did your coordinators manage the science of their projects adequately? Which of the projects in your area was a major success and why? Which were failures and why? What will you do differently next time?

For future evaluations we would like to recommend the following:

1. An increased role of the secretary provided by DGXII to include taking minutes during Panel meetings

2. That the Evaluation Unit provide a mechanism to assist the panel in analyzing questionnaires. This assistance could be either monetary to a specific panel member to allow recruitment of temporary staff or a contractual arrangement to allow third parties to assume the task of entering data and preparing outputs to aid the Panel with the analysis of results.

Sub-annex IIa

Terms of Reference

1. The Panel is composed of persons who are appointed by the Director General for Science, Research and Development (DG XII), as individuals and not as representatives of particular organisations or countries. Their views in no way commit their employing organisations. They are required to keep confidential any evidence, written or oral, submitted to them that witnesses indicate should be so treated.

2. The Panel is to evaluate the research and technological development programme in the field of biotechnology 1990-1994, the BRIDGE Programme, (Council Decision : Official Journal L 360/32 (9.12.89)).

3. The Panel is to assess:

- the scientific and technical achievements of the programme taking into account its original objectives and milestones and, whenever relevant, of changed circumstances;

- the quality and practical relevance of the results including commercial developent and exploitation and possible spin-offs;

- the effectiveness of management and the use of resources;

- the programme's contribution to the development of EU policies and to the social and economic development of the EU

- the benefits resulting from the implementation of the programme at the EU level (added value).

Quantitative indicators will be used whenever appropriate

The Panel's assessment of achievements and benefits should take into account the expenditure applied.

4. The evaluation should lead to recommendations of the following:

- the future continuation, alteration or termination of the programme or activity;

- the management of the programme;

- the use of research results by organisations carrying out the work;

- the transfer of technology to other organisations, by movement of personnel, by licensing and by other means.

5. Programme objectives and criteria:

The specific evaluation objectives and criteria are set out in Annex III of the BRIDGE

Council Decision (89/621/EEC).

6. Working procedures:

Panel members will attend the meetings convened by the Commission in the framework of this evaluation.

Information will be obtained by the Panel from the study of the programme's final reports, review papers, policy and other papers, related documents and from mailed questionnaires interviews and visits with:

- project participants;

- members of the BRIDGE advisory committee (CAN-BRIDGE);

- members of the Commission advisory committees, (CREST, CODEST, IRDAC);

- members of the European Parliament;

- other institutions and organisations;

- other relevant EU services.

Subject to prior approval of the Commission, the Panel members may travel within the EU to interview persons about the programme and to see work in progress in more detail.

The Panel should take into account the results of previous evaluations.

The Panel can ask for external assistance in the case of specific scientific knowledge if it is required. This is only possible within the available budget.

7. Evaluation Report.

7.1 The Panel, assisted by the rapporteur will prepare an interim and a final reportin English.

The Panel is required to produce its interim report by the end of April 1995 for discussion with the Commission and to deliver the final report by the end of July 1995 in a form ready for publication. The Commission will deal with the translations of the Executive Summary into other EU languages. The Panel may also prepare a confidential annex for the Director of DG XII if it feels that this is desirable and necessary.

7.2 The interim report should provide the Commission with information concerning:

- preliminary findings on the programme context, implementations and achievements (definitions, call for proposals, selection, contractual conditions, co-ordination, project follow-up, distribution of resources);

- preliminary findings from interviews and how the sample was decided;

- the data that has been collected and used by the Panel;

- a synthesis of the activities of the evaluation which have been undertaken;

- early recommendations if any.

7.3 The final report will contain the following;

- an executive summary;

- a short introduction including a summary of the methodology, itinerary and the time schedule followed by the Panel;

- the main report;

- any annexes that the Panel consider a useful complement to the report.

8. The final evaluation report is expected to be published and widely distributed. Among others, the Commission will transmit it to the Council of Ministers, the European Parliament, the Economic and Social Committee, the European Court of Auditors, advisory bodies (CREST, IRDAC, the programme committee), government bodies within the Member States, the scientific community and other interested organisations.

Sub-annex IIb

Composition of the Evaluation Panel

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Sub-annex IIc

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Sub-annex IId

Preparatory questions for interviewees

1. A brief description of your biotechnology activities

2. a) If you participated in the BRIDGE Programme:

   a short assessment of your own BRIDGE project stressing the impact on your laboratory and on other participants.

   b) If you did not participate in the BRIDGE Programme:

   your main reasons for not participating (and whether you have participated in the subsequent EU biotechnology programmes).

3. Your personal assessment of EU biotechnology programmes:

   impact in your own country
   impact on science at the level of the EU
   the development of EU programmes in relation to National programmes
   shortcomings and desired changes

4. How do you see the future of European biotechnological research.

Annex III

Evaluation of the Project Selection Process

Introduction

This chapter is the result of very wide consultation during the evaluation. It includes opinions expressed during oral interviews of participants and CAN-BRIDGE, discussion with DGXII programme managers, a detailed paper on the process itself prepared by one Panel member, (Sub-annex IIIa) and publications from the Commission, (Sub-annex IIIb) . A response from programme managers clarifying certain points raised in this chapter and Sub-annex IIIa is appended as Sub-annex IIIc. All these views and facts were extensively discussed by the Panel at a number of plenary session.

The procedure for the evaluation and selection of projects and its associated management appears to be one of the most difficult elements of the Programme on which to obtain a firm opinion. Those members of the Panel who have participated in evaluations had some unease but were able to understand why this procedure is used. Many of the people interviewed expressed dissatisfaction with the process and others presented anecdotal evidence of its influence important sections of the scientific community. The questionnaires were addressed to successful applicants but even so, they did not show substantial approval of the process. The Panel feel it is of fundamental importance that the project selection process should receive general support in the scientific community. In view of the evidence suggesting serious concerns, the Panel have spent a considerable effort to understand the process, its rationale and the apparent causes of the concern. We make some practical suggestions and outline some areas of analysis by which DGXII and the Commission might achieve greater acceptance of the selection process.

Description of the Evaluation and Selection Procedure

It has been constantly emphasised, and the Panel wholeheartedly accepts, that the process is designed to select only those projects that promise to be of the highest scientific quality. At the same time, the Commission has a number of other objectives in funding high quality strategic science and these must be taken into account during the selection process. These are, to improve the competitiveness of European industry and to foster a pan-European scientific community.

To ensure the first aim, that research of the highest quality is funded, DGXII maintains a panel of experts in the fields of the Programme. These experts are invited in groups to review and select projects within their field of expertise. At the time of BRIDGE each of these groups numbered a maximum of six experts. This is clearly a review by peers, but the fact that the process is so different from those operated by other granting authorities, such as the National ones, has led to vigourous and continuing debate as to what constitutes a "true" peer review process. There is substance to the question that is discussed below.

The willingness of industry to be involved in the programme is the best way to ensure that the Competitiveness aim is being served. This can be achieved at many levels, the most visible of which is direct participation in projects. To achieve this, the Commission

Officials believe that industry requires almost total confidentiality. Even the fact that a company is interested in a project area could be sensitive.

This perception has led to one of the features of the evaluation, that is, that all the project proposals are retained in the Commission offices and never distributed in a way that loosens the control over their fate. Confidentiality also extends to the names of the Panel of Experts from which the individual reviewing groups are selected. (Of course it would be totally unacceptable for the names of experts reviewing particular groups of projects to be published).

The aim of fostering a pan-European scientific community is achieved by the ensuring that projects include a true collaborative arrangement between scientists from different countries. Once the criteria of scientific quality are fulfilled, the experts are required to ensure that each partner is making a true scientific contribution to the collaboration and is not included for cosmetic reasons of transnationality. This feature of the Programme has not led to problems, indeed it is one of the most positive elements.

Causes of Concern

The causes for concern arise mainly from a lack of transparency of the review process which in turn results from the perceived need for total confidentiality. Reviewers do not see the proposals they are to review until they arrive in Brussels for the meeting. They can be unsure of issues or have poor recollection of facts but they have no opportunity to check themselves by consulting the literature or colleagues. Any errors they make cannot be challenged by proposers since feedback, which is criticised by project applicants as minimal, does not occur until after irrevocable decisions are made. The Panel believes that this lack of transparency and total reliance on the memory of an unknown group of people is one of the main reasons that the process has been characterised as not involving peer review.

The Commission believes that participation by industry requires total confidentiality, but those industrialists, (about 10 to 15) with whom the panel discussed this point, were not concerned by it. In any case, the list of contracts and their participants is very soon published, and the intention is to publish the results, so confidentiality is not maintained for long. Furthermore, the control exercised by the Commission only arises once the proposals arrive in Brussels. Before that, while they are being finalised, they must be passed between participants laboratories, both industrial and academic.

The Panel realise that all Community scientific Programmes use the same selection process. It may be that some industrial sectors are more concerned with confidentiality than others. The biotechnology sections of the Framework Programme are now large enough that it would not seem unreasonable to develop mechanisms appropriate to this sector. The Panel is aware that the first two VALUE Programmes sent copies of project proposals to reviewers some weeks before their arrival at the selection meeting. There is no indication that this process caused any difficulty. Nevertheless the VALUE system has subsequently been changed simply to bring it into line with other Programmes.

The development of very large T-projects was also a source of some concern for the Panel. Such projects become rather difficult to evaluate for three reasons. First it is

difficult to identify suitable evaluating experts from outside the project. The use of experts from non-EU countries could overcome this. Second, it is psychologically very difficult to reject a proposal from a network that involves a large number of laboratories. The third problem is that large networks may tend to develop rules of functioning which make it difficult for outsiders to join. These problems do not override the value of T-projects, but they should be noted and guarded against.

Recommendations

1). The Panel recommends that the list of names of the experts from which the reviewing panels are selected should be published. The membership of each review panel must remain strictly confidential, but the publication of the total list from which each panel is drawn would give individual scientists confidence that their project was reviewed by top experts in their field. This would eliminate the criticism that the process did not involve peer review since the list would almost certainly overlap with those from which peer review would be sought under the various National Programmes. Even publication at the end of the programme would help.

2). The Panel recommends that DGXII seek an independent review of the requirement for confidentiality of project proposals by industries involved in biotechnology, given that reviewers are at all times under an obligation of confidentiality that includes the way they handle documents entrusted to them. This would establish the degree of the need for confidentiality. The view should be obtained directly from the companies concerned, rather than only from their national or international trade associations.

3). The Panel recommends that project proposals should be sent to reviewers 2-4 weeks before their meeting in Brussels. This would ensure that reviewers could check their facts as in all other peer review situations.

4). The Panel recommends that each reviewer be requested to write a short critique of each project reviewed from which a composite feedback paper could be prepared for the proposer by the Programme Managers. This feedback would not offer an opportunity to reverse the decision but might help in formulating future proposals. Correspondence would be entertained for clarification only.

Sub-annex IIIa

Detailed analysis of the selection process

Introduction

The selection process for evaluating grants submitted to the BRIDGE programme was identified by many participants and non-participants as one of the main problem areas of the programme. Therefore the panel decided to look into it in more detail. We collected information from documents supplied by the commission, interviews with programme managers, participants, non-participants, CAN-BRIDGE members and we also used results from the questionnaires.

Background

Four hundred and sixty one project applications were received, corresponding to a total request for 430 MECU. It was decided to fund 91 projects including 69 N-projects and 7 T-projects grouping.

Evaluation Procedure

The evaluation of BRIDGE proposals took place over a 6 week period. Four hundred and two proposals involving 1884 laboratories were categorized in appropriate topics. A panel of 6 experts chosen from a list provided by the Member States (1024) and by the Commission Services (237) was coordinated by a staff member of the services of the Commission. A total of 184 experts participated in the evaluation process. Approximately 25% of the experts were from industry. These numbers vary slightly between different documents (211, of which 12% came from industry). Each evaluation session lasted 3 days. On day one, projects were split into 6 equal groups, distributed at the start of the meeting to the 6 evaluators, who were asked to exchange their proposals every 2.5 hours. One hour was allowed to read each project. Proposals were evaluated individually while reading, using evaluation forms provided by the Commission. Proposals were rated at this point between 2-4, 2 being high. No top rating was to be considered at this point. A selection strategy was then formulated to allow only 2 projects to emerge (less than 10% of the total number of proposals). Amongst proposals rated 2, some were selected to be eventually attributed the highest rating 1. Evaluation forms were returned to the moderator at the end of the 2nd day. On the third day, two best projects were proposed (from those rated 1). The entire panel had then to establish by consensus 6-12 projects, implying that the third or fourth best choice from each individual evaluator be also included if necessary. The projects in the priority list were debated for 30 minutes each, and a final mark was attributed to each project. Thus, only projects in the priority list were rated twice, once individually and the second time collectively. In this case, the second mark was considered to be the final one. Representative evaluations are shown in Sub-annex IIId It might be useful to get an understanding of how these percentages were arrived at, particularly in grey areas. The table below shows first and second ratings for these proposals:

	First rating	Second rating	
1.	2.00	1.00	HIGH
2.	2.00	1.80	HIGH
3.	2.33	2.17	HIGH
4.	2.60	2.46	HIGH
5.	2.60	-	LOW
6.	3.70	-	LOW

At this point, the priority list with projects ranked in the order of their final evaluation and the total list with projects ranked through averaged individual evaluations for each selection criterion, were transmitted to the CAN-BRIDGE for comments. The list included modifications of the proposals in terms of scientific content and scope, partners, budget etc., resulting from the expert review, management considerations and reviews by other Directorates and Commission Services. We were informed that CAN-BRIDGE rarely made any further changes to the proposals.

Identity of an Evaluation session

Number of evaluators	6
Nationalities	6
Academics/Industrialists	5/1
Duration	3 days
Number of projects/ participants to be evaluated	20/110

Feedback to the applicant

DG XII officials were relatively happy about the selection process and the feedback to applicants. Our discussion showed that even successful applicants did not agree with this perception. Selection criteria, including review procedures for applications, do not seem to be very clear and this was an issue that was re-iterated by many participants during subsequent interviews as well as many of the respondents to the questionnaires. Following evaluation, applicants received a very short report stating that their proposal was or was not funded. Applicants were also given a telephone number in Brussels to obtain detailed information regarding comments on their proposal. The general consensus was that the review process did not generate adequate feedback and constructive criticism to help applicants improve their proposal for future applications.

Criteria followed for the selection of research proposals

* Test for eligibility by commission services
* Expected contribution to removal of specific bottlenecks resulting from gaps in basic knowledge (N-projects) or from structural or scale constraints (T-projects).
* Scientific interest of the proposal, originality, feasibility and relevance to the workprogramme.
* Technical competence of the proposers.
* Multidisciplinarity and integration.
* Transnationality of participating laboratories.

* Industrial interest and involvement.
* Description of risks possibly associated with the proposed project.

Comments on Questionnaire sent to Evaluators by Commission

Following the conclusion of the evaluation procedure, the Commission sent a questionnaire to all evaluators to obtain feedback on the evaluation process. The following points were raised by the evaluators. The Panel is not aware of actions taken by the Commission based on these comments.

1. Have more time to discuss the methodology of evaluation or alternatively to mail the details in advance to the evaluators. (This may have been incorporated into later programmes).

2. One single panel should prepare the priority list for all projects falling within the same subtopic. (This also may have been changed).

3. Difficulties were found with a particular project of technological priority, because of its intrinsic complexity.

4. Timeliness and inadequacy of re-embursement while in Brussels.

Questions leading to Recommendations

1. What is the composition of the Expert list from which Evaluation panels are invited?
2. Projects participants believe a true peer review system involves evaluation panels making decisions with input from external referees
3. What mechanisms exist for ensuring that Commission Staff acting as moderators of the panels are impartial?
4. The result should include a comparison of the priority listing during the second stage of evaluation by the experts with the projects that were actually funded following the CAN-BRIDGE appraisal.
5. What are the details of the scoring procedures?
6. How can feedback to applicants (reviewer's comments, etc) be improved?
7. Does the system select against high-risk but innovative and potentially rewarding projects?
8. Is there an opportunity for the project evaluation team to make a post-mortem examination of final project reports?

Highlights on evaluation and selection procedure from questionnaires to participants

EC procedures for making an application for funding under BRIDGE were in general found to be straightforward to follow. Documents and information leaflets presented no major problems. Respondents from Great Britain had most problems, particularly in regard to adequate warning of deadlines and complexity of application forms.

When respondents were asked to comment on various aspects of the evaluation and selection procedures, they gave the following reactions:

Speed: In general satisfactory, with most problems coming from the GB, NL, F participants. For example whereas in a typical case, Germany would respond as happy: 18, OK 14, problems: 15, GB would be: happy : 7, OK: 7, problems: 21.

The following table shows the opinions of respondents from the four major countries on the transparency and ease of following of the award procedures:

Country	Satisfied	OK	Not satisfied	% not satisfied
Germany	16	14	15	33
Great Britain	7	11	19	51
France	17	13	10	25
Netherlands	11	16	9	25
All other countries	50	30	16	17

The next table shows the opinions of respondents from the four major countries on the adequacy of feedback of refereed information:

Country	Satisfied	OK	Not satisfied	% not satisfied
Germany	25	8	22	40
Great Britain	15	5	30	60
France	27	5	7	14
Netherlands	28	4	19	46
All other countries	76	22	25	24

There is still a large proportion of those who were successful that still had serious problems with feedback (54% satisfied, 32% not satisfied).

Sub-annex IIIb

Commission publications relating to the Project Selection Procedure

A. Aguilar, January 1993. Highlights of the peer review system followed for the evaluation of biotech research proposals.Commission of the European Communities, Directorate General XII. R&TD Actions: Life Sciences & Technologies-Biotechnology.

Anonymous. BRIDGE Breakdown of the selection process. Commission of the European Communities

Anonymous. Notes for the Evaluation Process. Biotechnology (1991-1994) Third Call for Proposals. Commission of the European Communities.

A. Aguilar. April, 1990. Highlights on the procedure followed for the evaluation of BRIDGE proposals. Responses to the questionnaire sent to BRIDGE Evaluators.

E. Magnien and D. de Nettancourt. 1993. What drives European biotechnology Research: IJTM. Interscience Enterprises Ltd. Special Publication on the Management of Biotechnology. 47-58.

Annex IV

Evaluation of Projects by Programme Area

Introduction

The Area Reports are based on a review of the Programme Progress and Final Report and other Programme publications, discussions with Participants and examination of the responses to the questionnaires. The Panel is aware of the contrast between the necessary brevity of the project evaluation reports that comprise this Annex with the large amount of literature that relates even to a single project. The review presented is what is required for the assessment of the Programme as a whole. Any greater evaluation would require a great increase in cost and time commitment.

Area Evaluation N- Projects
Area A: Information Infrastructure

Background

This area is one of qualitative significance within the BRIDGE Programme, though it received only about five per cent of the Programme funds.

Nine projects were funded in two sub-areas: "Processing and analysis of bio (techno)logical data (7 projects); Culture collections (2 projects).

From the seven projects under the first subarea, five correspond to databases (one on nucleotide sequences; two on protein sequences; one on carbohydrates; and the last one, on immunoclone and hybridoma). It is worth pointing out that one of them (BIOT-CT-910271) on "Integrated data and knowledge..." was really a research project and not a service. The other two projects fit into the concept of communicating networks (the EMB net and the Electronic linking services).

The two projects in the second subarea reflect the need to foster networking between different collections of biological materials. It has been recognised that the important national culture collections were seldom known by the industry and the scientific community. This lack of awareness hampered the application of this huge amount of information to scientific and technological problems.

Accomplishments

This area has facilitated the launch and upkeep of a series of databases, and extends the understanding and use of bioinformatics through the European Union.

As can be deduced from the reports (Final Report BRIDGE 1994, volumes I and II) the number of users showed a notable increase. Although this is hard to measure in a communications system that is freely available and unrecorded, the contract between the European Patent Office and the EMBL Data Library, the 50,000 users of the Protein Sequence Data bank, the 600 users of the "Immumoclone and hybridoma database" and the training impact of the nodes of the EMB net, attest to this increase.

Evaluation

There are doubts about the rationale of funding these activities through the mechanism of competitive project applications. They are basic infrastructures and services that require financial support not only for launching but for their effective upkeep. In spite of this, Area A represents a noteworthy effort to build a common infrastructure aimed at strengthening the scientific and technological base of all sectors where biotechnology will have an influence.

In view of the importance and specific characteristics of this activity it is proposed that a specific sum be allocated to ensure continuity of the operations. These funds should be distributed following a periodic review of performance.

The sub-area Culture Collections in which modest funding was invested does not show many positive results. The scientific community in Europe does not seem to be aware of the value of a transnational resource of this kind. Suggestions to correct this might include the elaboration of a data base on culture collections, to increase knowledge of their existence and to facilitate access by the scientific community.

Although the Final Report indicates that the ratio of publications per participant laboratory is one of the highest of the different BRIDGE Areas. This outcome does not seem an important indicator for the evaluation of Area A. The differences between the type of project and the qualitative value of publications make comparisons difficult. It is important to develop appropriate indicators of success to justify continuation of funding of potentially long term infrastructure activities.

Area Evaluation N- Projects
Area B: Enabling Technologies

Background

Enabling technologies comprised a total of 10 projects in three areas, Protein Design and Molecular Modelling (4 projects), Biotransformations (5 projects) and Gene sequencing (1 project). Initially there were 52 contracts with a projected expenditure of 7.5MECU. This averaged 150KECU per contract with a range of 100-180MECU. The objectives of the various contracts concerned the development of methods to overcome some of the problems in the development of new molecules and processes. These include methods to predict the structure of proteins from their sequence and changes in function from changes in structure; methods to control the use of enzymes in the synthesis and detection of small molecules; methods to speed up and automate the determination of gene sequences.

Accomplishments

The achievements within this area were rather mixed. The single project on Genome Sequencing did not achieve its main objective of demonstrating the ability of the method, a solution phase system, to give a direct read-out of a sequence. The overall aim of the project was clearly too ambitious for the resources available. Too many fundamental problems needed to be solved at the outset. Nevertheless there is a possibility of some spin-off applications.

The Biotransformation area also had mixed fortunes. The publication record shows that some projects had a good output whereas others appear to have had more difficulty and publication was rather meagre. Nevertheless, the overall aims of the area were sensible and some processes advanced to the point where industrial applications are anticipated.

Protein design and molecular modelling is an intense field of activity world-wide and the applications of the general techniques are frequently of great interest to industry. The work carried out in these projects led to some notable advances. There was a substantial number of publications, mostly in important journals. These projects show that Europe has high quality workers in this field and produces results of international stature. The work is truly enabling in that it links to and supports a number of other areas.

Evaluation

An overall view suggests that this area merits further selective support. There may be some useful applications from the sequencing project but the main aim is likely to be overtaken by new mass spectrometry methods. Biotransformation is not yet a commercial reality in most fields but it remains a valid approach that warrants selective support. Protein design and molecular modelling are clearly important in a number of biology-based industries and are beginning to have quantifiable commercial impact. The strength of the European effort in this field merits further support, since its effect on the competitiveness of industry will be immense.

Area Evaluations N- Projects
Area C: Cellular Biology
Physiology and molecular biology of industrial microorganisms

Background

A total of 5.1 MEcus was devoted to six N projects. Each project typically assembled half a dozen European laboratories of good scientific reputation, on subjects that in all cases had clear industrial relevance. Great care was obviously taken to ensure a good balance of laboratories from all parts of Europe, and four projects had direct industrial participation. There is a reasonable blend of industrially important bacteria (*Bacillus*, *Corynebacteria* and *Streptomyces*), yeasts (*S. cerevisiae* and 'non-conventional' yeasts) and filamentous fungi (*Aspergillus*).

Accomplishments.

All six projects had a reasonably good publication output. Two of them were particularly successful in this respect. It is, however, rather disturbing to see that some of the participating laboratories had no publications at all in the final report except those 'in preparation'. The 'non conventional' yeast project is the only one that led to a patent application which suggests a successful integration of the industrial partner. Nevertheless, even the two projects without industrial partners were highly relevant to microbial biotechnology exemplifying that there is often no direct correlation between industrial participation and industrial relevance in such precompetitive research projects.

Evaluation

The overall quality of the research was good. There were some weaknesses but also excellent work from some projects or partners, and a clear biotechnological relevance. The money spent was notably less than in the other two Cell Biology sectors, for no obvious reason. The great potential of recombinant DNA technology for industrial microorganisms (including environmental aspects such as bioremediation) is far from fully explored. Even without industrial endorsement it would have been a good idea for the EU to stimulate research in this area, for example by supporting precompetitive projects on microoganisms with promising but still poorly exploited biotechnological potential, such as archaeobacteria and cyanobacteria. In this area as in all others, there should be more room for young teams and truly innovative projects.

Area Evaluation N-Projects
Area C: Cellular Biology
Basic Biotechnology of plants and associated microorganisms

Background

The biotechnology of plants and related microorganisms was addressed by 13 projects worth a total of 9459 KECU, contributed by the Programme. Eighty-five participants, 13 from industry, representing 15% of the total, took part in the project. Of the 13 projects, two were concerted actions consuming 30 KECU each. The remaining 11 projects each consumed between 624 and 1151 KECU. Areas covered by the projects included: molecular genetics of development, reproductive biology, somaclonal variation, molecular plant virology, biological control, nitrogen fixation, molecular plant pathology, transposon tagging and genes involved in major metabolic pathways.

Accomplishments

Major cooperative links were established in almost all the projects with free exchange of information, material, technology and personnel. The degree of meeting original objectives as set in project descriptions and productivity in terms of publications is generally satisfactory. It is difficult to use the number of publications as an objective marker of output, without looking in depth at the citation index of specific Journals.

Evaluation

In general, projects ran smoothly with no major problems of coordination, interactions amongst participants and output. Most of the agreed objectives were met. However, it is surprising that so few joint publications resulted from these projects. This is striking, as the entire premise of BRIDGE was to foster collaboration across different laboratories in different countries. It appears that this was done by meetings and exchange of information and materials. Publication records do not reflect the establishment of a truly, cooperative environment across the participating laboratories.

Area Evaluation N-Projects
Area C: Cellular Biology
Biotechnology of animal cells

Background

This rather heterogeneous subarea had a total investment of 7.01MECU with 59 participants. It can be further subdivided into 3 groups of projects:

1. Two projects on *expression systems* (artificial chromosomes and protein production in animal cells), financed with 1.08 and 0.72 MECU, respectively. Although formally separate, these two projects had a close scientific relationship with the T-project on Animal Cell Biotechnology (meetings were actually held in common).
2. Three projects on *specific animal systems* (liver proteins, pig genome, fish genes), financed with 0.7, 1.2 and 0.94 MECU, respectively.
3. Four projects on *vaccines against viral diseases of domestic animals* (Marek, parvovirus, foot-and mouth, herpesvirus-1), financed with 0.54, 0.55, 0.56 and 0.72 MECU, respectively.

Accomplishments

The two projects in group 1 achieved relevant progress in the general biological understanding of the basic phenomena involved; in addition, some useful by-products (vectors) were obtained that could be of practical applicability.

The three projects in group 2 all had a high-profile publication output that attests to the good quality of results. The success of the PiGMaP project deserves special mention: genetic and physical mapping of the pig genome was performed concurrently and in integrated fashion in the 18 participating laboratories, resulting, in 3 years, in a 20 centiMorgan linkage map and in the regional localization of 270 loci on the 19 chromosomes. The identification on chromosome 4 of genes controlling growth and fatness could be of practical importance, while the development of a strategy for the study of multigene traits could serve as a model in several human diseases with a complex genetic basis. In this case, European science was able to compete successfully with a parallel project in the US, due to the network established under BRIDGE. This could not have been achieved without the unifying effects of the EU program.

The four projects on antiviral vaccines were limited in size (3 or 4 participants per project) and the publication output was correspondingly reduced. Significant progress was achieved in all projects and in two cases an effective vaccine was patented.

Evaluation

The vast field of animal cells received under BRIDGE only scattered attention in relatively few projects. Success was highest when substantial effort was invested in a given problem, while dispersed small projects produced scientifically worthy results, but failed to show impressive advances.

Area Evaluation N- Projects
Area D: Prenormative Research

Introduction

The N-projects of this area were supported by 10 MECU, which is 10 % of the total budget of BRIDGE. They were divided into two subareas:

1. In vitro evaluation of the toxicity and pharmacological activity of molecules
2. Biosafety

Neither subarea is normally the subject of academic research efforts. Activities of sub-area 1 are usually performed in industrial or applied institutional research establishments whereas sub-area 2 is a new target provoked by public concern about the deliberate release of genetically modified organisms (GMO).

Twenty-two projects were developed involving 105 participants from 14 countries including 3 of the EFTA countries (Austria, Switzerland and Sweden). The duration of the projects was 36 months for subarea 1 and 24 months for subarea 2.

1. In vitro evaluation of the toxicity and pharmacological activity of molecules

Background

This research addressed the development of instruments and strategies to replace the use of animals in pharmacological experiments, with potentially parallel effects on ethical and legal issues. A reduction in research costs may also be possible. This objective is within the goals of prenormative research.

Eight projects were selected, total funding, 4.5 MECU, or 4.5 per cent of the BRIDGE programme. The topics of the selected projects were quite diverse, providing a good spread of the problems faced by the current research on potential pharmaceuticals.

Accomplishments

Important steps were taken in the development of instruments and methodologies. Some of them led to validation tests.

A majority of the projects produced results of industrial interest.

This subarea had a good publications rate, averaging six publications per participant which is among the highest of the Programme. The range, however, was quite large amounting to 3 to 12 per participant. Most were in journals of reasonable quality.

Evaluation

There is no record of patents arising from projects in this subarea. The significance of the validation tests developed appears to be limited since there is no indication that they will be accepted by regulatory authorities.

The participation of industry in the projects was quite limited and in this case may reflect on the expected value of the outcome. However, in spite of the value of the objectives addressed, the link between pharmaceutical research and biotechnology is much broader than that represented by these projects.

2. Biosafety

Background

The subarea Biosafety had the goal of bringing experimental evidence to bear on the discussion of the environmental effects of the deliberate release of genetically modified organisms. This project area was in effect demanded by the public to provide information for risk assessment. It is also required by scientists and industrialists who need scientifically acceptable model systems and field tests to provide safety data on potential products.

In most cases, at the time of initiation of BRIDGE, the tools were not available to trace the GMOs or their specific engineered genes. It was thought that this subarea would provide a sound scientific basis for further discussions.

Accomplishments

Fourteen projects were selected with a total funding of 5.6 MECU, corresponding to 5.6% of the funds of the BRIDGE-programme. The projects were quite diverse, addressing releases of genetically modified plants and viruses, the latter for pest control and live vaccines. This was the first attempt to fund research on safety and risk assessment at the European level. Seven industrial laboratories participated. Some advances were achieved in sample preparation and standardisation that could potentially form the basis of a spin-off contract research company.

Evaluation

In no case did the experiments show a different risk to the environment of the GMOs compared to the original organisms. It is not clear that this data has been used in public discussion of this issue at any level.

The duration of the projects on biosafety was limited to 24 months. This is too short to assess long term behaviour. This fact was also stressed during interviews with participants and coordinators.

An important advance was achieved in sample preparation and standardisation. This could facilitate the transfer of the data collection for risk assessment to spin-off contract research companies rather than academic laboratories.

The publication rate amounts to about 3 per participant with 25% joint publications. However, a large proportion were only submitted for publication, and many were conference abstracts and EC publications. Two contracts had an unacceptably low output. In general publications were in high quality journals of molecular biology, microbiology and botany as well as some ecological journals. However, overall this does

not necessarily indicate a high level of performance.

The funds spend on Biosafety were greater than those spent on industrial microorganisms. Careful examination of the projects shows that, although this is an important area, the Programme supported some projects of questionable merit well below the standards of the rest of the Programme. Some did not even fulfill the obligatory requirement of transnationality. There is no doubt that pollen transfer between related plants occurs. The important questions are whether this produces an unacceptable risk or whether the risks can be contained. The projects in this sub-area did not address these questions in any scientifically valid way. It would be a mistake to perpetuate a culture in which social or political issues dictate that projects should be supported regardless of their scientific worth.

For future programmes the Panel recommends that problems in this area should be addressed by high quality research in fundmental ecology. The emphasis should be placed on ecological questions related to risk assessment. The Panel is concerned that this may not be occuring in current Biotechnology Programmes.

Area Evaluation T-Projects
Yeast Genome Sequencing

Background

Successful projects in the preceding Programmes culminated in the publication of the full sequence of chromosome III in 1992. The T-project in the BRIDGE Programme was set up to sequence two further chromosomes, (II and XI) and to prepare cosmids for the sequencing of three more, (VIII, XII and XIV). In addition there were separate projects on Informatics and Function Search. The latter is clearly of importance since such a large proportion of the putative genes identified have no known function or phenotype and no homology with other known genes. The project involved 31 laboratories and was expected to spend 5.06mECU over 36 months. Laboratories received 2 ECU per base, thus were paid by the amount of work done.

Accomplishments

The major sequencing objectives of this project were achieved in a timely fashion. The sequence of chromosome II was published in 1994 and chromosome XI was in press in 1995. European laboratories lead the field of yeast genome work at this point. Under an international agreement finalised in 1994, the sequencing programme was divided into 20 genomic regions, 13 whole chromosomes and 7 fragments from the remaining three. Of these, 13 were allocated to European laboratories including laboratories not funded under BRIDGE and including the 3 chromosomes now completed. The participants predict that the sequence of the whole genome will be complete in 1995 and published during 1996. They estimate that it will comprise just under 7,000 genes.

The informatics function continued its successful role in co-ordinating the alignment of the sequences produced. Checking systems assessed the average error rate. This was lower than previous projects, (99.97% accurate) and much better than other rapid sequencing projects. Most sequences are error free. Some have one error and these are easily detected if the gene is studied further. More information was obtained on chromosome organisation. Gene density and the proportion with no assignable function remained as found previously. Some of the novel genes are related to genes in higher organisms involved in differentiation or malignancy.

Evaluation

This T-project compares favourably with the most successful international scientific collaborations. The decision, in about 1987, to set up the original collaboration was clearly very far sighted. It faced some opposition and there was considerable pressure to add the resources required for this team effort to the international collaboration on the Human Genome project. The arguments for a separate yeast effort, and the decision to go ahead can now be seen to have many fundamental consequences. Some industries that traditionally use yeast may paradoxically be slower to feel the impact but the importance for fundamental biological studies, including those that will affect the pharmaceutical industry, cannot be overestimated.

Area Evaluation T-Projects
Molecular identification of new plant genes

Background

This project centred on three major Research Institutions, involved 22 teams from 13 different academic and 6 industrial laboratories. It aimed to organise European laboratories working on the molecular genetics of *Arabidopsis thaliana*, at a time when this small dicotyledon was increasingly recognised as an important model for plant molecular genetics. Haploid plants such as *A. Thalania,* facilitate the isolation of mutants and tha fact that it has a small genome (100 Mio bp) makes it easier to isolate genes. The project coincided with National research programmes on the same general theme in the UK, DE and FR. It followed a strong development of *Arabidopsis* research in the US and contributed to reducing the gap between US and European efforts. Specific themes included physical genome mapping, support to two resource centres, the development of gene replacement and gene tagging techniques, combined with research on floral induction, seed development and embryogenesis.

Accomplishments

Interesting results were obtained in most of the themes, with an excellent publication output. Reliable techniques for gene inactivation were not achieved and are in fact still an important bottleneck. It would have been useful to see a brief discussion of the perfectly good reasons why this objective was not met. Similarly, an important outcome of the project was to pave the way for a subsequent sequencing programme launched in the Biotechnology Framework Programme. Since the *A. thaliana* genome is six times larger than the yeast genome (but substantially smaller than the genome of all economically important plants), a brief discussion of the scientific choices involved in the formulation of this Framework Programme would have been most welcome.

Co-ordination was highly praised by most participants. For administrative reasons, the project had to be split into two consecutive grants, which generated excessive paperwork and some frustration among participants. This situation, presumably due to constraints beyond the control of the DG XII staff, may have damaged the image of European research grants in the laboratories concerned.

A. thaliana is of no direct industrial relevance and the project was clearly of a pre-competitive nature. It is therefore noteworthy that there were six industrial laboratories among the participants. However, the final report makes no mention of the contribution of three of them. This project obviously has considerable biotechnological relevance beyond that demonstrated by direct industrial participation. Plant biotechnology will gain from knowledge based on a tractable model like *A. thaliana*, provided that there is good transfer of that knowledge to economically important species.

Evaluation

This was a timely, well managed and scientifically productive project, that notably contributed to the development of good research on *Arabidopsis* in Europe. The decision to focus on *Arabidopsis* research in plant biotechnology was undoubtedly an excellent

one. Future collaborative European work in this field will require that specific scientific choices are made, for example: the relative effort on functional analysis compared to sequencing; the organisation of sequencing, (physical gene mapping as opposed to total sequencing, cDNA sequencing as opposed to genes); the priority of various physiological or pathological functions in the context of a biotechnology programme.

Area Evaluation T-projects
Lipases

Background

The project was organised by one main and four sub co-ordinators and included 12 other participants. Four of the 17 were from industry. The project addressed six research areas:

1. 3-D structure and catalytic mechanisms of industrially relevant lipases;
2. Characterisation of lipases for industrial application;
3. Structure-function relationship of *Pseudomonas* and *Bacillus* lipases;
4. Digestive tract triacylglycerol lipases and colipases;
5. Exocellular fungal lipases;
6. Molecular structure and specificity relationship of microbial triacylglycerol lipases.

The diversity of the participants in a number of projects, and the fact that three of the sub co-ordinators were from industry, resulted in a network that enabled efficient industrial use of the scientific results generated by the academic partners.

The lipase project included many highly productive European laboratories, permitting effective use of both the 3-D structural analysis and enzyme catalytic studies for the prediction and construction of industrial lipases with desired pH and temperature stability for future applications in detergents.

Accomplishments

The central question of the mechanism by which lipases are activated by interfaces was addressed by investigating the structure, the interfacial binding and the catalytic mechanism of digestive tract triacylglycerol lipases and their colipases and of fungal lipase (cutinase).

The research gave rise to several useful and interesting results. These included:

1. The cloning and overexpression of lipases in the Baculovirus expression system among others.

2. The purification of lipases for crystallisation and kinetic studies.

3. The crystallisation of several lipases leading to (i) the structure of *P. glumae* lipase which contains a calcium binding site that helps to stabilise the active site and (ii) the structure of the *Chromobacterium vicosum* lipase.

4. Heavy atom derivatives of *B. subtilis* lipase crystals were not formed so SDM was carried out to identify the possible catalytic triad as Ser77, His156 and Asp133.

5. 2-D and 3-D NMR studies of porcine pancreatic prolipase in solution leading to a partial solution structure.

6. Modelling of *P. aeruginosa* lipase structures based on sequences and established 3-D structures of several lipases.

7. Insight into the mechanism of "interfacial activation" which involves a shift in the lid over the active site of several fungal lipases.

8. Molecular modelling of the interactions between fatty acid moieties and potential binding sites of fungal lipases.

9. A comparison of the incomplete lid domain of guinea pig pancreatic lipase with the complete domain of the coypu enzyme indicating that both enzymes can be active and that the intact lid of the coypu enzyme does not necessarily cover the active site.

10. *P. glumae* was found to be an excellent potential source of lipases for detergent applications. However, it was found to be cleaved by Savinase, (a NOVO subtilisin preparation currently used in detergents), at a single site in water and at multiple sites at a detergent interface. From the structural studies it may be possible to predict forms that will be resistant to proteolytic attack.

Evaluation

This was a highly successful project that led to three new 3-D structures via X-ray crystallography and models for 7 other lipases based on comparisons with known 3-D structures. Suggestions of how lipases may be modified for use in specific applications may well be of value to industry.

The published results were substantial. There were 110 joint and individual publications in good to excellent refereed journals and 7 patent applications, illustrating that good science and potential industrial applications can be combined fruitfully.

Area Evaluation T-Projects
Lactic Acid Bacteria

Background

Lactic acid bacteria (LAB) play a key role in industry. The value of products produced with their aid exceeds 100 BECU per annum and they are used in the agricultural production of over 200 million tonnes of silage. They are thus the most important group of micro-organisms used in the food industry as well as agriculture.

The objective of this T-project was to advance knowledge of the genetics, molecular biology, physiology and biochemistry of LAB and the identification and/or construction of improved starter culture strains to meet the requirements of industries that are of major economic importance for Europe and thus relieving important bottlenecks in production and process applications. The aim was also to enhance culture performance and efficiency and generate novel characteristics for new applications.

The project covered 36 months, 34 participating groups, (7 from industry), from 12 countries and had a budget of almost 4.9 MECU.

Accomplishments

The project encompassed 5 major areas. These were (i) Proteolysis, (ii) Phage and Phage Resistance, (iii) Antimicrobials and Molecular Aspects of Food Preservation, (iv) Metabolism and Growth in Extreme Conditions, (v) A core activity of Chromosome Analysis, Regulation of Gene Expression and Conjugation Systems.

Major achievements were:

1. Biochemical and taxonomic classification of over 600 strains involved in various food products and processes.

2. Development of foodgrade systems for stable cloning and controlled expression of heterologous genes.

3. Development of practical strategies for chromosome integration.

4. Determination of biochemical, functional and genetic properties of proteolytic enzymes of *L. lactis*.

5. Analysis of the effects of several genetically modified strains on cheese ripening.

6. Establishment of the full sequence of phages Tuc2009 and blL67.

7. Development of tools to achieve a higher degree of phage resistance.

8. Identification and characterisation of novel bacteriocins with structure/function relationships, production and mode of action.

9. Characterisation of the control of *L. lactis lac* operon and identification of tagatose-6-phosphate as the physiological inducer.

10. Metabolic design of strains with higher yield of flavour precursors, e.g. alpha aceto-lactate, without lactic acid production.

Evaluation

More than 250 joint and individual papers were published, many in highly respected journals. More are in preparation or submitted. Seventeen patents were filed, 8 of which are now granted.

This project is one of the most successful undertakings of the EU biotechnology programmes. The publication and patent output supports the strategy of fostering basic research as a prelude to, and in support of possible industrial applications. Since the industrial enterprises depending on LAB are highly decentralised, the outcome of this project will have great significance for small as well as large multi-national companies.

The scientific basis for the application of the tools of modern molecular genetics in food production has been substantially enhanced.

The questionnaires and interviews with participants showed that the project was effective in bringing together a critical mass of scientists, integrating smaller countries and assisting academic workers to enter a new field in a short space of time. The involvement of industry in the planning phase was valuable and it is clear that this project is a good example of how to establish a network in the European scientific community. Such successes merit further support.

Area Evaluation T-Projects
High Resolution Automated Microbial Identification (HRAMI)

Background

The overall aim of this project was to speed up and improve the procedures for identifying microorganisms, considered at the time to be a bottleneck in development of many biotechnological projects and processes. The specific quite broad objectives were:

1. To develop molecular methods based on the analysis of macromolecules and antigenic determinants for rapid identification of microorganisms;

2. To develop probes to enable detection and analysis of selected organisms in different environments, particularly GMOs (Genetically Modified Organisms);

3. To assess the utility and compare different methods through the analysis of a common set of strains selected from diverse taxa;

4. To expand the microbial taxonomy base, with emphasis on environmentally relevant and uncharacterized microorganisms;

5. To automate the most promising methods.

The project started with some delay compared to the rest of BRIDGE (October 1991) and received 2.1 MECU, about 2 per cent of the total funds, over a two year period.

Accomplishments

The project was highly multidisciplinary since it involved molecular genetics, immunology, analytical chemistry, biochemistry, instrumentation and separation techniques. This was achieved by forming a group of 10 participants from 6 EU countries. The difficulties in managing such a complex, multifaceted project were evident. These were overcome by allocating well defined responsibilities to four groups with adequate links between them. In addition, a Monitoring Unit consisting of three persons representing all parties was given the task of co-ordinating the activities.

New methods for the application of nucleic acid, lipid and protein analyses to microbial identification were developed, and existing methods were improved. Strains and isolates of selected problematic and significant taxa (*Pseudomonas* and mycobacteria) were analysed. The data sets were correlated with each other and incorporated into data bases. A definitive taxonomy of *Pseudomonas* was claimed, but this may be exaggerated.

Evaluation

The HRAMI Project shows one of the highest ratios of publication output per participant laboratory (Final Report BRIDGE). However, the journals where most of the publications have appeared stand in the medium to low range of impact.

This project seems to have suffered from lack of feedback in the project application

evaluation procedure. The requirements of the potential users of the project results do not appear to have been fully taken into account. There is no information on the link and relationship between the output of the project and its participating laboratories with the eventual users of products and information.

The project has some of the characteristics of an information infrastructure project. Its aims are horizontal and may be complementary to many other actions of the BRIDGE and other BIOTECH Programmes. It could interact with the Information Infrastructure Area, the Industrial T-Projects, and the Biosafety Area.

In retrospect, many of the aims of this project may have been overambitious. For example, molecular methods will not distinguish between live and dead organisms which may be of crucial concern to some users.

Area Evaluation T-Projects
Animal Cell Biotechnology

Background

The 6 sub-projects of this T-project were financed with a total of 2.52MECU for the 24 participants. Two of the sub-projects had 2 participants, two had 3 and two had 7.

The overall aim of the T-project was to improve the production of recombinant proteins expressed in animal cells. Such a broadly defined area included disparate topics ranging from expression vectors (2 projects), post-translational modifications (2 projects), and the expression of specific classes of proteins (2 projects).

Accomplishments

It is not surprising that results were quite heterogeneous, ranging from rather modest achievements to interesting advances. Industrially applicable results were obtained, which included various novel vectors and promoters, a study of the media requirements for optimal expression and glycosylation, a detailed description of some proteolytic processing enzymes and a protein with chaperone activity. Industrial interest was facilitated by the creation of the Animal Cell Technology Industrial Platform (ACTIP) . A panel of 30 industries were provided with the data arising from the project every six months.

The distinction between N-projects and T-projects adopted under BRIDGE shows its limitations in cases like this one: it would not be easy to define this T-project as a clear targeted effort towards the elimination of specific bottlenecks resulting from structural or scale constraints . The project was rather disperse, with too little investment in each specific sub-area, and it could hardly be distinguished from a pool of N-projects. In fact, two N-projects were doing very similar work and were participating in joint meetings with this project.

Evaluation

This project reflects the limited effort that was generally devoted to animal cells under BRIDGE. This tendency was modified in subsequent biotechnology programmes, where a much larger investment was provided for animal cells and, more recently, for biomedical research.

Area Evaluation T-Projects
Plant Cell Growth and Differentiation

Background

The major objective of this project was to provide knowledge of the mechanisms by which a variety of signals control growth and differentiation. A secondary objective was to develop tools at the cellular and molecular levels to render morphogenetic events accessible to scientific analysis. It involved an expenditure of 3.9MECU. The strategy was to form a team working on the basic mechanisms of growth factor perception at the cellular level and the study of key morphogenetic events such as somatic embryogenesis, microspore embryogenesis and rhizogenesis. The practical objective was to improve the basic knowledge necessary for rendering the regeneration of plants a more predictable process. The task was distributed among five groups of comparable size in five contracts. These were: regulation of the inductive phase of microspore embryogenesis; Plant growth regulators: perception, interaction and response; The molecular analysis of higher plant embryogenesis; the Rol genes as privileged tools to study plant morphogenesis; molecular analysis of auxin-specific signal transduction in plant communication.

Accomplishments

Some of the major achievements of the programme were: the delineation of the role of secreted proteins and glycoproteins in the regulation of somatic embryogenesis; the discovery of genes and gene products involved in several aspects of cell differentiation; the production of tools for use by the wider scientific community. A variety of nucleic acid probes, mutated genes, gene constructs, transgenic plants, antibodies, oligosaccharides, new ligands, cell lines etc., were prepared and distributed widely. This led to the initiation of 110 joint experiments. Up to December 1993, more than 200 papers have been published describing the results of the project. This number will probably increase dramatically when the project is concluded. A newsletter, T-News was created at the start of the project and this served as the internal link between the participating research groups. Three to six sectoral meetings for each sub-project area and three general meetings were organized. More than 30% of the papers published involved researchers from different laboratories and about 20% corresponded to publications with transnational authorship.

Evaluation

The project addressed fundamental issues in plant biotechnology. It provided new information, tools and technology for participants and the wider scientific community. A number of the outputs of the project were taken up by industry. Industrial laboratories comprised about 13% of the project team. Results from some project areas provided a biochemical understanding of fundamental plant processes and were impressive. The training component of the programme was strong and this was reinforced by encouraging postdoctoral fellows to interact with other members of the project and to attend sectoral and general meetings. The creation of a Plant Industrial Platform (PIP) was also a means to disseminate results and technology.

Annex V

Impact of the BRIDGE Programme on the EU Biotechnology Industry

Measures to establish the impact of the BRIDGE Program on industry include: the involvement of project participants with industry during their BRIDGE project; the output of individual projects with respect to publications, patent applications and use of the results by industry, and development of post BRIDGE projects together with industry.

The involvement of University and Institute groups with industry was not equally distributed in Europe. A number of indicators shows that such interactions were best developed in the Netherlands and the United Kingdom, were rather less developed in France and Germany, and were sporadic in other European countries. This pattern is still seen today, although project participants were often optimistic about post BRIDGE activities with industry. Many participants developed links with industry as a result of being involved in a BRIDGE project, and generally felt that having carried out a BRIDGE project increased the opportunities for future industrial collaboration, while not impairing access to National funding.

Industry participated directly in about 11% of the BRIDGE projects. Of the respondents to the questionnaires, 6 of the 52 co-ordinators (12%) and 20 of the 262 partners (7.6%) were from industrial laboratories. These samples are too small to allow clear statements about the perceptions and experience of industrial versus non-industrial participants, but no obvious differences seem to emerge.

However, since only 11% of the projects involved direct industrial participation it suggests that a large number of potentially eligible industries did not participate. The Panel therefore decided to conduct a limited and informal poll of leading protagonists in biotechnology industries, located throughout Europe, most of which had not participated in the BRIDGE Programme.

To this end the Panel contacted directors or senior managers of general and biotechnology R&D companies, and asked for their views on European and National biotechnology programmes via a short questionnaire. Half of the responding biotechnology leaders were from established large European companies or sophisticated smaller research intensive biotechnology companies with at least 100 employees, and half of the respondents lead smaller or less sophisticated biotechnology industries. The Panel was particularly interested in determining whether these industries were aware of the BRIDGE programme and other relevant European programmes; why eligible industries did not participate in the BRIDGE Programme; and how they valued European and National biotechnology programmes. The results of this poll are given in Annex VIc and discussed below.

About half of the 37 industrial leaders polled had been aware of the BRIDGE Programme, and most were aware of subsequent European Biotechnology Programmes. The general feeling among these industrial leaders is that European Programmes are important to their industries in an indirect manner, by creating a European scientific

community. Industry did not regard these programmes as the right place to access specific results such as patentable knowledge, nor have they been designed to support new industrial approaches and strategies. National biotechnology programmes were seen as more appropriate for the latter purposes.

It is interesting that, despite the lukewarm perception of National and European Biotechnology Programmes by industrial leaders, virtually all felt that both National and European funding for such programmes should be expanded by amounts ranging from 10 to 100%. Leaders from smaller companies tended to favour higher increases suggesting 50-60% increases for national programmes and 35% for European programmes. Those from larger companies favoured increases of 20% and 25% for the national and European programmes respectively. The industrial biotechnology leaders felt that about 35% (small companies) to 45% (large companies) of the available government funds for biotechnology in Europe should be distributed via European programmes. The reponse from the leaders of small companies resembled that of the participants in the BRIDGE Programme who, although giving a wide range, averaged 35% in response to a question about how much of total biotechnology funding should occur via European programmes.

Annex VI

Main findings of the Questionnaire Surveys

Introduction

All participants in the BRIDGE programme received questionnaires either as co-ordinators or partners of projects. The questionnaires were sent out by the evaluation unit of DGXII and responses were returned to the Institute of Biotechnology, ETH Zurich Switzerland, where they were analysed.

Of the total of 91 funded proposals and 579 participants in the Programme, 52 Co-ordinators (57%) and 262 partners (53.7%) responded, an overall response of 54%.

Both questionnaires are appended as Sub-annex VIa and Sub-annex VIb. These annexes include a summation of the quantitative data obtained from the responses. The data were analysed by splitting responses according to the country of origin of the respondent, and in some cases, according to the project area.

Interpretations based on the overall data and on country data are given below.

Project Area

Table 1 shows the distribution of the N-project and T-project areas and the responses of co-ordinators and partners in each area. The response was well distributed for both co-ordinators and partners, with the exception of the co-ordinator response for a few T-projects.

Table 1

Project Area	Co-ordinators responding	Partners responding	% response Co-ordinators	% response Partners
Information Infrastructure	2	18	22	55
Enabling Technologies	9	23	90	55
Cellular Biology	12	57	43	37
Prenormative Research	9	35	41	42
Yeast Genome Sequencing	0	19	0	66
New Plant Genes	1	20	12	100
Lipases	3	16	60	84
Lactic Acid Bacteria	1	25	100	76
HRAMI	0	6	0	67
Animal Cell Biotechnology	4	14	67	78
Plant Cell Growth Factors	5	14	83	58
Totals	46	252	45	54

BRIDGE Programme Initiation

It is interesting to trace the sources of the different projects and the roles that were played by co-ordinators and partners.

Of the 52 responding co-ordinators, 12 (23%) provided input into the formulation of the scientific objectives of the overall BRIDGE Programme and 10 (19%) did so directly via Commission (DGXII) staff, with co-ordinators from GB, IR, D, F and NL being most active in this respect. Of the 262 partners, 69 (26%) provided input, however, only 29 (11%) did so via Commission staff. The greatest influence was exerted by partners from NL, D and I.

Setting up Proposals

The majority of partners (56%), became aware of the BRIDGE call for proposals via personal contacts with other scientists, while about 18% and 19% respectively became aware via contacts with DGXII staff or through National authorities or representatives. Very few partners became aware of the BRIDGE proposal call via the Official Journal of the EU or through the scientific press. This general pattern was seen for partners from all of the EU member states.

For co-ordinators, awareness of the BRIDGE proposal call came about equally through contact with DGXII staff, National authorities and personal contacts with other scientists.

Of the 52 co-ordinators, 34 (65%) were primary instigators of the proposals and they were highly influential in selecting partners. Some co-ordinators, (20%), contacted potential partners who declined to join the team. About 70% of the co-ordinators made new contacts in setting up the project. The selection of partners was determined by scientific reputation, technical expertise and previous collaboration. Geographical balance was a minor factor in the selection of partners, and the EU requirement for transnational projects was seen as a hindrance by only 8% of the co-ordinators. Half the co-ordinators saw this requirement as neutral and the rest saw it as helpful. About 40% were assisted by their home institution in setting up the project. Half sought help from EU officials in setting up their proposals, mainly for clarification of procedures, terminology and documents.

In 60% of projects, co-ordinators were asked by the BRIDGE management to modify their projects, most often by reducing their funding request and in several cases by combining with other proposals. Half the co-ordinators were content with the resulting changes.

Of the 262 partners, only 15 (6%) were primary instigators of the proposals. Nearly half belonged to a group of existing collaborators, while the other half was invited to join such groups. Most, (80%), made new contacts in setting up the project. About 10% saw the EU requirement for a spread of participants as a hindrance, 54% saw this as neutral and the rest considered it as helpful. Only 30% of the partners were aided by their home institutions in setting up the project. Only 28% sought help from EU officials in preparing their proposals, mainly for clarification of procedures and to a lesser extent for help with terminology, documents and guidance on research categories.

Funding and Scientific Networks are major reasons for initiating a BRIDGE project

Major motives for applying for BRIDGE funding for both co-ordinators and partners were access to funding, access to scientific expertise and establishing a network for future collaboration. Prestige and possible business reasons (partnership, access to products, access to sales, market intelligence) were negligible factors in setting up projects, and interestingly, technical expertise was also unimportant in this respect.

BRIDGE funding clearly supplemented rather than replaced National funding and for 25-20% of partners and co-ordinators it has been a stimulus to obtaining further National funding.

BRIDGE projects support ongoing work

About 90% of the partners and co-ordinators carried out related work prior to the initiation of the BRIDGE project, funded from National sources, University or other intramural funding, other European funding or industry funding, in that order. Both co-ordinators, (70%), and partners, (64%), had had collaborations with one or more of the other partners before the BRIDGE project commenced. These collaborations generally involved joint experiments, exchange of materials, data and personnel as well as training of PhDs and post-docs.

The BRIDGE project was well embedded in the ongoing research of the project participants. BRIDGE-funded work was connected with other projects in the laboratories of most co-ordinators, (80%), and partners (72%).

Almost all of the partners and co-ordinators (about 90%), continued work on the project post-BRIDGE via National programmes, University or intramural support, a European programme and in a limited number of cases, via industry, i.e. via those channels that funded the project pre-BRIDGE.

Almost all the partners and co-ordinators (90-95%)also plan to continue collaborations with one or more of the partners. Despite the clear continuity of these projects both pre and post-BRIDGE, most participants (about 65-75%) felt that the present collaboration would not have occurred if the BRIDGE project had not taken place.

It is interesting that, although industrial partners played a minor role in the projects, about half of the participants reported that the continuation projects would involve industrial collaborators. Apparently, industrial interactions have grown post-BRIDGE. Whether this was a result of the BRIDGE Programme or independent of it has not been established.

The application and award procedures were perceived with mixed feelings

A questionnaire sent to all participants showed that 57% (150/262) felt the application procedures were difficult to follow (rating them 3 or above on a 1 to 5 scale) with 10% giving the worst rating. A related question on the clarity of these procedures gave almost identical figures. Finally, 39% felt that warning on application deadlines was inadequate. The same questions were addressed to project coordinators, who had a closer contact

with DGXII, and the figures were not very different (50%, 38% and 42% respectively). In summary, applying to BRIDGE appeared to be an unduly complicated affair. The complexity of the application forms must have been recognised, since these forms are more streamlined in the present Biotech programmes. Whether this really simplified the situation for the applicants remains to be seen.

Both co-ordinators and partners were unhappy about the project evaluation and selection procedures. The procedure was considered to be average for speed, somewhat obscure and rather difficult to follow, and the feedback of refereed information was considered inadequate. Since these are the views of European researchers who were successful in gaining support from BRIDGE, it is likely that the views of the many who were not supported would have been even more critical. This is one area in which improvement is essential if European science programmes are to gain widespread support, respect and appreciation from the European scientific community.

Operation and management of the project

The co-ordinators were reasonably satisfied with the help they received from the EC management in administering their projects and most (70%) felt that the EC managed the distribution of funds efficiently.

The co-ordinators were rather satisfied with the co-ordination of their projects and nearly 90% received help from other partners in preparing proposals. Apparently co-ordination is a satisfying task since 88% would co-ordinate another EC funded project. It is interesting that the partners were even more satisfied than the co-ordinators with respect to project co-ordination.

Many co-ordinators (61%) ran a formal project monitoring system, mostly via written annual or half-yearly reports and meetings.

On the whole, both co-ordinators and partners found the co-operation to be reasonably easy. In the more difficult collaborations, problems were caused by a single partner in half the cases and by most of the partners in other cases. Difficulties with non-delivery of promised results, technical and administrative problems predominated and, in some cases, personality problems occurred. Language was rarely a source of problems.

In most cases the transnational collaboration required by the EC significantly facilitated the achievement of the scientific and technical goals, (70% according to both co-ordinators and partners). The achievement of scientific and technical goals was hindered in fewer than 4% of the project according to both co-ordinators and partners.

In most cases, new personnel were recruited for the BRIDGE project, generally from the same country and less frequently from other EC countries. Notable exceptions are Italy and Portugal, where National regulations apparently prevented recruitment of personnel. National authorities should be urged to remove such serious obstacles to a fruitful investments of research funds.

Output of the projects

A large majority of the co-ordinators (85%) and partners (75%) felt that unexpected results were obtained in their projects. Most of these were scientific results although there were also unexpected results relating to the quality of inter-laboratory contacts and in generating new academic and to some extent, industrial contacts. Unexpected intellectual property and unexpected product opportunities were clearly less frequent.

Other interesting effects were increased industrial interactions of academics and increased access to National funding. It is rather astonishing that no co-ordinators and only 2-3% of partners consider National funding harder to obtain as a result of EU funding via BRIDGE, while none feel that EC funding has made it harder to develop or finance industrial collaborations. In fact, 30-40% of the partners and 40-50% of the co-ordinators reported that following EU support for BRIDGE projects, it was easier to develop National and industrial projects and funding sources.

Future Biotechnology funding in Europe

Virtually all project participants feel that more funds should be spent on biotechnology research both at the European level and Nationally. In a separate survey, the Evaluation Panel found that this feeling is shared by industry, even when those industries do not benefit directly from European or National programmes.

Given the reality of limited European funding possibilities, about one third of participants opted for more projects with smaller contributions per project, while roughly one third preferred larger projects, of which fewer would then be carried out. The remainder were not interested in limiting resources and wanted to see more projects with equal or more resources than available via BRIDGE.

Given that ultimately total funds for biotechnology or other research will be limited, the participants felt that it would be appropriate to disburse about 25-30% of these funds via European programmes while 70-75% should be disbursed via National programmes. Here also industries with an interest in biotechnology tended to favour more EU and less National control over total biotechnology research and development spending.

Sub-Annex VIa[1]

BRIDGE EVALUATION QUESTIONNAIRE FOR CO-ORDINATORS

General instructions. Where questions require a "Yes" or "No" answer, please circle the chosen word. In all other cases where there are multiple choices, please tick above the line next to your answer. Some questions can have more than one answer. These are indicated.

I . Personal and project details.

1. Name and address: **Responses were obtained from 52 individuals**

2. Contract number

3. Project title

4. Project area, tick one:

N-Projects:

2	A.	Information infrastructure
9	B.	Enabling technologies
12	C.	Cellular Biology
9	D.	Pre-normative Research

T- Projects:

0	T1	Yeast Genome Sequencing
1	T2	Molecular Identification of New Plant Genes
3	T3	Lipases
1	T4	Biotechnology of Lactic Acid Bacteria
0	T5	High Resolution Automated Microbial Identification
4	T6	Animal Cell Biotechnology
5	T7	Factors Regulating Plant Cell Growth and Differentiation

[1] In the questionnaire Annexes, only numerical summation of the responses is given. Narrative and other comments are of necessity omitted.

II. Initiation of the BRIDGE Programme

1A. Did you have any input into the formulation of the scientific objectives of the overall BRIDGE Programme?

Yes 12 No 38

1B. If yes, was this:

2 a) Indirect, through national representatives
10 b) Direct, through Commission staff
2 c) Other, (please specify) _____

III. Setting up your contract proposal.

1. How did you become aware of the BRIDGE call for proposals?

2 a) through the Official Journal of the European Union.
19 b) through contact with DG XII staff
18 c) through National Authorities or representatives
8 d) through the scientific press
20 e) through personal contact with other scientists
1 f) other, please specify. _____

2. Were you:

34 a) the primary instigator of the proposal,
13 b) one of a group of existing collaborators
4 c) invited to join a group assembled specifically to prepare a BRIDGE proposal
0 d) Invited to join the group after the proposal had been substantially formulated.

3. How were partners in the group selected? (multiple answers permitted)

44 a) by you as co-ordinator
30 b) by other members of the group
3 c) by suggestions from the EC management
8 d) by partners offering their services.

Please indicate the most important factor if more than one is chosen ___

4A. Did you make any new contacts during the process of setting up the project.

Yes 35 No 16

4B. If yes, were they:

36 a) Academic
21 b) Industrial,
and c) please specify from which countries _____

5A. In preparing the Bridge proposal, did you contact potential partners who declined to join the team?

Yes 10 No 41

5B. If yes, how many were:

4 a) Academics
66 b) Industrialists

5C. Please summarise the main reasons for refusing:

a) Academics

_____
_____

b) Industrialists

_____
_____

6. In developing the contract proposal, did you find that the Programme requirements for a spread of participants from a number of Community countries was:

19 a) a help
4 b) a hindrance
26 c) neutral

7. Did your home Institution, (Contracts Officer, Industrial Liaison Group or others), help in setting up the project.

Yes 22 No 30

8. What factors affected the mix of partners in your group?

14 a) geographical balance
38 b) scientific reputation
38 c) technical expertise
29 d) previous collaboration
3 e) other, please specify. _____

9. Which countries are represented in your project team?

14	a)	Belgium	11	b)	Denmark	26	c)	France
34	d)	Germany	5	e)	Greece	11	f)	Ireland
22	g)	Italy	0	h)	Luxembourg	27	i)	Netherlands
5	j)	Portugal	18	k)	Spain	32	l)	UK
9	m)	EFTA countries						

10. What were your main motives in applying for BRIDGE funding? Please select three in order of importance, by marking 1, 2 and 3.

1	2	3		
28	5	4	a)	Access to funding
14	10	11	b)	Access to scientific expertise
4	6	7	c)	Access to technical expertise
1	1	3	d)	Prestige
7	6	5	e)	Limited National funding
12	10	6	f)	To establish a network for future collaboration
0	0	0	g)	For business reasons, (partnerships, access to products, access to sales, market intelligence, etc.)
1	0	1	h)	Other, please specify

11. Has your BRIDGE funding:

4	a)	Replaced earlier National funding
18	b)	Been a stimulus to obtaining further National funding
26	c)	Supplemented National funding

12A. Prior to the award of the BRIDGE funding did you carry out work related to this project?

Yes 47 No 3

12B. If Yes, which of the following was the source of this funding:

15	a)	University or other intramural source
29	b)	National programme
14	c)	Industry
5	d)	Non-Government/Charity/Private funding
15	e)	a European programme
0	f)	EUREKA
2	g)	other international programmes
1	h)	other, please specify _____

13A. Was the project, during its lifetime, co-ordinated with or related to other projects within your lab with funding from the above sources?

Yes 41 No 10

13B. If yes, indicate the relevant funding source: _____

14. During the period of this project, how many people in your laboratory, not funded by the BRIDGE project, were working on related areas? ____

15. In which other EC Programmes have you participated?

_____

IV. Project Application and Award Procedures.

1. How did you find the EC procedures for making an application for funding under BRIDGE?

	1	2	3	4	5	
Easy to follow.....	4	21	12	10	4	.....Difficult to follow
Documents and information leaflets clear.....	4	28	10	9	1	Documents and information leaflets .....clear unclear
Warning of deadlines adequate.....	23	13	5	9	1	Warning of deadlines .....inadequate

2. How did you find the project evaluation and selection procedures?

	1	2	3	4	5	
Quick.....	5	11	20	12	1	.....Slow
Transparent/easy to follow.....	6	6	12	17	11	Obscure/difficult to .....follow
Adequate feedback..... of refereed information	4	5	11	15	16	.....Inadequate feedbac of refereed information.

3. What is the single most important improvement which you would propose to the procedures of calling for, selecting and awarding project proposals?

_____

_____

_____

4A. Did you seek help from EC officials in preparing your proposal?

Yes 26 No 25

4B. If yes, Did this include:

16 a) Clarification of procedures
11 b) Clarification of documents
12 c) Clarification of terminology
5 d) Guidance on categories of research
3 e) Other, please specify _____

5A. Was your project modified by the BRIDGE management before being awarded?

Yes 30 No 21

5B. If Yes, were you requested to:

26 a) reduce funding and by what percentage
2 b) include additional objectives
2 c) reduce the number of objectives
4 d) include additional partners
7 e) combine with other proposals
2 f) other, please specify: _____

5C. Are you content with these changes, if any?

Yes 12 No 13

Comments: _____

_____

_____

_____

5D. If you were requested to combine with other proposals, as suggested in **5B** (e) above, did this result in duplication of expertise in the project group?

Yes 1 No 9

Comments: _____

_____

_____

_____

V. Operation and Management of the Project.

1. Has the distribution of funds to you as co-ordinator and to the partners been efficiently managed by the EC?

Yes 35 No 15

2. Are you satisfied with the help you have received from the EC management in administering the project?

	1	2	3	4	5		
Satisfied	16	17	12	5	0	.....	Not satisfied

3. What is the single most important improvement the EC management could make which would have assisted you?

_____

_____

4. Are you satisfied with the coordination of the project?

	1	2	3	4	5		
Satisfied	17	22	4	6	0	.....	Not satisfied

5. Was the percentage of your time required to run the project greater than expected, less than expected, or about the same as expected? Please indicate:

a) the expected percentage ___ %
b) the required percentage ___ %

6. Were the reports required by the EC:

15 a) too early in the project
7 b) too frequent
1 c) too infrequent
0 d) requiring too much scientific detail
6 e) too focussed on adminisrative detail

7. Did you receive help from other participants in preparing proposals?

Yes 44 No 8

8A. Would you co-ordinate another EC funded project?

Yes 46 No 6

8B. Can you give reasons?

_____

_____

9A. Did you operate a formal project monitoring system?

Yes 32 No 19

9B. If yes, did this include:

____	a)	written reports:	2	(i)	quartly
			9	(ii)	half-yearly
			15	(iii)	annually
____	b)	oral reports:	17	(i)	by telephone
			32	(ii)	at meetings, (indicate frequency) _____

10. Was the co-operation between the partners, on average, easy or difficult?

	1	2	3	4	5	
Easy	15	17	9	6	2	..... Difficult

11. For scores of 3 and above, was the difficulty focused on:

9	a)	one partner
9	b)	about half the partners
2	c)	essentially all the partners

12. Were the problems largely:

7	a)	technical
14	b)	non-delivery of promised results
8	c)	administrative
2	d)	language
9	e)	personality
4	f)	other, please specify: _____

Any other comments: _____

_____

13. Did the transnational collaboration required by the EC facilitate or hinder the achievement of the scientific and technical goals?

36 a) Facilitate
2 b) Hinder
11 c) No impact

14A. Have you had collaborations with any of the partners before the project commenced?

Yes 36 No 14

14B. If yes, with how many? _____

14C. Did they involve:

9 a) Literature work, (reviews etc)
28 b) Joint experiments
29 c) exchange of materials
27 d) exchange of data
19 e) exchange of personnel
6 f) training undergraduates
9 g) training of PhDs
9 h) training of post-docs

15A. Are you or will you be continuing collaboration with any of the partners?

Yes 49 No 2

15B. If yes, with how many? ___

15C. Would this collaboration have occurred if the project had not taken place?

Yes 9 No 33

VI. Personnel

1A. Have personnel been recruited into your laboratory specifically for the project?

Yes 43 No 7

1B. If yes, indicate the number of staff hired in the following categories:

9 a) from other projects in the lab
35 b) from own country
19 c) from other EC countries
(name countries) _____
8 d) from non-EC countries
(name countries) _____

1C. Indicate the number of staff recruited to the project in your laboratory in the following categories:

Scientific _____
Technical _____
Administrative _____

2. How many staff were retained in permanent posts? _____

VII. Output of the Project.

1. Please list the three most important objectives identified at the start of the project. In each case, what percentage of the original milestones of this project were met?

a) Objective 1 Percentage met ___

_____
_____
_____
_____

b) Objective 2 Percentage met ___

_____
_____
_____
_____

a) Objective 3 Percentage met ___

_____
_____
_____
_____

2. What were the reasons for non-achievement of objectives?

6 a) Unrealistic formulation of objectives
16 b) Scientific*
7 c) Technical limitations (please specify) _____
8 d) Inadequacy of funding
1 e) Limited availability of equipment
0 f) Poor management by the EC
7 g) Poor cooperation between partners
13 h) Other (please specify) _____

* e.g. new information rendering the original objective obsolete impossible or unnecessary.

3A. Did the project have results which were unexpected or could not have been predicted before the work started?

Yes 44 No 8

3B. If yes were these results:

44 a) scientific
16 b) in the quality of inter-laboratory contacts
16 c) in generating new academic contacts
16 d) in generating new industrial contacts
12 e) in generating intellectual property
9 f) in generating new product opportunities
1 g) other, (please specify)_____

VIII. Meetings and Exchanges

1. Have you had contact with the EC Committee of Advisory Nature for BRIDGE, (CAN-BRIDGE), from your country during the project?

5 a) More than 5 times
12 b) Less than 5 times
34 c) Never

2. Indicate the level of interaction by the project partners:

47 a) Attendance at combined project meetings. Number of meetings ____
40 b) Visits between Principal Investigators of partner labs
31 c) Exchanges of research staff. Number of researcher weeks _____
49 d) Sharing of data
43 e) Exchanges of protocols, software etc.
45 f) Exchanges of materials, cell lines etc.
4 g) other, specify _____

3. Have you made any new contacts other than participants as a result of working on the project?

Yes 46 No 6

4. Are these contacts, or work with other participants, leading to further project proposals or collaborations?

Yes 38 No 10

IX. Dissemination.

1. Indicate the importance of the following dissemination routes on assessing the success of the project and try to quantify the expected output.

	Primary Output Route	Secondary Output Route	Expected Output Number
a) Publication in refereed journals	45	6	_____
b) PhD theses	13	22	_____
c) Other technical publications	6	14	_____
d) Conference presentation/abstracts	28	11	_____
e) Patent application	12	9	_____
f) Software	3	4	_____
g) New methods	11	8	_____
h) Standards	4	3	_____
i) Prototypes or pilotstudies	3	3	_____
j) New products	6	1	_____
k) New services	5	3	_____
l) Other, please specify: _____	2	2	_____

2. Which of the following will be the main users of the results of your project?

35 a) Academic scientists
26 b) Industry
2 c) Other, (please specify) _____

3. If the main user is industry, in which of the following categories is it having or is expected to have an impact?

	Current	Expected
a) academic-industry contracts	15	8
b) patents adopted by industry	4	6
c) product development by industry	10	11
d) marketed product	3	2

X. Post-Programme Considerations

1A. Is research continuing in your laboratory on the topic of the BRIDGE Programme?

Yes 47 No 4

1B. If yes, please give the source of funding:

21 a) University or other intramural source
27 b) National programme
12 c) Industry
5 d) Non-Government/Charity/Private funding
21 e) a European programme
0 f) EUREKA
1 g) an international programme
2 h) Other, please specify _____

2. Does the continuation project involve any of the same personnel?

Yes 40 No 8

3. Does the continuation project include any of the same collaborators?

Yes 41 No 5

4. Does the continuation project include any industrial collaborators?

Yes 25 No 19

5. Has EC funding affected the development of your group and your activities by making National funding?

21 a) easier to obtain
0 b) harder to obtain
29 c) unchanged in this respect

6. Has EC funding affected the development of your group and your activities by making industrial projects?

26 a) easier to develop or finance
0 b) harder to develop or finance
23 c) unchanged in this respect

7. About 20% of proposals submitted to BRIDGE were funded, the average EC contribution being 0.77 million ECU per total project. In your opinion would it have been preferable to have:

14 a) more projects, each receiving < 0.77 million ECU
12 b) fewer projects, each receiving > 0.77 million ECU
16 c) other, (please specify) _____

8A. Several EC countries feel that they should reduce funding National programmes as funding via EC programmes increases. Assuming that EC and National funding are related in this way, how would you prefer your country to spend its resources, (give percentages totaling 100%):

___ % by direct National funding
___ % via EC funding

8B. Please explain your reasons:

_____
_____
_____
_____
_____

9. Did the project have added value with respect to: (multiple answers allowed)

21 a) links with other EC programmes or policies
- 0 i) energy
- 21 ii) agriculture
- 1 iii) communications
- 6 iv other, please specify _____

42 b) improvements in scientific cohesion in Europe

29 c) improvements of scientific infrastructure
- 10 i) at a National level
- 33 ii) at a European level

4 d) connection with the social ethical and legal issues in the use of Biotechnology

10. Please list what, in your opinion, are the three most important outputs of your BRIDGE project:

a) _____
_____
b) _____
_____
c) _____
_____

11. Finally, is there one important issue which you feel is not addressed by this questionnaire or is there any other information you would like to add?

_____
_____
_____
_____

Thank you for your help in completing this questionnaire.

Please return the completed questionnaire, as soon as possible and in any case before 10 March 1995, to:

BRIDGE Evaluation Panel
c/o Institute of Biotechnology
ETH Honggerberg, HPT
CH-8093, Zurich
Switzerland

Sub-Annex VIb[2]

BRIDGE EVALUATION QUESTIONNAIRE FOR PARTNERS

General instructions. Where questions require a "Yes" or "No" answer, please circle the chosen word. In all other cases where there are multiple choices, please tick above the line next to your answer. Some questions can have more than one answer. These are indicated.

I . Personal and project details.

1. Name and address: **Responses were obtained from 262 individuals**

2. Contract number:

3. Project title:

4. Project area, tick one:

N-Projects:

18 A. Information infrastructure
23 B. Enabling technologies
57 C. Cellular Biology
35 D. Pre-normative Research

T- Projects:

19 T1 Yeast Genome Sequencing
20 T2 Molecular Identification of New Plant Genes
16 T3 Lipases
25 T4 Biotechnology of Lactic Acid Bacteria
6 T5 High Resolution Automated Microbial Identification
19 T6 Animal Cell Biotechnology
14 T7 Factors Regulating Plant Cell Growth and Differentiation

[2] In these questionnaire Annexes, only numerical summation of the responses is given. Narrative and other comments are of necessity ommited.

II. Initiation of the BRIDGE Programme.

1A. Did you have any input into the formulation of the scientific objectives of the overall BRIDGE Programme?

Yes 69 No 179

1B. If yes, was this:

38 a) Indirect, through national representatives
29 b) Direct, through Commission staff
16 c) Other, (please specify) _____

III. Setting up your contract proposal.

1. How did you become aware of the BRIDGE call for proposals?

11 a) through the Official Journal of the European Union
57 b) through contact with DG XII staff
60 c) through National Authorities or representatives
11 d) through the scientific press
188 e) through personal contact with other scientists
5 f) other, please specify. _____

2. Were you:

15 a) the primary instigator of the proposal
101 b) one of a group of existing collaborators
104 c) invited to join a group assembled specifically to prepare a BRIDGE proposal
29 d) Invited to join the group after the proposal had been substantially formulated

3A. Did you make any new contacts during the process of setting up the project?

Yes 205 No 51

3B. If yes, were they:

190 a) Academic
85 b) Industrial
c) please specify from which countries _____

4. In developing the contract proposal, did you find that the Programme requirements for a spread of participants from a number of Community countries was:

87	a)	a help
25	b)	a hindrance
141	c)	neutral

5. Did your home Institution, (Contracts Officer, Industrial Liaison Group or others), help in setting up the project?

Yes 75 No 175

6. What were your main motives in applying for BRIDGE funding? Please select three in order of importance, indicationg your choice, 1, 2 and 3.

1	2	3		
105	37	38	a)	Access to funding
41	81	47	b)	Access to scientific expertise
4	18	27	c)	Access to technical expertise
2	1	17	d)	Prestige
15	29	20	e)	Limited National funding
52	54	48	f)	To establish a network for future collaboration
3	2	10	g)	For business reasons, (partnerships, access to products, access to sales, marketintelligence, etc.)
5	2	0	h)	Other, please specify _____

7. Has your BRIDGE funding:

13	a)	replaced earlier National funding
66	b)	been a stimulus to obtaining further National funding
158	c)	Supplemented National funding

8A. Prior to the award of the BRIDGE funding did you carry out work related to this project?

Yes 225 No 29

8B. If Yes, which of the following was the source of this funding?

77	a)	University or other intramural source
139	b)	National programme
45	c)	Industry
12	d)	Non-goverment/Charity/Private funding
38	e)	a European programme
0	f)	EUREKA
3	g)	other international programmes
8	h)	Other, please specify _____

9A. Was the project, during its lifetime, co-ordinated with or related to other projects within your lab with funding from the above sources?

Yes 182 No 71

9B. If yes, indicate the relevant funding source _____

10. During the period of this project, how many people in you laboratory, not funded by the BRIDGE project, were working on related areas? _____

11. In which other EC Biotechnology Programmes have you participated:

IV. Project Application and Award Procedures.

1. How did you find the EC procedures for making an application for funding under BRIDGE?

	1	2	3	4	5	
Easy to follow.....	31	66	64	59	27	.....Difficult to follow
Documents and information leaflets clear.....	30	71	81	31	17	Documents and information leaflets .....clear unclear
Warning of deadlines adequate.....	92	60	43	41	17	Warning of deadlines .....inadequate

2. How did you find the project evaluation and selection procedures?

	1	2	3	4	5	
Quick.....	19	51	92	61	24	.....Slow

Transparent/easy to follow.....	18	31	70	79	51	Obscure/difficult to .....follow
Adequate feedback of refereed information	11	32	64	68	68	Inadequate feedbac of .....refereed information

3. What is the single most important improvement which you would propose to the procedures of calling for, selecting and awarding project proposals?

_____
_____
_____
_____

4A. Did you seek help from EC officials in preparing your proposal?

Yes 73 No 176

4B. If yes, Did this include:

53 a) Clarification of procedures
31 b) Clarification of documents
24 c) Clarification of terminology
22 d) Guidance on categories of research
4 e) Other, please specify _____

V. Personnel

1A. Have personnel been recruited into your laboratory specifically for the project?

Yes 189 No 65

1B. If yes, indicate the number of staff hired in the following categories:

48 a) from other projects in the lab
140 b) from own country
29 c) from other EC countries
(name countries) _____
19 d) from non-EC countries
(name countries)_____

1C. Indicate the number of staff recruited to the project in your laboratory in the following categories:

Scientific _____
Technical _____
Administrative _____

2. How many staff were retained in permanent posts? _____

VI. Inter-laboratory contacts.

1A. Did you have collaborations with any of the partners before the project commenced?

Yes 180 No 74

1B. If yes, how many? ___

2. Are you satisfied with the coordination of the project?

	1	2	3	4	5		
Satisfied	144	71	24	14	4	.....	Not satisfied

3. Was the co-operation between the partners, on average, easy or difficult?

	1	2	3	4	5		
Easy	99	94	38	17	6	.....	Difficult

4. For scores of 3 and above, was the difficulty focused on:

28 a) one partner
26 b) about half the partners
12 c) essentially all the partners

5. Were the problems largely:

22 a) technical
26 b) non-delivery of promised results
32 c) administrative
4 d) language
16 e) personality
13 f) other, please specify: _____

Any other comments: _____

_____

6. Did the transnational collaboration required by the EC facilitate or hinder the achievement of the scientific and technical goals?

183 a) Facilitate
9 b) Hinder
65 c) No impact

7A. Have you had collaborations with any of the partners before the project commenced?

Yes 168 No 73

7B. If yes, with how many? _____

7C. Did they involve:

19 a) Literature work, (reviews etc)
95 b) Joint experiments
126 c) exchange of materials
117 d) exchange of data
43 e) exchange of personnel
12 f) training undergraduates
37 g) training of PhDs
22 h) training of post-docs

8A. Are you or will you be continuing collaboration with any of the partners?

Yes 224 No 27

8B. If yes, with how many? ___

8C. Would this collaboration have occurred if the project had not taken place?

Yes 58 No 161

9A. Did the project have results which were unexpected or could not have been predicted before the work started?

Yes 194 No 56

9B. If yes were these results:

128	a)	scientific
75	b)	in the quality of inter-laboratory contacts
90	c)	in generating new academic contacts
36	d)	in generating new industrial contacts
22	e)	in generating intellectual property
18	f)	in generating new product opportunities
5	g)	other, (please specify)_____

VII. Post-Programme Considerations

1A. Is research continuing in your laboratory on the topic of the BRIDGE Programme?

Yes 226 No 29

1B. If yes, please give the source of funding:

70	a)	University or other intramural source
131	b)	National programme
47	c)	Industry
12	d)	Non-Government/Charity/Private funding
82	e)	a European programme
0	f)	EUREKA
3	g)	an international programme
15	h)	Other, please specify _____

2. Does the continuation project involve any of the same personnel?

Yes 172 No 57

3. Does the continuation project include any of the same collaborators?

Yes 177 No 52

4. Does the continuation project include any industrial collaborators?

Yes 111 No 111

5. Has EC funding affected the development of your group and your activities by making National funding:

99 a) easier to obtain
6 b) harder to obtain
144 c) unchanged in this respect

6. Has EC funding affected the development of your group and your activities by making industrial projects:

75 a) easier to develop or finance
0 b) harder to develop or finance
167 c) unchanged in these respects

7. About 20% of proposals submitted to BRIDGE were funded, the average EC contribution being 0.77 million ECU per total project. In your opinion would it have been preferable to have:

85 a) more projects, each receiving < 0.77 million ECU
61 b) fewer projects, each receiving > 0.77 million ECU
58 c) other, (please specify) _____

8A. Several EC countries feel that they should reduce funding National programmes as funding via EC programmes increases. Assuming that EC and National funding are related in this way, how would you prefer your country to spend its resources, (give percentages totaling 100%):

____ % by direct National funding
____ % via EC funding

8B. Please explain your reasons:

_____
_____
_____
_____
_____

9. Did the project have added value with respect to: (multiple answers allowed)

60 a) links with other EC programmes or policies
- 2 i) energy
- 69 ii) agriculture
- 15 iii) communications
- 18 iv) other, please specify _____

206 b) improvements in scientific cohesion in Europe

107 c) improvements of scientific infrastructure
- 73 i) at a National level
- 125 ii) at a European level

34 d) connection with the social ethical and legal issues in the use of Biotechnology

10. Please list what, in your opinion, are the three most important outputs of your BRIDGE project.

a) _____
_____
b) _____
_____
c) _____
_____

11. Finally, is there one important issue which you feel is not addressed by this questionnaire or is there any other information you would like to add?

_____
_____
_____
_____

Thank you for your help in completing this questionnaire.

Please return the completed questionnaire, as soon as possible and in any case before 10 March 1995, to:

BRIDGE Evaluation Panel
c/o Institute of Biotechnology
ETH Honggerberg, HPT
CH-8093, Zurich
Switzerland

Sub-Annex VIc[3]

BRIDGE EVALUATION QUESTIONNAIRE
INDUSTRIAL ASSESSMENT OF BRIDGE ACTIVITIES

General information. The term European Programme refers to a Biotechnology Programme within the Framework Programmes such as BAP, BEP or BRIDGE. Where questions require a "Yes" or "No" answer, please circle the chosen word. In all other cases where there are multiple choices, please tick above the line adjacent to your answer.

The answers given in this questionnaire will be used collectively and will not be attributed to an individual or an organisation. Under these circumstances, would you be willing to have your name and affiliation stated in the Evaluation Panel's Report as a person who was consulted?

Yes 30 No 7

I. Personal details.

1. Name:

2. Position:

3. Organisation:

4. Address:

II. Awareness.

1. Did your organisation participate in one or more of the projects carried out under the BRIDGE Programme?

   Yes 5 No 24

2. Were you, or was your organisation aware of the BRIDGE Programme?

   Yes 24 No 4

[3] In these questionnaire Annexes, only numerical summation of the responses is given. Narrative and other comments are of necessity omitted.

3. Were you aware of European Biotechnology Programmes preceding BRIDGE, (i.e. prior to 1990)?

Yes 18 No 11

4. Are you aware of biotechnology programmes following BRIDGE, (i.e after 1992/3)?

Yes 26 No 3

5. Are you interested in the biotechnology programmes of the European Union?

	1	2	3	4	5	
Very interested.....	17	5	5	0	2	.....Not interested

6. Are you interested in the biotechnology programmes of your own country?

	1	2	3	4	5	
Very interested.....	21	4	1	1	2	.....Not interested

III. Future EU and National Biotechnology Programmes.

1. How useful are government programmes for the development of a strong European biotechnology industry?

National Programmes.

	1	2	3	4	5	
Very useful.....	8	12	8	1	0	.....Not useful

EU Programmes.

	1	2	3	4	5	
Very useful.....	13	8	3	3	2	.....Not useful

2. How useful are government reseach programmes for your company?

National Programmes.

	1	2	3	4	5	
Very useful.....	7	16	3	2	1	.....Not useful

EU Programmes.

	1	2	3	4	5	
Very useful.....	5	7	8	5	4	.....Not useful

3. How do European programmes in biotechnology support the activities of your company?

Directed by:	Very Significant 1	2	3	4	5	Not Significant
Input into R&D activities	2	10	3	4	8	
Development of applications	2	3	2	11	10	
Patent development	1	2	3	7	15	
Indirectly by:						
Increased research in areas of interest to your company	4	13	6	3	1	
Integration of European research and scientific community	9	8	3	3	4	

4. Please indicate the significance of European programmes in biotechnology to your company, (1 = most important, 5 = least important):

		1	2	3	4	5
__	a. Development of European scientific community	7	9	6	1	5
__	b. Development of European knowledge base	4	12	6	3	3
__	c. precompetetive research	5	10	9	3	1
__	d. strategic research	7	6	6	5	1
__	e. development of specific products or processes	8	2	6	7	5

5. What is your view of European and National expenditures for R&D programmes in biotechnology. (Give percentage changes you would like to see for higher or lower expenditures or tick for unchanged).

National

Expenditures should be __ % higher __ unchanged __ % lower

European

Expenditures should be __ % higher __ unchanged __ % lower

6. What proportion of the total government research expenditures in biotechnology should in your opinion be distributed through EU and National programmes?

via European programmes ____ %

via National programmes ____ %

(totals must be 100%)

IV. Non-participation in the BRIDGE Programme.

1. Please give the reasons why your company did not participate in the BRIDGE Programme. Multiple answers are permitted.

___ a. Grants are too small
___ b. Confidentiality problems
___ c. Complexity of collaborating with academics
___ d. Requirement for precompetetive research
___ e. Expecteation of limited pay-off
___ f. Irrelevance of research areas in BRIDGE
___ g. Slowness or complexity of administration of the award system
___ h. Limited company funds
___ i. Limited availability of specialised company manpower
___ j. Requirement for a transnational collaborative programme
___ k. Other, please specify, _____

Annex VII

Evaluation of the Programme Management

Introduction

BRIDGE was managed by the Biotechnology Unit (called "Division of Biotechnology" at the time) of DG XII. The Evaluation Panel collected information on management aspects from three main sources:

1. Presentations by scientific officers of the Biotechnology Unit, covering essentially all aspects of the programme, an interview with Dr D. de Nettancourt (Head of the Biotechnology Unit when BRIDGE was launched), two presentations by Dr E. Magnien (the present Head of the Biotechnology Unit) and an interview with Mrs Soares, from the Administrative Sector, interviews with Mr. Hansen, Head of Life Sciences, DG XII, and other programme managers.
2. The official documents and leaflets edited by DGXII and pertaining to BRIDGE (including the Final Report edited in 1994) that collectively give an official presentation of the programme as seen by its managers.
3. Interviews and questionnaires from the coordinators and the participants of the various research projects. The scientific and the administrative aspects of these responses have been considerated elsewhere.

SCIENTIFIC MANAGEMENT

The Panel is happy to express its very positive judgment on the enthusiasm and the professional competence of the Managers of the Biotechnology Unit. The success of BRIDGE was to a large extent due to the dedication and sound judgement of the scientific officers in charge of the Programme. Interviews with the participants confirmed that contacts with the scientific officers in Brussels had generally been very satisfactory, especially for the reassuring feeling that the person "on the other side" was able to speak the same language as the researcher. It is important that this valuable team be kept at maximum efficiency, with aquisition of new skills, continuous updating of scientific information, and frequent dialogue with academia and industry. Without wishing to diminish our good opinion of the Unit, the Panel therefore wishes to draw attention to areas in which problems were perceived in the role of DGXII. These include the initial planning of project areas, the format of the application procedures, and the way the scientific output of the programme was assessed by the scientific officers in charge.

Role of DGXII in the initial planning

The initial choice of research areas to be included in a programme has tremendous influence on the overall significance of the programme itself. It is not surprising that some national representatives, members of industry or individual scientists should have expressed criticism about the choice of BRIDGE topics. It is unfortunate, however, that there should be a general feeling that these decisions were taken somewhat arbitrarily, on the basis of obscure criteria and in response to ill-defined pressures. It is important that the initial process of topic selection be carried out with the utmost transparency,

clearly publicising the various inputs that concur to the final decision such as Council and Parliament mandate, Directorate guidelines, national representative input, expert panels, ad hoc investigations, industrial representatives and so on.

Format of the application procedures

A questionnaire sent to all participants showed that 57% (150/262) felt the application procedures were difficult to follow (rating them 3 or above on a 1 to 5 scale) with 10% giving the worst rating. A related question on the clarity of these procedures gave almost identical figures. Finally, 39% felt that warning on application deadlines was inadequate. The same questions were addressed to project coordinators, who had a closer contact with DGXII, and the figures were not very different (50%, 38% and 42% respectively). In summary, applying to BRIDGE appeared to be an unduly complicated affair. The complexity of the application forms must have been recognised, since these forms are more streamlined in the present Biotech programmes. Whether this really simplified the situation for the applicants remains to be seen.

Scientific assessement of the Programme by the Biotechnology Unit

The Biotechnology Unit is facing a difficult task in assessing the scientific output of a Programme like BRIDGE. On the one hand, a substantial effort had to be made in presenting the results of BRIDGE to the general public, an important endeavour in view of the some apprehension about biotechnology. Most of the numerous leaflets that were published on various BRIDGE topics were clear, informative and attractively edited. Little evidence is available about the efficiency of dissemination of such material. On the other hand, the Unit has to be aware of the scientific or industrial shortcomings of the Programme (and of individual contracts) as well as of its successes, and must be well-informed of the latest scientific and technical progress to encourage innovative research.

Documents produced for public relations purposes are of little use for scientific evaluation. This could be one of the main functions of the Final Report which was, however, inadequate in several respects. It attempted to organise individual reports into a standard format with five sections (Background/ Objectives and primary approaches/ Results and Discussion/ Major scientific breakthroughs/ Major cooperative links), but the length of these contributions was very heterogeneous between different reports. For example, one network took 7 figures and 18 pages to present its results, whilst listing only two publications and one paper presented in a national symposium, which indicated a rather modest scientific output. The format of these reports could be simplified, for example by merging Results, Breakthroughs and possibly Cooperative Links into a single section that gives the main results of the contract, and by specifying a strict maximum length.

The publication lists did not discriminate between the quality of the various references and were consequently very difficult to use for scientific evaluation. They mixed genuine publications in refereed journals or international symposia with congress abstracts and papers in obscure journals, (in one report, the list of publications was limited to three papers in a little-known Hungarian journal), contributions to symposia organised by the BRIDGE programme itself (quite abundant in some reports), papers submitted for

publication and even numerous manuscripts "in preparation". References were pooled in a way that made it quite difficult to identify individual contractors and, in some reports, the lack of titles did not allow a check of whether they were actually relevant to the contract. Additional editorial effort is needed to turn the Final Report into a more useful reference document, both for internal DG XII use, for external presentation to the scientific community and for independent Programme evaluation.

The 11 scientific officers of the Biotechnology Unit all have PhDs or equivalent academic titles, and several of them were active post-doctoral scientists before joining the EU administration. However, their main link with active science will inevitably be through their contractors and scientific advisers. Indeed, the personal commitment of some scientific officers to the projects they had in charge was quite perceptible. This may lead to a biased view of the quality of European-funded projects as opposed to similar research elsewhere (including in Europe). Really mediocre science will generally be recognized as such, but there is a risk of encouraging self-perpetuating scientific "clubs", whereas small innovative teams may have difficulty to be included in transnational networks.

T-projects deserve special scrutiny in this respect, because of the large sums involved, the number of participants (which has grown to more than 100 in recent Biotech framework programmes), the fact that most of these projects went on in subsequent Framework Programmes and finally, the considerable responsibility and power of the coordinators of such projects. There will inevitably be a tendency to delegate part of the necesseray controls from DG XII to the coordinators themselves, which has obvious advantages in terms of management, but is not without risks. The Panel knows of no serious problem related to this situation as far as BRIDGE was concerned, but is aware that this is a somewhat controversial issue in the European scientific community.

The staff of the Biotechnology Unit is well aware of these problems, and should be encouraged to find appropriate solutions. Several suggestions can be made at this point. They include more opportunity for scientific officers to attend international meetings (in addition to the internal symposia organized within BRIDGE-funded networks), sabbatical stays in research institutions or industry, individual visits to laboratories. T-projects should be evaluated by independent scientific committees making recommendations as to the renewal or future evolution of these projects. Devices should be found to support small innovative teams (i.e. young group leaders and possibly alleviating the requirement for multinational participation).

ADMINISTRATIVE MANAGEMENT

The Administrative Sector of DGXII took care of the voluminous procedures involved with the disbursement and the accounting of BRIDGE funds. With the continuing expansion of the sums involved and of the number of contractors, this demanding task deserves full appreciation from the scientific community. A questionnaire directed to a sample of industrial laboratories that did not participate in BRIDGE indicated "slowness or complexity of administration of the award system" as the most frequent reason for non-participation (quoted in 16/37 responses). There was also anecdotal evidence on this issue in the interviews of individual contractors. Some of these criticisms should be taken *cum grano salis*, the European administration being a

convenient scapegoat for the sins of local administrations. Indeed, when BRIDGE coordinators were asked whether they were satisfied with the help received from the EU management in administering the project, their answer was fairly positive (33/52 rating <3 i.e. good to satisfactory). Coordinators also gave a generally favourable judgement on the handling of fund distribution (36/52 positive answers). Nevertheless, the Panel believes that some real problems emerged about the complexity of procedures and the slowness of payments. Moreover, the fragmentation of research funding between consecutive programmes appears to have serious managerial drawbacks.

Complexity and slowness of procedures

This is probably one of the most common complaints about EU research programs. Yet, when the Panel attempted to explore the administrative procedures, little was found that could be drastically simplified. In fact, some aspects such as the accounting requirements could be reasonably classified as quite liberal. An almost automatic doubling of complexity is due to the fact that funds are disbursed to project coordinators and then subdivided to all participants. This is unavoidable if the Brussels administration is unable to deal with each single contractor. Complaints about the slowness of procedures are obviously linked to the previous ones in a cause-effect relationship. However, this is more easily quantifiable, since the time elapsed between launching of BRIDGE (call for proposals) and implementation (initial payments) was of the order of one year or more. Much of this time (about six months) was taken by the project selection procedure. It is disturbing to see that the evaluation by scientific experts, which is the key step in this process, took only about one month. As far as the Panel could see, the rest of the time was spent in complicated in-house reviewing procedures involving discussions by CAN-Bridge, inter-Directorate reviewing and information to the Director General and his Cabinet. It is hard to believe that this lengthy process is really necessary as far as project selection is concerned. Indeed, it would be rather surprising if the priority list produced by scientific experts was revised by the DG XII management (the Panel has been told that this happened only in very exceptional cases, but there were apparently cases where the amount of money allocated to given contracts was substantially reduced with little or no explanation). The Panel firmly believes that drastically reducing the time spent on in-house reviewing would be a notable improvement in the management of EU research programmes.

Continuity of Infrastructure Projects.

The BRIDGE Programme has supported a number of projects that contribute to the infrastructure supporting biotechnology research and development, in particular a series of N-projects that are reviewed elsewhere. These activities are currently supported by funds from competitive applications. This mechanism of support does not make sense when applied to Infrastructure projects. Such projects may involve for example setting up a data base or a culture collection. Once the project is over, if further funding is not forthcoming, the data base will become derelict or the culture collection die out. The initial funding will have been wasted and the service is not easily reinstated.

Such projects may be started by competitive tender, but they need secure funds for the maintenance of the service and to keep it up to date. Obviously performance should be reviewed periodically and the review could include a further element of competitive tender. A mechanism should be devised to ensure that valuable infrastructure services are not dependent on competitive funding for their maintenance.

Conclusions & recommendations

1. The scientific management was carried out by a remarkably competent and dedicated team. It is important that the scientific competence of programme managers be maintained at the highest level by continuous cultural updating and by frequent exchanges with the "outside" academic and industrial community.

2. Efforts should be made to increase the transparency of the programme planning mechanisms that lead to the topics selected for inclusion in the proramme.

3. A more careful editing of the Final Report is needed to make it a useful scientific evaluation tool and to document the scientific credibility of the Programme.

4. Attention should be directed to the simplification of intra- and inter-Directorate procedures that contribute to the slow administrative process in the project selection procedure and lead to an unacceptable time lag between project selection and the first payments.

Annex VIII

Evaluation of the Training Activities

1 Summary of activities

1.1. The training programme amounted to about 7 MECU (7% of the total Bridge programme), with 6.2 MECU for fellowships and 0.4 MECU for Workshops. The proportion of funds allocated to training activities, relative to the total framework programme, was substantially higher under the previous BEP (21%) and BAP (9%) programmes but has been unchanged or slightly reduced in subsequent Biotechnology programmes.

1.2. One hundred and sixty nine fellowships were granted out of 552 applications, (29%). In addition, 42 fellowships were awarded from the "European Postgraduate Training Network" (see below, 1.7). There were three types of grants:

> 90 fellowships of "category 20", for post-graduates (applicants with a University degree) with at least one publication in a peer-reviewed journal.
>
> 63 fellowships of "category 30", for applicants with a PhD degree (or more than 2 years postgraduate research experience) and at least four publications. Applicants with the degree or the experience of "category 30" but with less than the requested 4 publications could still be awarded a "category 20". About a quarter of the "category 20" trainees belonged to that subclass.
>
> 9 fellowships of "category 40". These are short term fellowships (less than 6 months), for established researchers visiting another laboratory of the EU to learn or practice specific techniques.

Travel expenses were covered by the fellowships.

1.3. Laboratories hosting a category 20 trainee received bench fees of 5 kECU. Category 30 trainees included 10 kECU Bench fees. Bench fees are not mentioned in the 92-94 Information Package for Training Grants but a contribution towards host laboratory expenses, which will be only partial, is mentioned in the 94-98 package.

1.4. Categories 20 and 30 fellowships could not exceed 24 months. In practice, all but one of the requests were limited to 18 months because the funds available would have otherwise limited the total number of fellowships granted. In addition, 43 fellowships were awarded for one year and 12 for six months or less.

1.5. Most trainees were from France, Italy, Spain, Germany, Greece and Belgium, with the United Kingdom and, to a lesser extent, France, Germany and the Netherlands contributing most of the host laboratories. This shows a tendency towards the spread of expertise from more northern to more southern countries by the training programme.

1.6 The selection procedure for BRIDGE training grants was rather unusual being carried out entirely in Brussels by a committee of two scientific delegates elected in a plenary

session of the CRN-Biotechnology, plus the head of the Biotechnology Unit. A new procedure, developed for Biotechnology 92-94 and 94-98, is described below (paragraph 3.5).

1.7. The European Postgraduate Training Network, a special postgraduate training programme was targeted to a network of 59 laboratories working in the area of Genetic Engineering & Molecular Biology of Seed Improvement. It was operated by the Dept of Physiology, Carlsberg laboratory (Prof. D. von Wettstein). Forty-two fellows (all external to the network) were selected from 81 applicants to work in 16 host institutions belonging to the network. The geographic distribution of host laboratories was quite skewed, with the United Kingdom (18) and Denmark (9) providing half of the host laboratories. This experiment has not been repeated, although one large project in Biotechnology FPIII had an internal training scheme.

1.8 There were 9 two-week workshops with a mixture of practical courses and lectures, mostly directed to the training of young scientists. They were held in scientifically less strong European countries, to facilitate the participation of local scientists. The average funding by the commission was of about 40 kECU per workshop.

2 Major changes since the completion of BRIDGE

Since the completion of BRIDGE there seem to have been fewer fellowships and an unchanged financial input. According to the 94-95 information document on Research Training Grants, the budget of the FPIV training programme for biotechnology has increased roughly by a factor of 5 (33 MECU) when compared to Bridge, thus remaining more or less in the same proportion with respect to total biotechnology funds (7%). However, the total number of fellowships foreseen (estimated at about 350), would be less than half those expected by extrapolating the number awarded under Bridge (211). This lower output in terms of fellowship number is a very negative trend. Its sources are apparently multiple. On the one hand, fellowships are more expensive due to adjustments for inflation, and, because they are now treated as grants, they are liable to taxation. On the other hand, a new type of "R" fellowships was introduced. These one-year re-entry grants are reserved for researchers that held a post-doctoral fellowship of "category 30" and undertake to return to "less-favoured" regions as defined by the Council of Ministers.

The definition of categories 20 and 30 of fellowships became more restrictive under Biotechnology FPIII, since candidates with a PhD but with less than 4 publications were no longer covered by "category 20". Under Biotechnology FPIV, "category 20" was extended to graduates with up to 4 years of experience and at least one publication. A PhD with less than 4 publications will remain excluded from the training programme.

According to the FPIV Information Package, a commitment letter is sent to all selected applicants within four months after the submission deadline (rejection notices are given within two months). Upon signature of the contract by the Commission, applicants have six months to start their activities.

3. Comments

3.1. The training programme was a successful and very important component of BRIDGE, especially with regard to fellowships. Allocating fellowships to young and promising scientists is a simple and effective way of promoting a European science community, supporting good quality science in the technically less advanced countries and encouraging technology transfer. The capacity to attract young scientists is in itself a sign that the host laboratories are scientifically productive. All this contributed to building a wider cultural community amongst European scientists.

3.2. The percentage of programme budget allocated to these activities continues to show a decreasing trend. Concomitantly, the success rate of applications has decreased, while there is no indication that their quality deteriorated. Moreover, according to the FPIV information document on Research Training Grants, about 350 fellowships might be granted, i.e. half what would have been expected by extrapolating from the 211 fellowships awarded under Bridge, since the overall budget was multiplied by five.

3.3. The cut to 18 months in the maximum duration of all fellowships is unfortunate. This is too short for a young and relatively inexperienced researcher in a new environment to produce optimal results. Curiously, European training grants can be extended to 3 years in various other disciplines, but are "strictly limited" to 24 months in biotechnology.

3.4. A system of short-term fellowships (ranging from a few weeks to three months and accessible to any pre- or post-doctoral scientist) would probably be one of the more efficient and cost-effective way of promoting human mobility in this rapidly expanding and evolving high technology field.

3.5. The selection procedure initially used under Bridge was replaced by a procedure primarily based on written evaluation from external experts who are explicitly instructed to rely entirely on scientific criteria. The Panel views this as a very positive change. The role of the in-house selection committee was apparently limited to ranking applicants according to the referees judgement, adapting the scores when serious discrepancies appeared between referees and possibly redressing unjustifiable biases in terms of geographic distribution. This pre-eminence of scientific quality in the selection procedure is crucial to the credibility of European training grants. The list of evaluators was not disclosed, even to this Panel. Individual evaluators of a given application must of course remain anonymous, but a regular release of the list of evaluators would document their competence and would increase the credibility of the system. The panel regrets that it can make no judgement on the scientific competence and general reliability of these experts.

3.6. The difference in the amount of bench fees paid under Bridge to laboratories hosting category 30 versus category 20 trainees is unjustifiable. Bench fees are an important aspect of training fellowships and should be maintained at the level used in Bridge for category 30 fellowships.

3.7. The publication criteria for category 30 (4 publications, preferably as first author) is very stringent and probably eliminates a large proportion of new PhDs at a time in their careers when they are most flexible and able to benefit from working in another country.

3.8. The 42 fellowships awarded under the European Postgraduate Training Network were considered as an experiment by the Bridge planners. The Panel was unable to collect unequivocal evidence to decide whether this was a success or not. Given the sizeable amount of resources taken up by this sub-programme (about a quarter of the normal Bridge fellowships) and the possible problems connected with any exception to general procedures, it is probably best to reserve such special initiatives to exceptional cases.

3.9. The small number (nine) of Advanced Workshops held under Bridge covered reasonably important subjects and thus presumably contributed to strengthen European expertise in Biotechnology. However, the Panel made no specific attempt to scrutinise the scientific quality and relevance of these workshops.

4. Recommendations

The importance of training programmes is often overlooked in favour of more visible research funding. Yet, this is a most effective way to disseminate technical know-how and to support active laboratories capable of attracting young scientists. We strongly recommend that the financial priority given to the training fellowship programme be higher than in the past. We endorse the doubling in size (about 15% of the total budget of biotechnology programmes) already recommended for Bridge by the BEP-BAP Evaluation Panel, and regret that this recommendation remained largely ignored. We are particularly worried by current projections indicating a two-fold reduction in the number of fellowships allocated per unit cost.

The Panel believes that the training programme was handled in a fair, competent and efficient way. We recommend the following measures to improve its efficiency:

1. Introduce a system of short-term fellowships (less than 3 months), to increase the flexibility of the current training system and its capacity to promote the fast dissemination of new techniques.

2. Revise the upper limit of 24 months for long-term fellowships. The possibility of a third-year extension should be preserved.

3. Revise the strict requirement for four publications in the case of category 30, which discriminates against fresh PhD holders.

4. Release the list of the evaluators at regular intervals, as a tribute to their work but also to document their general competence. The strict secrecy of DGXII in this regard is detrimental to the credibility of the selection process.

5. Documents consulted

Bridge: Draft report on the training grants. Internal document prepared by DGXII (14 pp. January 1995).
European Postgraduate Training Network: application of genetic engineering and molecular biology for seed improvement. DG XII, Division Biotechnology, 18 pp. (undated)
Information Package on Research Training Grants (edition 1994-1995)
List and summary description of the nine advanced workshops supported by the Bridge training programme.

The Panel had a presentation of the training programme by Dr A. Vassaroti (6 February, 1995), and a 40 min interview with him on the same topic (Apr. 4, 1995). Three letters were also written by Drs A. Vassaroti and E. Magnien in response to specific points raised by the Panel on the training programme.

Finally, the Panel examined the recommendations on the training programme made by the evaluation Panel of the previous biotechnology framework programmes BEP and BAP.

Annex IX
Evaluation of the Concertation Actions

Introduction

The inclusion of concertation actions in the BRIDGE programme was based on the Council Decision of 27 November 1989. Concertation was integrated quite early into the European Biotechnology Programmes as a response to the rapid development of new technologies involving both the biological sciences and engineering. Since the field has high economic potential, but is also open to much misunderstanding and criticism, Concertation was initiated to network the information dissemination activities, both within the Commission and publicly to ensure a constant flow of information.

The evaluation has to consider whether the programme has in fact implemented the task specified in the Council decision.

Accomplishments

Concertation was supported by a budget of 4.6 MECU. There were four main tasks required by the Council decision. These were:

1. Monitoring, assessing, and informing. To monitor developments in Biotechnology particularly in research and technology development (RTD) and to assess their impact on social and economic aspects. Commission services and national and public authorities could use this information to implement policy and make decisions on future programmes.

The main output has been the launching of the European Biotechnology Information Service (EBIS) in paper and electronic form generating a mailing list of about 7000. In addition a number of reports and studies on different topics related to the programmes were compiled. A series of information meetings, that aided in the monitoring and assessment of programmes, took place.

2. Contextual conditions, effectiveness, coherence, international collaboration. The Council decision stated the main objectives as "Identifying possible ways in which the contextual conditions for the beneficial development of biotechnology in Europe may be improved, and the effectiveness and coherence of Member State and Community biotechnology programmes and related policies enhanced, including those involving international collaboration".

This targets internal services of the Commission as well as external institutions. One result was the creation by the Commission of the high level inter service Biotechnology Coordination Committee (BCC). Other activities were supported, for example, meetings for European students and alumni and providing an on-line inventory of publicly-funded biotechnology research projects in Europe. Intellectual property was recognised as an important component of these activities, however, this was transferred to another unit (Legal and Ethical Aspects of Life Sciences and Technologies).

3. Disseminating knowledge, increasing public awareness. The Council decision included "Disseminating knowledge and helping to increase public awareness and understanding of the nature, potential and possible risks associated with biotechnology".

A survey was financed in 1991 and 1993 called Eurobarometer. This was designed to identify trends in public opinion on biotechnology and genetic engineering.

4. Identifying needs and promoting greater SME activity. The Council decision was: "...to promote greater activity in the biotechnology small-firm sector in the Community".

The aim was to reinforce the biotechnology component within existing initiatives of the Commission for the support of SME`s. Prominent Commission programmes were SPRINT and VALUE. Training initiatives were also included.

Evaluation

Concertation activities were run by CUBE (Concertation Unit for Biotechnology in Europe) until September 1992. Our interviews indicated that CUBE performed an important function and we confirmed its overall effectiveness prior to the reorganisation. In September 1992 a reorganisation took place which disrupted its function. Concertation tasks were continued outside the framework of the Unit with the following results.

For task 1 our findings indicate that the residual function was one of information. This was a direct consequence of the closure of CUBE which resulted in limited human resources to carry out effective monitoring and assessment. It is not clear that these services are widely used.

The emphasis in task 2 appeared to favour external initiatives (addressed to Member States) rather than activities within the Commission. Included were the dissemination to all services of information about BCC activities and the secretarial support to the members of DG XII attending the meetings of BCC. CUBE also played a role in the discussions of regulatory and intellectual property issues although the results in this area have not been entirely satisfactory.

The main effort in task 3 has been to develop means to assist the public understanding of biotechnology. Significant progress has been demonstrated in this field. However, there were some limitations. Member states varied in the degree in which they used this activity. This may have resulted in a missed opportunity to use the full authority of Commission bodies.

In spite of the importance of task 4 the outcome has been inadequate. Reports and publicity are not sufficient to entice small firms to participate in programmes.

Recommendation

Concertation actions continue to be required but should be focused on specific audience needs.

Reports to busy executives, administrators, Members of the European Parliament and other policy makers and opinion formers, should be very concise and user friendly.

It is particularly important to explain the role of risk assessment in relation to such issues as the Deliberate Release of genetically modified organisms to ensure that reliable scientific knowledge is available to those involved in making judgements about ethical and legal issues.

Intellectual property issues require special attention to ensure that decisions are made on the basis of scientific knowledge and with full regard to international competition. Decisions on ethical issues in this area are equally in need of a full information base.

Programmes must take full account of the need to inform the public about scientific issues, their benefits, and possible disadvantages, so that informed judgements can be made.

Annex X

A survey of R&D spending by National Governments and the EU

The European Community of 12 member states until 1994, and the present EU of 15 member states, spends public funds on R&D via the National governments, and via the EC/EU Framework Programmes. According to the European Report on Science and Technology Indicators 1994 (Report EUR 15897 EN, October 1994, produced by DGXII), total government R&D spending via National governments has increased from 31 billion ECU in 1984 to 50.3 BECU in 1993. This is based on current prices and current exchange rates from national currencies to ECUs for each year and is not corrected for inflation or exchange rate fluctuations and currency devaluations. During the same period, the budget component reserved by the European Commission for R&D increased from 0.44 BECU to 1.95 BECU. For the period 1994-1998, a further increase will be seen, with yearly spending for R&D via the FPIV in excess of 3 BECU.

The percentage of EC funding versus aggregate National government funding for R&D has increased in the past decade, from 1.5% in 1984, to 4% in 1993, and should reach 6-7% in 1994-1998. There is room for further growth after 1998, since R&D funds allocated by the EC will amount to only about 4% of the total EC budget of 75 - 80 BECU per year for 1994-1998.

Allocation of R&D funds at the National and European levels

The allocation of R&D funds by National governments and the EC differs considerably, thereby introducing large variations in the impact of EC R&D programmes on National R&D activities. For the aggregate National governments, major R&D allocations are made for Defence (about 10 BECU per year from 1988 to 1993, or more than 20% of the total National R&D budgets) and space research (about 2.5-3.5 BECU from 1988 to 1993, or more than 6% of National R&D). In these same areas, the EC has allocated no funds to Defence, and a decreasing amount of only 25 to 8 MECU from 1988 to 1993, or 2.5-0.3% of total EC R&D funds, for space research.

Another major component of National R&D spending not seen at the EU level is Research from General University funds (about 9.1-13.6 BECU from 1988 to 1993, or 22-27% of total National R&D spending). Free Research (4.8-7.1 BECU from 1988 to 1993, or 13-14% of National R&D), has lately been supported by EC funding, going from 24 MECU in 1988 to 285 MECU in 1993, or increasing from 2.5% to 14% of total EC R&D spending.

Thus, about half of National governmental R&D funding is devoted to areas in which there is no EC R&D spending: Defence (about 20%), Space (about 6%), and Research from General University funds (about 25%).

EU funds for specific R&D Programme will average 12% in 1994-1998

EC funds for R&D are used in specific areas, which are often also supported by National government programmes. Since all of the available EC funds (more than

3 BECU per year from 1994-1998) are used for such specific areas, while only half of the National funds (about 25 BECU per year in the same period) will be available for these same areas, the EC contribution to specific National R&D programmes will be 12% on the average.

R&D expenditures by National governments

There are significant differences among the European member countries in total and per capita R&D spending by National governments. Taking the decade from 1984 to 1993, and based on current prices and current exchange rates from national currencies to ECUs for each year, Germany, France, Italy, and Spain have doubled (or in the case of Spain, even tripled) their spending on biotechnology and other R&D programs, and increased their total percentages of GNP allotted to R&D. In the same period, spending in the Netherlands increased by only 60%. Remarkably, in Great Britain total government R&D expenditures in current ECUs remained constant during the past decade, which implies a decrease in British R&D funding equivalent to the cumulative inflation in the past decade.

Taking total National government expenditures on R&D in 1993, Germany and France now account for about 31% and 27% respectively, of all National R&D expenditures in the EU. Italy and Great Britain each account for about 11-12%; Sweden, Spain, and the Netherlands each account for about 4%; Belgium, Austria, Finland and Denmark each account for 1.5-2.1%; and Ireland, Portugal and Greece each spend 0.4-0.7% of total R&D funds available from National governments in the EU.

The contribution of FPIV spending to European R&D spending in 1994-1998

The FPIV contribution of the EU to total government R&D spending in 1994-1998 will be of the order of 6-7% of total National spending. However, since National government funding includes all government funding via Universities, Institutes and Industry (especially in the Defence area), the impact of the FPIV programme will average 12% in those areas which the programme focuses on, such as Biotechnology, Environmental Sciences and Human Health.

The EC/EU contribution to biotechnology research in Europe

The EU contribution to biotechnology research has grown considerably in the past decade. The BRIDGE Programme entailed total expenditures of about 100 MECU, and the subsequent FPIII Biotechnology Programme distributed about 170 MECU, which represented a modest addition to National programmes.

From 1994 to 1998, the FPIV programme will distribute 550 MECU for Biotechnology, as well as significant funds in related areas (680 MECU for Agriculture and Fisheries related projects, 340 MECU for Biomedicine and Health, and 850 MECU for Environment and Climate). This can be compared to the total spending on biotechnology programs by National governments. The National governments of the expanded EU (including Austria, Finland and Sweden) have distributed totals of about 2,000, 2,300, and 1,300 MECU per year in 1992 and 1993 for Agriculture, Human Health, and Environment, respectively. It is perhaps not possible to compare these amounts directly,

since they may involve differing definitions of the research areas covered. However, they provide a general indication of the level of EU versus National funding in the areas listed. To compare European and National expenditures, European expenditures for Biotechnology (550 MECU) and Biomedicine and Health (340 MECU) for 4 years are therefore compared to total National expenditures in Human Health of about 2,400 per year for the next few years, in which case yearly European spending in the general area of Biotechnology and Human Health accounts for about 9% of total National spending.

Looking at total spending on Environment, Agriculture and Human Health (including Biotechnology), yearly European spending during FPIV will amount to about 10% of total National government spending.

Annex XI

Evaluation of the relationship of COST Activities to BRIDGE

Introduction

The COST (Cooperation Scientifique et Technique) Programme represents the oldest instrument for putting into practice the cooperation in science and technology in Europe. It was established at the beginning of the nineteen sixties by a European Community of six countries along with the thirteen EFTA countries.

Main Characteristics

1. The COST Programme matches the classical scheme of international scientific cooperation. The activities were developed through concertation mechanisms. Research activities from the participants were financed from internal sources, i.e. National funds, whereas the European Commission allocated COST funds to finance the sharing of scientific knowledge through scientific meetings, workshops, short-term exchanges and visits of scientists.

COST was a forerunner of European networking in science and technology and continues to contribute to this activity.

2. The States contribute to the COST Programmes through agreements from their respective Foreign Affairs Ministries.

3. The COST Programme is managed through a Senior Officials Committee (SOC), with representatives from the countries and a Chairman and a Vice-chairman elected by them.

The Secretariat of the SOC is part of the Council Secretariat. The Commission organized the horizontal support of the COST Programme through DGXII, providing specific support from the Programme Managers in cases where there was a specific relationship to the R&D Programmes. COST actions in Biotechnology Area related to the BRIDGE Programme are listed at the end of this Annex.

4. COST actions arise and are run "bottom-up". Scientists from a given member country of COST propose topics of interest. The SOC approves an action, a Memorandum of Understanding is signed and a Management Committee for the specific action is agreed. This Management Committee is composed of scientists, representing the participating countries.

5. The COST Programme has served to facilitate the incorporation of non-member countries into European research. It is becoming a good way to encourage the participation of laboratories from Central and Eastern Europe to R&D activities of the EU. In this respect, it must complement or overlap with other Programmes such as "RTD initiatives for the specific programme of cooperation with third countries and international organizations"

General Assessment

Our findings show that the integration of COST activities with the objectives and management of the BRIDGE Programme presented difficulties.

In many areas, COST actions have been at the origin of programmes that were eventually incorporated into the RTD Framework. This was the case for Agro-food (Eclair and Flair), Transport and, in part, Telecommunications. But this has not been the case for Biotechnology, the onset and incorporation of which into the Framework Programme derived from prospective analysis (FAST programme).

It therefore seems likely that the difficulties in integrating COST actions into BRIDGE resulted from the lack of a tradition of COST activities in the field of biotechnology. Biotechnology programmes and the Biotechnology Unit were built and managed without a previous reference to COST activities.

Specific assessments

From the reports published on the COST activities associated with BRIDGE, several conclusions can be drawn.

COST actions appeared to be complementary to the main objectives of BRIDGE in that they focused on agricultura and animal health issues.

COST actions involved a high number of institutions and countries. The objective of fostering cooperation, a main aim of COST schemes, seems to have been attained quite satisfactorily.

The ratio between the expenditures on BRIDGE and COST actions is such as to suggest a high added value of the COST activities.

The leadership and strong participation from laboratories and researchers of the EFTA countries in the BRIDGE COST actions provided good grounds for the later integration of these countries and their laboratories into European Biotechnology RTD programmes.

There was an excessive selection of topics with little potential for future application, probably resulting from the fact that the proposals were bottom-up with scant industry participation.

Recommendations

The COST schemes should be maintained provided that the aims and methods of implementing their actions is fully specified.

The potential for applications arising from COST proposals should be highlighted since they may help to develop future roads within the programmes of the Life Sciences Division.

The applied orientation of FPIV in Biomedical and Agriculture and Fisheries Research

may help to integrate COST actions into the new Programmes.

The potential for a leadership role of research institutions from non-European countries that are members of COST should be stimulated.

The potential for COST to provide a platform for the collaborative participation of laboratories from Eastern and Central European countries with those in the EU should be encouraged. Good coordination with other Programmes and Activities within the EU (i.e. RTD for third countries, PECO, PHARE) is needed.

List of COST actions

Action 48. "Aquatic primary biomass-marine microalgae"

Duration:	1985-1989 (first phase)
	1990-1994 (second phase)
Financing:	Total/10 years: 13.25 MECU
	National/10 years: 12 MECU
	CEC/10 years: 1.25 MECU

Action 87. "Plant in vitro culture"

Duration:	1983 start
	incorporated in BAP
	incorporated in BRIDGE
Financing:	Total/10 years: 10 MECU+15 MECU= 25 MECU
	National/10 years 25
	CEC: not available, probably 1.25 MECU

Action 88. "Methods of Early Detection and Identification of Plant Diseases"

Duration:	1987-1993
Financing:	3 MECU
CEC:	3 MECU

Action 89. "Basic research on coccidioses of poultry and farm animals and development of vaccines using biotechnological procedures"

Duration:	1990(1989)-1993(1994)
Financing:	Total 8.4 MECU
BRIDGE:	0.250 MECU

Action 810. "Vesicular-arbuscular mycorrhizae"

Duration:	1990-1994, 1994-1998 (COST 8.21)

Note: The numbering of COST actions is as follows: the first digit designates a major sector, (4 represent Oceanography, 8 Agrofood). The subsequent digits indicate the age of the action, lower numbers indicating and an earlier time of initiation.

European Commission

EUR 16650 – Evaluation of the BRIDGE Programme (1990-1994)

P. Christou, N. Carey, H. Brunner, D. Cioli, E. Muñoz, P. Thuriaux, B. Witholt

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A panel of seven experts was entrusted with the task of evaluating the EC BRIDGE Programme (1990-1994).

The panel was chaired by Professor Paul Christou. The panel met in Brussels on seven occasions between December 22nd, 1994 and July 11th, 1995. The major instruments for the evaluation methodology were a series of questionnaires (to programme participants, project coordinators and industrial leaders from non-participating countries), personal interviews and a study of selected programme reports and publications.

The final report is divided into two parts: the first part includes the Executive summary and the Principal recommendations; the second part includes, among others, the evaluation of the projects by programme area, the main findings of the questionnaire surveys, the evaluation of programme management, training activities, concertation actions and BRIDGE-COST activities.

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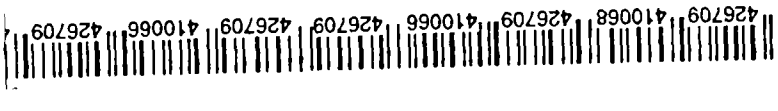

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