FORFÁS EVALUATION OF IRISH MEMBERSHIP OF EMBL

MARCH 2010

Forfás

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Executive Summary

The European Molecular Biology Laboratory (EMBL) is a non-profit basic research institute which is funded by subscriptions from 20 member states[1] and one associate member (*Australia*). The Laboratory has five units with the main Laboratory located in Heidelberg. The other units are located in Hinxton (the European Bioinformatics Institute), Grenoble, Hamburg, and Monterotondo near Rome. EMBL's mission includes performing basic research; training scientists, providing access to facilities for students and visitors at all levels; provision of vital services to scientists in member states; development of new instruments and methods in the life sciences; and technology transfer. It also sponsors an active Science and Society programme.

Ireland became a member of European Molecular Biology Laboratory (EMBL), with effect from January 2004, on foot of a Government decision. At the time it was seen as a focal point for European aspirations in the biotechnology industry, one which would enable Ireland to leverage its ongoing public and private investment in the development of both the research and industry bases in this country. Biotechnology and the associated underpinning sciences are one of the priority areas where Science Foundation Ireland (SFI) provides research supports. It was anticipated that membership would complement that investment through opportunities for research training, networking and enhanced international collaborations. It would enable researchers across a range of disciplines, in both public and private research, to have access to world-class facilities including specialist equipment and instrumentation, which might otherwise have to be duplicated in Ireland. Also it would stimulate the research community in Ireland to strengthen their research capacity, in addition to increasing networking and collaborative activity with scientists in other countries.

The Department of Enterprise, Trade and Employment requested that Forfás carry out an evaluation of Ireland's membership of EMBL in line with an undertaking at the time of the decision to join EMBL to carry out triennial cost benefit reviews of membership. Forfás commissioned CIRCA Group Ltd to carry out a background study on its behalf and this study provides the basis for the Steering Group recommendations that are contained in the report.

The objective of this evaluation is to investigate the extent to which researchers in Ireland, in the relevant fields, are taking advantage of and participating in the range of activities, programmes and technologies provided by EMBL. The evaluation also sought to understand how and why researchers are interacting with EMBL and possible obstacles to enhanced participation.

1 Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the UK.

Key Findings and Recommendations

Researchers view EMBL as one of the leading molecular biology research centres in Europe and one of the few on the radar of US researchers. EMBL is a focus for molecular biology research because most of the leading researchers in that field in Europe have worked there at some stage in their careers. In particular, the EMBL outstation at Hinxton, near Cambridge, is a very well known and widely used centre for bioinformatics. EMBL is considered by researchers to be doing research in a number of areas of particular relevance to Ireland, for example, structural biology, genomics and proteomics, bioinformatics and imaging technology.

There is a low level of awareness in relation to EMBL across the Irish research system with the exception of the molecular biology community. Many of the organisations and individuals consulted in this study do not receive any regular information from or about EMBL and are unaware of EMBL services and offerings. Even amongst the molecular biology community the level of awareness of EMBL is very general with few consulted having detailed knowledge of EMBL activities.

Irish involvement in EMBL activities has been steady if not spectacular and appears to be comparable to that of other countries of similar size. However, this evaluation highlights that there is considerable scope for Irish researchers to further engage with EMBL. As members of EMBL, Irish researchers have an opportunity to gain valuable international experience which could add significant value to their research experience and also benefit the country through the skills and networks formed while interacting with EMBL.

It is therefore recommended that the research community in relevant disciplines need to be more pro-active in identifying and taking up, where appropriate, opportunities to use EMBL facilities and services in carrying out their research programmes and projects.

In terms of industrial impact, Ireland is a recent member of EMBL and, as outlined in the Georgia Tech Review[2], impacts on industry as a result of EMBL membership may take five years or more to be realised. None of the companies interviewed in this evaluation currently make any use of EMBL facilities or training opportunities. The companies were, however, generally supportive of the opportunities at EMBL in developing and nurturing the R&D base. In terms of the future, the likely impacts on industry would perhaps be the absorption of EMBL alumni into industry and the utilisation of their expertise in the development of new products, processes and services.

[2] Cozzens, Shapiro, Krige and Porter: *Assessment of Irish Participation in Inter-Governmental Research Organisations (2001)* Final Report (unpublished) Prepared for Forfás (National Policy and Advisory Board for Enterprise, Trade, Science, Technology and Innovation in Ireland). Georgia Tech School of Public Policy and Technology Policy and Assessment Center, Atlanta, GA

The general view among participants in this study is that no organisation in Ireland is visibly active in promoting EMBL. EMBL officials recognise themselves that some of their activities may need better advertisement in Ireland in order to raise awareness and participation levels. It is recommended that steps be taken to raise such awareness among the relevant researcher community and that SFI be the main vehicle to drive their implementation.

It is recommended that funding agencies and HEIs need to be more proactive in promoting EMBL programmes and opportunities to the relevant researchers in Ireland and that SFI, taking into account their current available resources, consider a number of actions to promote awareness and use of EMBL.

Such activities may involve coordinating the awareness raising activities through SFI's existing communication channels to the research community, providing information to Irish researchers in relation to EMBL on the SFI website and coordinating certain elements of EMBL interaction with other Irish agencies so that these agencies may promote funding opportunities for Irish researchers to avail of the EMBL offer within their promotional material. In addition, targets could be established for Irish researcher interaction at EMBL which might include the number of visiting scientists per annum.

In other countries EMBL alumni often play an active role in encouraging their peers or younger colleagues to make greater use of EMBL. Indeed, many of EMBL's research staff graduate to eminent positions in several different countries. EMBL report that a major element of their interaction with the scientific communities in member countries is through Alumni. Alumni are generally enthusiastic about the potential of EMBL, they have detailed knowledge of research interests within the organisation, and also have personal contacts. They are therefore in a good position to act as ambassadors within national research communities. There are currently 48 Irish EMBL alumni. During their stay at EMBL twelve of these were post-docs and 26 were scientific staff. In addition there are currently six non-Irish EMBL alumni working in Irish institutions. While, as noted above, there was a low level of Irish awareness in relation to EMBL activities, the exception to this is EMBL alumni who receive regular updates via email on EMBL activities.

It is therefore recommended that another action which SFI should consider is to encourage, develop and support the establishment of an EMBL alumni association in Ireland and provide appropriate administrative supports to facilitate the use of this pool of knowledge as a resource for Irish researchers.

The EMBL Council guides EMBL strategy and therefore plays a key role in determining the organisation's future. Ireland is represented on the EMBL Council by a representative from the Department of Enterprise, Trade and Employment and a representative from SFI. In order to optimise researcher interests at EMBL Council meetings, Sweden and the Netherlands have established mechanisms to achieve greater scientific input to the meeting. In the Netherlands a scientific committee meets twice a year before EMBL Council meetings and discusses various technical issues that are on the agenda.

In order to optimise the representation of research interests at EMBL Council, and to help Irish Council members prepare positions and talking points in advance of Council meetings, the EMBL delegates could consider the establishment of a Pre-EMBL Council Meeting Advisory Panel.

This panel would consist of leading scientists in the field of molecular biology. The objective would be to allow greater involvement of the research community in the decision-making process, and also provide a greater range of avenues for disseminating information about EMBL.

1 Introduction

In 2000 Ireland established a major new fund for basic research of strategic relevance to economic development. One element of this funding was the establishment of a National Strategic Research Foundation to undertake research of world class status in key areas, including biotechnology. This later became Science Foundation Ireland (SFI).

This new investment in research led to a renewed look at Irish membership of some relevant international research organisations. As a result Ireland became a member of the European Molecular Biology Laboratory (EMBL) in 2004.

EMBL is a non-profit basic research institute which is funded by subscriptions from 20 member states and one associate member. Its mission includes performing basic research; training scientists, students and visitors at all levels; provision of vital services to scientists in member states; development of new instruments and methods in the life sciences; and technology transfer. It also sponsors an active Science and Society programme.

The Office of Science and Technology (OST) within the Department of Enterprise, Trade and Employment has responsibility for international research activities and provides one of the Irish representatives on EMBL's Council. Membership fees of international organisations, including EMBL, are paid out of OST funds. It is important to ensure that good value for money is obtained from these investments and OST, in conjunction with Forfás, have regularly evaluated the S&T programmes they fund.

DETE has commissioned Forfás to undertake a cost benefit review of Irish membership of EMBL, and this task overseen by a Steering Group.[3] The report is substantially based on research carried out by CIRCA Group and Forfás would like to acknowledge the quality of their work. The recommendations of the Steering Group are based on the CIRCA Group's findings and conclusions.

This review addresses the extent to which researchers in Ireland in the relevant fields (mainly molecular biology but also molecular medicine, bio-informatics and chemistry) are taking advantage of, and participating in, the range of activities, programmes and technologies provided by EMBL. It seeks to understand how and why researchers are interacting with EMBL and also any possible obstacles to their greater participation. It also addresses the impact of EMBL membership on strengthening the molecular biology (and wider life sciences) research capability in Ireland and the forging of new international links and collaborations.

[3] Please see Appendix 1 for the Terms of Reference.

This report is structured in five sections. After this Introduction (Section 1) it outlines the broad background to the study – what EMBL is and does, and the rationale behind Ireland becoming a member (Section 2). The methodology followed in the review is set out in Section 3 and the major findings in Section 4. Finally, conclusions and recommendations are presented in Section 5.

2. Background

2.1 About EMBL

EMBL was established in 1974 as a European Intergovernmental research organisation with a core group of ten founder member states. It was conceived as a means to strengthen basic research in the molecular life sciences in Europe, with a mission that allows it to both supplement and foster related activities in the national research communities. It currently has 20 member states, including Ireland which joined in 2004; Australia is an associate member.

EMBL currently has five core activities:

- Basic Research
- Technical Services to the Member States
- Advanced Training
- Development of New Technologies and Instrumentation
- Technology Transfer

EMBL has a total of 1,400 staff from 67 countries:

- 50% scientific staff (including PhD students and postdoctoral fellows)
- 40% technical staff (technicians, database curators, engineers)
- 10% administrative staff

EMBL operates from five sites. The main laboratory in Heidelberg houses four research units – Structural and Computational Biology, Gene Expression, Cell Biology and Biophysics, and Development Biology. Most of the core facilities are in Heidelberg.

The two structural biology outstations in Grenoble and Hamburg are located adjacent to large-scale sources of synchrotron and neutron radiation, and undertake research in structural biology. They also provide the infrastructure and assistance required by the large number of life science users of these facilities.

The European Bioinformatics Institute (EBI), in Hinxton in England, designs, builds, maintains and provides data resources and bioinformatics tools to a global user community, and has research programmes aimed at organising and extracting information from biological data.

The outstation in Monterotondo, Italy, is devoted to the study of mouse biology and has expertise in mammalian physiology and mouse models of human disease.

The EBI facilities can be accessed through the internet while the others require a visit.

EMBL houses a range of scientific core facilities in Heidelberg. These are mainly used by EMBL researchers but are also accessible to visiting scientists. The facilities cover:

- Advanced light microscopy
- Chemical biology
- Electron microscopy
- Flow cytometry
- Transgenics
- Genomics
- Proteomics
- Protein expression and purification
- Monoclonal antibodies

The operating budget of EMBL was €147 million in 2007, of which Member States contributed 54%, external research income accounted for 25%, internal tax (12%) and other receipts (9%).

An Irish student can obtain a PhD (also referred to as pre-doc, until PhD is awarded) from EMBL in two ways:

(i) the student can be hosted within a research group using funding from non-EMBL sources (members and non-members). Such students are recruited directly by researchers who have secured funding for these positions.

(ii) students can be part of the EMBL- funded International PhD programme (available to students from member states). However, students from non-member states can apply for admission to the programme, provided that they have their own funding or work with a group leader who has external funds available. There are about 900 applications for the current year for approximately 47 'predoc' positions in EMBL, a four year research course leading to a PhD. EMBL has a very rigorous selection procedure to ensure they obtain only the best students. About 100 of the International PhD programme applicants are invited to Heidelberg for interview before final selection. See Section 4.1 for Irish involvement.

Post-doctoral positions at EMBL can be obtained in several ways. EMBL employs post-docs from its own funds on an annual basis. These positions are advertised and are only available to citizens of member countries. In addition, post-docs can be employed on funds obtained from other sources (open to non-members as well) such as mobility fellowships, collaborative research grants etc.

Visiting Scientists: EMBL have excellent facilities in certain areas, including electron and light microscopy, chemical biology, flow cytometry, proteomics, genomics (Genecore), and protein expression and purification. Visiting scientists from EMBL member states, may use the facilities for elements of their own research, or for advanced training on specific techniques or equipment.

In 1999 EMBL established a wholly owned subsidiary, EMBLEM, to identify, protect and commercialise the intellectual property and associated technologies developed at EMBL. This unit also provides technology transfer services for other R&D institutions. It employs eight people and has a licensing income of €3.3 million, a portion of which feeds back to EMBL, from over 200 licenses. It deals with around 40 inventions or disclosures per year from EMBL. EMBLEM also has its own Venture Fund of €26 million to support early stage development. It has been involved in ten spin out companies, including Triskel Ltd. in Galway and Elara Pharma in Heidelberg which both have NUIG links.

2.2 EMBL Programme 2007-2011

Over the 30 years of its existence, EMBL has assembled critical mass in several sub-disciplines of the molecular life sciences, including structural biology, biochemistry, genetics, cell biology, development biology and bioinformatics. These fields were chosen because together they have enabled EMBL to cover the range of biological scale from the atom to the organism, and have provided a framework that has allowed a broad interdisciplinary approach to a number of important biological problems.

Developments in molecular biology have brought basic biological research and medicine much closer together, as molecular approaches have explained the defects underlying certain disease states. The technologies emerging from this research have also spawned the biotechnology sector. Together these changes have made the life sciences even more important strategically for all EMBL member states**.** There is a growing international realisation that investment in basic research in the life sciences drives innovation. Unfortunately, in terms of increased research funding, the US, Japan and some developing countries such as China have reacted much more forcefully to this realisation than Europe.

EMBL has a history of and considerable expertise in reductionist molecular biology. These powerful approaches for understanding living systems have now been supplemented by cross-disciplinary approaches that provide new types of information: functional genomics, quantitative imaging and computational biology. The synthesis of all these diverse approaches with the iterative use of computational modelling and simulation methods in order to develop a detailed quantitative understanding of aspects of biological function is systems biology. This approach is the natural next step for EMBL to take and will form the heart of the next five-year Programme (2012-2016). The Programme builds on the strengths of EMBL's existing Units but will require new horizontal activities to further emphasise interdisciplinary activities/interactions and to ensure the wider dissemination throughout the Laboratory of the required expertise.

To achieve this, EMBL intends to build three centres. These centres will focus on functional genomics, imaging and computational biology. This will help the Laboratory to face the challenge represented by biological complexity. A further innovation will be to assimilate chemical biology and biochemical instrumentation development, which have formed a separate Unit in Heidelberg, into the four remaining research Units of the headquarters Laboratory. This will promote the seamless integration of technology development with basic research activities.

This strategy is a reflection of the important role of systems biology in future developments and the need to promote interdisciplinarity in three key areas: computational biology, imaging and image analysis, and high-throughput screening technology.

In addition to strengthening its research capabilities in these areas, EMBL plans to expand the EBI bioinformatics infrastructure at Hinxton and build new structural biology beamlines in its Hamburg station. A major new conference and training centre is currently nearing completion in Heidelberg, which will allow European life scientists to host meetings on a scale currently available only in the US.

2.3 Rationale for Ireland Joining EMBL

Georgia Tech Study

In 2001 the Government appointed consultants from Georgia Tech to examine the merits of possible membership of four inter-governmental research organisations, including EMBL. Ireland was already a member of two bodies closely allied to EMBL – EMBO (the European Molecular Biology Organisation) and EMBC (the European Molecular Biology Conference), which support training and careers in molecular biology at all stages of the scientific career path. While located on the same Heidelberg campus as EMBL, they are very different organisations with no formal links to each other, although they maintain a close relationship in practice.

The Georgia Tech report [4] assessed the potential benefits of Irish membership of EMBL against four factors – science, industry, strategy and international standing and culture.

[4] Cozzens, Shapiro, Krige and Porter: Assessment of Irish Participation in Inter-Governmental Research Organisations (2001) Final Report (unpublished) Prepared for Forfás (National Policy and Advisory Board for Enterprise, Trade, Science, Technology and Innovation in Ireland). Georgia Tech School of Public Policy and Technology Policy and Assessment Center, Atlanta, GA

In addressing the science factors the study first of all used bibliometrics (the analysis of publication records) to establish that there was (in the late 1990s) a significant body of expertise already in place in Ireland that used the kind of research EMBL produces, and that could help Ireland take advantage of the opportunities EMBL represents. The report then assessed EMBL's suitability for Ireland as being strong, moderate or weak in relation to the following criteria:

1. World class and unique research
2. Fit with Irish strategic research goals
3. Fit with strengths of Irish research base
4. Training opportunities for Irish scientists
5. Enhancing international collaborative relationships
6. Annual membership cost
7. Relative value for money for DETE

The report assessed suitability as being strong for six of these criteria and moderate for the other.

For industry, the report noted the significant presence of high-tech multinational companies, many in the pharmaceutical or medical devices sectors, in Ireland. It also noted a small but growing indigenous capacity in biotechnology, diagnostics and imaging. Again, the report assessed the potential for Irish industry to make use of the various EMBL offerings in relation to the following:

- Fit with Irish industrial strategy
- Opportunities for Irish firms through technology transfer and human capital networks
- Increased opportunities for skills development and training
- Enhancement of industry's international collaborations
- Enhancement of Ireland's reputation as a high tech environment
- Relative value for money for DETE

The report assessed the Irish position as being strong in four of these areas, moderate in one (international collaborations) and weak in one (high tech environment).

The report also examined whether, in joining EMBL, Ireland would be in a position to influence the future direction of the organisation's research strategy. Although larger countries dominate EMBL in terms of both funding and people, the organisation is flexible and has a policy of employing younger scientists with a relatively high turnover. There are, therefore, opportunities for a small country with a strong research capacity in molecular biology and biotechnology to have some influence on future research priorities.

Finally, the report discussed how membership of EMBL would impact on co-operation with other member countries of the organisation. Not surprising, it found that Ireland already had extensive political and economic links with the sixteen member states at that time. However, it did acknowledge the contribution membership would make to achieving Ireland's objective of having a higher international profile in research and to increasing its contribution to, and participation in, various EU scientific initiatives.

Visit of Irish Scientists to EMBL April 2003

In April 2003 an Irish visit to EMBL was organised by the Director General of EMBL. The purpose of the visit was to familiarise the scientific community with opportunities at EMBL, prior to Ireland taking up full membership.

After the visit eighteen participating scientists gave their reactions and comments. These included the following expected benefits from joining EMBL:

- Membership would raise awareness amongst Irish scientists of what EMBL has to offer;
- It would put Ireland on the 'molecular biology map of Europe' and enhance our credibility in scientific research;
- It would allow access to the core facilities in EMBL, which was seen as a cost effective way of supplementing the facilities then being built in Ireland. A small country cannot develop state-of-the-art facilities in every area;
- Access to genomics and proteomics core facilities at EMBL would be a gateway for Irish researchers to participate in systems biology, a 'big science' activity not easily accessible by small specialist groups;
- It would give Irish researchers preferential access to laboratories, research programmes and facilities of an extraordinarily high standard;
- It would allow access to the short and long-term training opportunities for young scientists and to the wealth of expertise among EMBL staff;
- It would increase the number of Irish applications for both short-term and long-term fellowships (both EMBO and EMBL);
- It would allow increased collaborations with the Heidelberg laboratory and its core facilities.

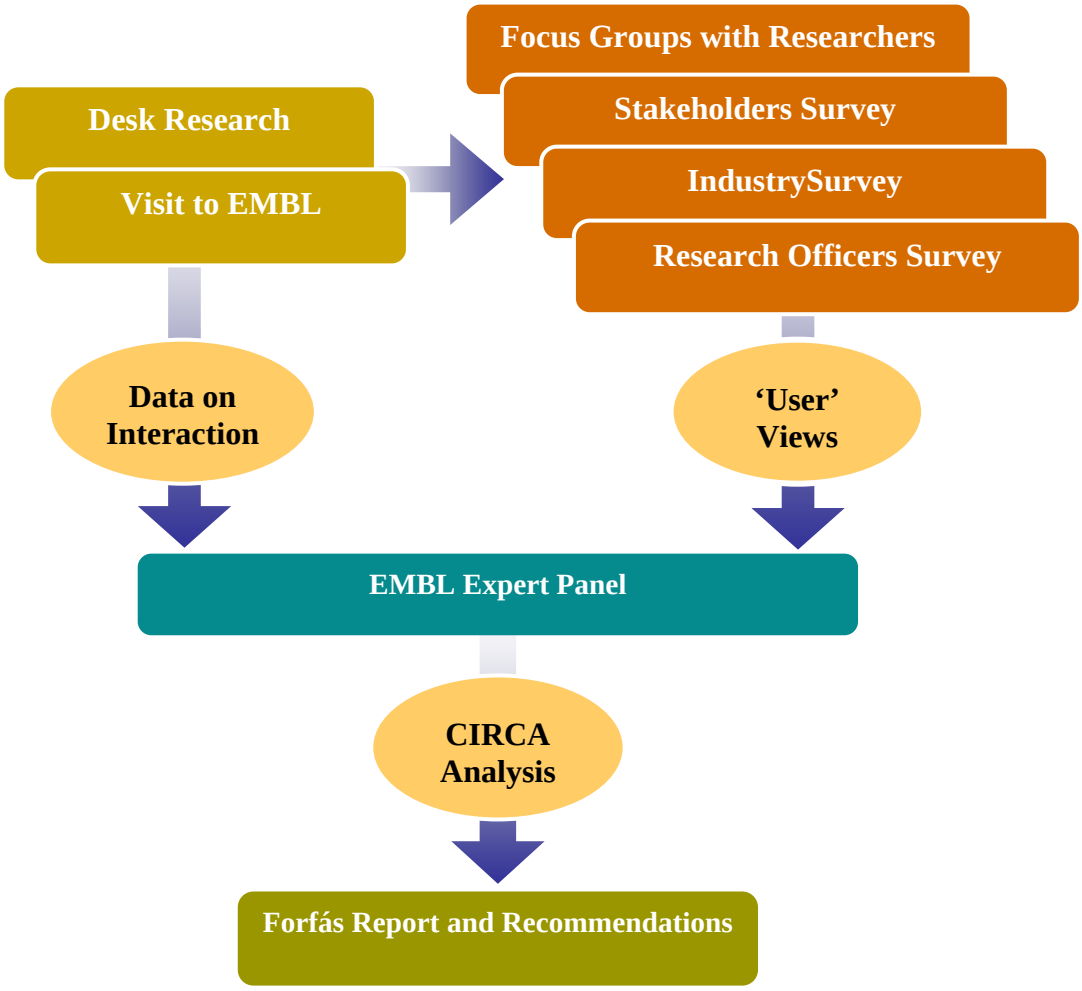
2.4 Cost of Membership

Ireland's contribution to EMBL in 2008 amounted to €1.03m and for 2009 will amount to €1.06m. This equates to 1.19% of overall member states contributions. A member state's annual contribution to EMBL is calculated using a Cost Variation Index (CVI) based on prices across Germany, France and the UK at a point in time. The annual CVI rate is agreed by Member States at the winter EMBL Council meeting each year for the forthcoming year's EMBL budget. The EMBL Indicative scheme (i.e. the EMBL programme of research activity to be supported) for the 2007 – 2011 period and currency fluctuations involving the Euro and Sterling will also have a bearing on the calculation of the CVI. It should be noted that there is also a reduced membership rate (in the region of 30%) for the first three years of membership which Ireland availed of in the 2004 – 2006 period.

3 Methodology

The approach to the evaluation involved a series of actions designed to identify the impact of EMBL membership on Irish research activities and programmes. The overall approach to the task is represented in Figure 1 below.

Fig.1: Methodology Overview



3.1 Desk Research

A full understanding of the rationale for joining EMBL, and of the expected benefits, was obtained from a detailed review of the Georgia Tech study and of the report of the Irish delegates who visited the Heidelberg facility in April 2003. The EMBL website provided some details of activities and programmes. The visit to EMBL (see 3.2 below) provided us with a range of reports about EMBL and its operations which also facilitated the desk research process.

3.2 Visit to EMBL

A visit to EMBL took place on the 16th October to obtain further information on Irish participation, and also to get a greater understanding of the potential for Irish participation. EMBL management were extremely helpful, open and accommodating at all times.

This meeting provided a more detailed view on Irish interactions in relation to the different elements of the EMBL 'offer', i.e. training, facilities use, cooperation and policy interaction. EMBL also provided further data on Irish 'use' of different programmes and facilities within EMBL. This information was highly relevant to the design of the focus group meetings (see below).

Insight was gained into EMBL structures and procedures for interacting with member states and for disseminating material about their activities.

3.3 Focus Groups with Researchers

The primary group of direct beneficiaries of EMBL membership are researchers. This phase was designed to directly assess the views of Irish scientists (mainly molecular biologists) about EMBL as a research partner, training location, facility provider.

Participants at the Focus Groups were selected from among Principal Investigators (PIs) funded by the main funding agencies (SFI, EI and HRB) in recent years. These were supplemented with additional names suggested by these researchers, and from the websites of relevant research centres and University Departments. The locations for the meetings were on-campus rooms in UCD, UCC and NUIG by courtesy of each of these colleges. Researchers were invited by means of an email which indicated the general purpose of the evaluation and the specific purpose of the meeting.

Four focus groups were planned of which one was for researchers who had minimal involvement with EMBL. However, as the project progressed it became clear that most researchers were in this category. Therefore a focus group of researchers, who had been on an Irish delegation which visited Heidelberg in April 2003 (see end of Section 2.1), was arranged. These researchers all provided very positive individual opinions at the time on Irish membership of EMBL, and defined the benefits that each saw as arising from membership.

Three Focus Groups were held as follows:

Venue	Date	Number Attending
UCD Belfield	22-Oct	6*
UCC	28-Oct	8
NUIG	30-Oct	4
*Invitees were from UCD and TCD		

The issues to be explored in these groups were based around those listed below. As is usual with focus groups, these issues were modified somewhat in successive meetings to explore issues that arose in earlier discussions

- Does EMBL impact your research activities, and how?
- Which, if any, of these impacts is the most effective, and most useful?
- What changes happened as a result of Ireland joining EMBL?
- Are any of the services offered by EMBL available from other services or organisations, and how are these differentiated?
- How does EMBL differ from Marie Curie as a source of training support for molecular biology?
- Have your international links been strengthened as a result of Ireland's EMBL membership?
- What would change if Ireland was not a member of EMBL?

3.4 Stakeholder interviews

Interviews were conducted with ten people from organisations directly or indirectly involved in promotion or support of Molecular Biology and related activities in Ireland. Those approached were:

Funding Agencies: SFI, HRB, HEA, IRCSET and EI;

Potential Beneficiaries such as Universities, Molecular Medicine Ireland, IoT Ireland

Policy and development organisations including OST (DETE), IDA and Forfás.

Their views were obtained through meetings or telephone conversations. The issues to be explored varied according to the nature of the organisation, but were based around the following:

- What interactions, if any, does your organisation have with EMBL?
- Do EMBL services or activities impact your programmes, and how?
- Which, if any, of these impacts is the most effective, and most useful?

- Are the EMBL services available from other international organisations and how are these differentiated?
- How does EMBL differ from Marie Curie as a source of training support for molecular biology?
- Are you aware of any impact of EMBL on Irish industry?
- What would change if Ireland was not a member of EMBL?

3.5 Industry Survey

One of the potential benefits of EMBL membership is that Irish companies can licence technology through EMBLEM, the technology transfer organisation operated by EMBL. To assess awareness of this opportunity, and of other services available from EMBL, an email/phone survey was conducted with 9 Irish research-active companies. The issues to be explored included the following:

- Are you aware of EMBL in general, or as a source of technology for license?
- Have you had any contact with EMBL on any issue?
- If so, what was your experience?
- What would change if Ireland was not a member of EMBL?

3.6 Academic Research Officers Survey

A usual route for information on research supports is through the research office in each HEI. A phone and email survey was therefore conducted to establish the views of Research Officers or Deans of Life Sciences. These interviews assessed the awareness of these officers of the services offered by EMBL, and their views on the information provided by EMBL or intermediary agencies. The issues explored included.

- Are you aware of EMBL as a provider of support for your researchers?
- What is your major source of information on EMBL activities and offers?
- Are you satisfied with the nature, frequency etc of the information provided?
- How does EMBL compare with other sources of support?
- Have the international links of your research groups been strengthened as a result of Ireland's EMBL membership?
- What would change if Ireland was not a member of EMBL?

3.7 EMBL Members Panel

An important element of the study is benchmarking how Ireland 'manages' its membership against other member states.

Approaches were made to the EMBL Council representatives from the state sector rather than academic scientists from a number of other smaller member states and the workshop convened on 18th November was attended by:

- Dr Jeannette Ridder-Numan
  Ministry of Education, Culture and Science, Netherlands
- Prof Brita Beije
  Swedish Research Council

4 Findings

4.1 Usage of EMBL by Irish Researchers

As members of EMBL, Ireland can avail of the following EMBL-funded programmes and/or services:

- PhD (pre-doc) opportunities
- Post-doc opportunities
- Visiting scientists.

EMBL has about 1,400 staff, of whom 1,117 are scientists. Research staff includes EMBL Faculty[5], who are group leaders across the five locations involved. They are employed on successive three-year contracts and only under very exceptional circumstances can the tenure exceed nine years. There are currently two Irish Faculty Members out of a total of 85. Other research staff are employed in postdoc positions or are PhD students.

In 2007 there were nineteen Irish people among the 1,400 EMBL staff, (ten scientists and nine administrative staff). This is on a par with a number of other small countries. Denmark, Belgium, Finland and Sweden also have one per cent of total research staff, while the Netherlands and Greece have two per cent. Germany (25%), UK (16%), France (10%) and non-EU countries (19%) are the major players.

PhD (Pre-Doc) Students: There are two ways in which an Irish student can obtain a PhD at EMBL:

1. Irish students can be hosted within a research group at EMBL, using funding from non-EMBL sources, or
2. They can be part of the EMBL 'International PhD Programme' which currently includes 180 students from 30 countries. Acceptance of students for pre-doc positions in this programme is a highly competitive process. Students may apply for placement in one of two specified units within EMBL. Applications have averaged 650 per annum since 2005. Of these, around 100 are selected to come to Heidelberg for interview with the heads of the selected EMBL units and an average of 47 are awarded studentships. Between 2005 and 2008 there were altogether almost 3,000 applicants, 1,100 of them from EMBL member states, including thirteen from Ireland. On average, the success rate for applicants from member states is about 9%.

[5] Members of the Faculty are scientists who lead research groups or the equivalent: Unit Coordinators, Group Leaders and Team Leaders as well as Visiting Scientists in a Group Leader position.

EMBL has been able to award its own PhD degrees since 1997, but most PhDs are awarded jointly with one of 29 partner universities (in 19 countries). University College Cork is one of these partner universities, but no joint award has ever been made between these institutions.

At the moment there is one Irish student within the 'International PhD programme' and one further PhD student was hosted for a period during 2007. During 2005 and 2006 there were a total of three and four Irish students respectively within EMBL.

Post-Docs: Post-doctoral positions at EMBL can also be obtained in several ways. EMBL will employ post-docs from its own funds on an annual basis. These positions are advertised and are only available to citizens of member countries. In addition, post-docs can be employed on funds obtained from other sources such as mobility fellowships, collaborative research grants etc. There are currently 4 Irish EMBL-funded post-docs in EMBL and this has been the position since 2006. In 2005 there were three.

Visiting Scientists: EMBL have excellent facilities in certain areas, including electron and light microscopy, chemical biology, flow cytometry, proteomics, genomics (Genecore), and protein expression and purification. In addition to conducting their own R&D projects, these facilities are available to visiting scientists. Visiting scientists may use the facilities for elements of their own research, or for advanced training on specific techniques or equipment.

Irish Visiting Scientists

	2005	2006	2007	2008
Visitors	3	3	6	4

Courses and Conferences: EMBL run series of conferences and courses on relevant topics each year[6]. These events are specifically EMBL events or EMBO events hosted by EMBL. There are also a wide range of EMBO events which have no EMBL connection. The table below shows Irish participation (less than 1%) in EMBL events.

Irish Course / Conference Participants

	2005	2006	2007
Total Participants	1,972	2,052	2,243
Irish Participants	4	15	10

[6] http://www.embo.org/courses_workshops/practical_courses.php

Alumni: EMBL post-docs and staff commonly go on to eminent positions in other countries. Approx 90% of staff are in contracts which oblige them to leave EMBL after a maximum of 9 years. There are currently over 4,274 EMBL alumni worldwide and EMBL report that (of the 58% of these who can be traced) almost 80% live in EMBL member countries.

Currently there are 48 Irish who are EMBL alumni of which 12 were pre-docs and 26 were scientific staff during their EMBL stay. Of the 35 of these whose location is known to EMBL, 15 are in Ireland; 12 are in other EMBL member states and 8 are in the rest of the world.

Of specific interest is the fact that non-Irish EMBL alumni have begun to join Irish institutions and there are now six non-Irish alumni in Ireland. One EMBL faculty member, who was about to move to Ireland, noted that he was attracted to University College Dublin by the relevance and quality of the scientific cluster which existed there, and the facilities available.

EBI Database Usage: The European BioInformatics Database (EBI) is one of the premier databases of genetic and proteomic information in the world. It is available to all researchers and also allows researchers to contribute data for common use. It is available through the EBI website[7]. As a representative example of traffic, EBI report that over 600 users with .ie domains used EBI in the month of May 2008. Below are the monthly Irish user statistics (i.e. hosts that resolve to the .ie domain) from Jan 2007 up to Oct 15 2008.

Irish User Statistics for EBI databases (from users having a .ie domain)

Month	Hits	Bandwidth	
Jan-07	43,577	162,886	0.81
Feb-07	76,493	162,264	1.15
Mar-07	58,120	165,846	1.13
Apr-07	74,481	306,336	1.33
May-07	34,308	115,547	0.82
Jun-07	35,345	105,973	1.12
Jul-07	44,754	140,967	1.08
Aug-07	38,388	109,243	0.63
Sep-07	46,562	120,992	0.76
Oct-07	38,083	129,898	1.14

[7] www.ebi.ac.uk

Nov-07	49,548	163,081	1.46
Dec-07	40,857	220,622	2.56
Jan-08	68,827	323,423	4.67
Feb-08	83,448	361,721	5.5
Mar-08	267,125	488,882	15.03
Apr-08	655,592	1,096,278	71.46
May-08	1,265,355	1,658,832	138.11
Jun-08	90,679	336,126	9.81
Jul-08	96,441	361,056	10.51
Aug-08	193,034	439,975	5.84
Sep-08	134,627	391,533	17.77
Oct-08	82,379	239,722	4.71

On a comparative basis, Irish usage of EBI in 2007 and 2008 is shown below. It is difficult to establish an average usage per user as access is seen to vary significantly among all users over phases of research projects. In the case of the major increase in Irish usage between 2007 and 2008 shown above and below, EBI report that this is mainly due to a very significant usage of the database by one Irish user during May 2008. This is also shown in the table above. This data, and the information from the focus groups, show that Irish researchers are active users of the EBI databases.

Irish Usage of EBI		
	2007	**2008**
% of all pages	3.37	16.54
% of all hits	0.32	12.87

Collaborations: There are/were several on-going collaborations between Irish researchers and individual researchers in EMBL, for example, between researchers at EMBL and researchers at NUIG, DIT, UCD, TCD and UCC.

4.2 Research Officer Interviews

The research officers interviewed (see Methodology Section 3.6) were all generally aware of EMBL, but had little specific contact with the organisation. Relevant points made include:

- The Research Offices never receive any information from EMBL on any services or offerings, although they are generally aware of the organisation as a potential collaborator for their researchers, and as a source of training expertise.
- There was a general, if uncertain, view that EMBL information was regularly received at one time but that this flow had ceased within the last few years.
- Regarding PhD training, some noted that the colleges were anxious to keep good PhD students for their own laboratories, and that the research offices are not encouraged to promote opportunities which might result in the departure of these students from the college
- It was also noted that the Research offices are mainly charged with winning research funding and that some of the EMBL offers (e.g. scientist visits, courses etc) are not issues that they would normally promote. EMBL is therefore 'not a big deal' for the research office as it does not represent a source of funding for internal research.
- For the same reasons, services such as EBI, visiting scientist facilities and courses are 'invisible' to the Research officers. They would expect researchers to be aware of these opportunities for themselves.
- One research officer, who had occasion to contact EMBL, noted that they were easy and open to deal with and that the process involved "a minimum of bureaucracy".

4.3 Industry Survey

Almost none of the nine company representatives interviewed (see methodology in section 3.5) had any current contact with EMBL. Several had never heard of EMBL while others were aware of EMBL from past experience in academic study or research. No company currently made any use of EMBL facilities or training opportunities, nor could they see any major potential to do so. Collaboration with EMBL in Framework Programme research, or technology licensing were the main possible opportunities noted but neither was a priority interest for any company.

The only interviewed company which had any specific relationship with EMBL is Triskel Therapeutics Ltd., which is a start-up (still in technology development mode with no current employees) developing improved anticancer therapies. The technology on which this company is founded (engineered receptor selectivity for TRAIL molecules) was developed within an Framework Programme Five project which was a collaboration between NUI Galway, University of Groningen and an EMBL researcher, Luis Serrano. The latter researcher has now left EMBL, but EMBL remains one-third owners of the technology. Triskel Therapeutics has negotiated with EMBLEM for a license to the technology and this has been the extent of the interaction between EMBL and Triskel. The company had no difficulties with EMBLEM in the process of the negotiations.

Despite having no direct contact with EMBL or indeed no knowledge in some cases, the companies were generally supportive of the availability of such supports for the R&D base. No negative views on the principle of Irish membership were heard.

4.4 Stakeholder Interviews

A number of those interviewed (see methodology in Section 3.4) had little to say, either because EMBL was not seen as relevant to the work of the organisation or because EMBL was viewed as a basic research performer and of little direct interest to the clients of the organisation (EI, IDA). The main points raised by the other interviewees were:

- EMBL has low visibility in Ireland and does not seem to try to promote itself here. Very few molecular biologists here seem to be aware of EMBL or receive EMBL funding.
- EMBL could do more to publicise what they offer. Their website could be made more user-friendly. They should be circulating the higher education institutions, on a regular basis, with details of developments and opportunities.
- Although EMBL might still be under-utilised in Ireland it is important for Ireland's international visibility and reputation in research to remain a member. To do otherwise would send very wrong signals.
- EMBL has been very active in the area of science policy, particularly in career structures and PhD training. EMBL's structured PhD education programme served as a model for similar programmes in Ireland in recent years.
- EMBL is playing a critical role in hosting the European Institute of Bioinformatics and is leading in developing a European research infrastructure in bioinformatics. This is a critical area for Ireland but we are not involved in the design phase of the new infrastructure.
- Other member countries have a leading academic scientist as a representative on the EMBL Council, and this facilitates contributions to scientific discussions as well as strengthening communications between EMBL and HEIs and researchers in Ireland.

4.5 Focus Groups

Three focus groups were held with leading researchers in relevant fields (see methodology in section 3.3). This section presents an overview of the findings from the three meetings. A detailed report is in Appendix 3.

4.5.1 Views about EMBL

Generally EMBL was seen as exceptional as a research centre. Key comments include:

- "Top rate". "One of the best in the EU, if not the world"
- "Centre of research excellence for molecular biology research", which also has a "strong training role for PhD students and Post-Docs"
- "It is one of few EU institutions which are comparable to the best in the US" - "at one stage it was the only one"
- "one of the few institutions outside the US which is on the radar of the American scientific research community"
- "Many of the leaders in microbiological research in Europe have worked at EMBL"

It was suggested that more people are more aware of the facilities than of EMBL itself, e.g. EBI (the bioinformatics centre at Hinxton) is very well known but perhaps not recognised as being a part of EMBL. Some are very familiar with the facilities available but many are unaware of the full extent of what is offered.

As a location for PhD or Post-Doc training, "Heidelberg is the Molecular Biology Capital of Germany - therefore provides a wonderful learning environment for research" and therefore an excellent experience for pre-docs. Their facilities were typically referred to at the level of storybook or fairy tale and their Group Leaders are the top in their fields. Importantly, they only do research and have no teaching function. It was stressed that the experience, for a PhD student, of working in a group that had the expectation of a Nature publication was particularly inspiring.

In summary, all participants saw EMBL as a hugely impressive research facility with a unique intensity where all staff only cared about one thing, i.e. working in science. Also researchers were exposed to invited speakers from all over the world.

It was pointed out that Irish scientists are still more likely to look to the US for career opportunities, because this was traditional, and there are many more opportunities. Also, from the nature of the discussion it appeared that institutionally there are greater similarities between Irish universities and universities in the US rather than with high level research bodies, such as EMBL, and that it probably was easier to establish such relationships at faculty level, including at administrative level.

The discussions produced a listing of areas of research in EMBL of particular relevance to Ireland:

- Structural Biology
- Bio-Informatics
- Genomics/Proteomics and Gene Expression technology
- Imaging Technology
- Developmental Biology

It was also noted that there are a host of other excellent labs at EMBL that are less well known.

4.5.2 Awareness and Usage of EMBL

There was a fairly high level of general awareness of the totality of facilities/awards offered by EMBL (72% of participants had a superficial knowledge of EMBL's existence), with the highest awareness being 'Facilities for Visiting Scientists' (90%). Awareness of Pre-Doc and Post-Doc Fellowships were at 80% plus levels, with the greater awareness being about Post-Doc Fellowships (86%). 'Collaborations' also scored high at 76%.

That said, 'awareness' meant simply that. When considered in greater depth many had no idea how EMBL schemes/facilities operated or how to access them, and of the 21 participants only a small minority had been to EMBL or had actually sent students there.

Most had no idea whether Ireland was a member, nor were they exposed to EMBL information on a consistent basis, particularly in recent years.

Generally, the level of detailed awareness of EMBL appeared to be linked to the numbers of EMBL alumni present in each group. Generally this information remained personal to each alumnus, except when they gave career talks each year. Consequently, many researchers, even colleagues, were hearing some information about EMBL for the first time at the focus groups.

Among points raised in the discussions:

- A few pointed to the importance of collaborators and three said that they had sent people there under EMBL's Visiting Scientists Programme;
- There was some discussion about using EMBL to access funding, but this was challenged and it was pointed out that EMBL is not primarily a funding body but more a centre for excellence in research;
- Regarding funds, it was pointed out that 'EMBL is not a source of external funding and in that regard it is therefore not on their (researchers) radar' as a funding source;

- It was also stated that "EMBO is the more useful funding mechanism for Irish scientists– EMBO Post-Doc Fellowships – albeit some ended up working in EMBL but funded by EMBO";
- The main barrier to participation is not lack of funding per se but rather a lack of information.

Few of the participants have on-going inter-active relationships with EMBL but 40% appear to have sporadic contact/involvement or to receive information from EMBL, though not necessarily directly.

By contrast, most use EMBL databases and a few have sent people for placements and collaborative visits for between one and six months.

In one of the focus groups five of the eight participants indicated that they had contact with EMBL. Three alumni had contacts regularly from EMBL and all five had regular contacts initiated by them with EMBL. They listed these channels explicitly (See detailed report in Appendix 3.) The following ranked order reveals the type of engagements people reported. This pattern was broadly the same for each focus group:

1. Databases (remotely accessed) – used by almost all participants (and also by many hundreds of other Irish scientists');
2. Pre-Doc/Post-Doc Programmes;
3. Use of research facilities and training in new techniques;
4. Student collaborators ranked most highly as a connection mechanism;
5. Each researcher's own links to EMBL Network were also emphasised as very important.

4.5.3 Promotion of EMBL

There was wide consensus that EMBL is not very visible to researchers, either through its own promotional efforts or through any awareness-raising activities in Ireland. Many participants were unsure whether Ireland is a member of EMBL. All believed that there was no 'national contact point' and that no organisation was actively promoting EMBL. There was a general observation that information about EMBL was less evident than it was a few years ago. All EMBL alumni do receive regular update information from EMBL. However there was no evidence of information sent to Alumni being made more widely available.

The research offices in the higher education institutions are seen as one potential intermediary for transmitting information about EMBL to researchers. There is no perceived conflict of interest between sending PhD students to EMBL and the national strategy to increase PhD graduate numbers in Ireland, mainly because the numbers involved (realistically, not more than one or two per year) are small.

4.5.4 Barriers to Greater Use of EMBL

Lack of information about EMBL activities and services was seen as the major barrier. Those with experience of EMBL spoke highly of its people and facilities, but they were in the minority.

Other points made:

- Generally, "contact was made on a personal basis and through personal relationships" - "that is the way science works", one respondent suggested. This was corroborated by others and it was pointed out that EMBL is 'not strictly a facility but a research institute and that it was through collaborations that people got access';
- As Ireland is now a country member, access mechanisms needed to be formalised and made more obvious to the scientific community here;
- Irish EMBL alumni are not visible and not organised. An Irish alumni group could be a useful mechanism to promote EMBL and Ireland's relationship with it. Ireland has no research funding to assist researchers obtain positions in foreign laboratories such as EMBL. There was no clear consensus that this was a barrier to people going to EMBL however, but it was considered a possibility. Likewise, some participants suggested that specific grants to fund short-term visits to EMBL would be helpful.

4.5.5 International Collaborations

The focus groups discussed whether EMBL offers particular advantages as collaborators or as intermediaries for collaboration with other molecular biologists in Europe. Key points made:

- The EMBL alumni were very aware of the importance and relevance of collaboration possibilities, but others less so;
- EMBL was seen as very supportive of collaboration;
- One participant, who has a continuing relationship with EMBL through visits and collaborations, stressed that this had led to the establishment of a wide personal network of collaborators;
- EMBL's reputation is such that its involvement in a research proposal tends to enhance the prospects of success, especially at EU level.

4.6 EMBL Members Panel

Two EMBL Council members, one from Sweden and one from the Netherlands, were consulted in order to understand how EMBL activities are managed in their countries. In many ways the situation in these two countries is similar to that in Ireland, although both have been members of EMBL since 1974. Neither country is overly keen for their best science graduates to do a PhD at EMBL, despite its excellent reputation, because of the current policies to maintain or increase PhD output levels from the universities. For example, in Sweden both the Karolinska Institute and the University of Stockholm have agreements with EMBL for joint PhD awards (as does UCC here) but these have never been implemented.

The composition of the two-person delegation to EMBL is the same in both countries. One member is an academic scientist from the field of molecular biology; the other is either from the relevant Ministry (the Netherlands) or the National Research Council (Sweden). Both countries have established mechanisms for getting wider scientific input to the delegates. The Netherlands, for example, have set up a scientific committee which meets twice a year before EMBL Council meetings and discusses various technical issues that are on the agenda.

In Sweden, responsibility for the national contribution to EMBL now rests with the Research Council and this has led to a questioning of the monetary support for EMBL from those responsible for national research budgets. This issue has not been resolved and it is likely that Sweden will undertake an evaluation of its membership of EMBL in the near future. Both countries operate research support programmes to enable postdocs to go abroad for a number of years for experience, and these can be used to gain entry to EMBL.

There is little effort in either country by EMBL alumni to promote greater use of the organization. There is a Scandinavian alumnus group but until recently it was more active in Norway. Many of the Swedish alumni were in EMBL in the 1980s and are no longer motivated to do promotional work. However, one recent alumnus is attempting to change this situation.

Other promotional efforts are sporadic. Sweden did organize a successful conference in 2008, which attracted 170 attendees. The conference targeting senior university students, PhD students and young researchers was organised in Stockholm by The Swedish Research Council, The Royal Swedish Academy and EMBL. This promotional conference entitled "EMBL – a jump start to an international career in molecular biology" involved the promotion of the unique possibilities available at EMBL and the sharing of experiences by EMBL scientists. The Director General of EMBL also spoke at the conference.

The Netherlands does no promotional work. The Ministry receives occasional information from EMBL about PhD programmes etc., and promotional information and notices are believed to go to the universities directly from EMBL. The Swedish Research Council receives regular emails about vacancies, new positions and other current information from EMBL, which is then put on their website with links to EMBL.

5 Synthesis, Conclusions and Recommendations

5.1 Synthesis of Findings

In this section the findings of the study are synthesised under six broad headings.

Views about EMBL

Many of those consulted, outside the research community, had relatively little knowledge of or contact with EMBL. This was true even in the Research Offices of the higher education institutions. The little contact that did occur gave rise to positive rather than negative impressions.

Two of the research funding agencies had greater interaction than other stakeholders. EMBL is seen as playing an important role in developing the European research infrastructure in bioinformatics. EMBL is also seen as active and influential in areas peripheral to its core research function, for example in leading the way in developments in PhD training programmes and in career structures for researchers, and being willing and able to share its expertise in these areas with member states.

Researchers view EMBL as one of the leading molecular biology research centres in Europe and one of the few on the radar of US researchers. EMBL is a focus for molecular biology research because most of the leading researchers in that field in Europe have worked there at some stage of their careers. In particular, the EMBL outstation at Hinxton, near Cambridge, is a very well known and widely used centre for bioinformatics.

EMBL is considered to be doing research in a number of areas of particular relevance to Ireland; for example, structural biology, genomics and proteomics, bioinformatics, and imaging technology.

Awareness of EMBL

Awareness about EMBL and its activities is generally quite low across the system. Many of the individuals and organisations consulted in this study (for example, Research Offices in the higher education institutions, business enterprises, research funding agencies) do not receive any regular information from or about EMBL and are unaware of EMBL services or offerings. That said, most do not see EMBL as relevant to their own activities and do not actively seek such information.

The exception to this is the molecular biology research community but, even here, the awareness of EMBL is very general and there is no detailed knowledge about what EMBL does or how to make better use of it. In general, researchers are not informed about EMBL activities either by EMBL itself or by an Irish 'contact point'. The exceptions to this were the EMBL alumni in Ireland (those who had previously studied, trained or worked in EMBL), who receive regular updates via email on EMBL activities.

These remarks apply mainly to the main EMBL centre in Heidelberg; the facilities in the outstations in Hinxton (bioinformatic databases) and Hamburg and Grenoble (synchrotron radiation) were fairly regularly used.

The situation in Sweden and the Netherlands is slightly different. Both have been members of EMBL for over thirty years and have a large number of alumni in residence. EMBL is probably more widely known in either country than it is in Ireland, but there is no evidence that it is more widely used.

Usage of EMBL

Irish involvement in EMBL activities has been steady if not spectacular. In terms of high level research positions there are currently two Irish 'Faculty Members' out of 85 in total, a higher proportion (2.35%) than one might expect on a per capita basis. There is only one Irish PhD student on the international PhD programme at present but there had been four in 2006 (out of a total of around 180 in all). There are four Irish postdocs working in EMBL. In total, there are ten Irish researchers out of the current total of 1,117 research staff in EMBL, just under one per cent. In 2007 six Irish scientists visited EMBL facilities for research and advanced training. A further ten attended courses or conferences at EMBL in 2007.

Irish researchers are active users of bioinformatics databases (EBI) in Hinxton. Usage data are available from the EBI website but are difficult to interpret accurately. Information from the focus groups of researchers confirms the high visibility and usage of the EBI facilities.

Promotion

The absence of any promotional activity relating to EMBL was a recurring theme from all those who participated in this study. The result is that EMBL is effectively invisible to many researchers. The general view among researchers is that no organisation in Ireland is actively promoting EMBL. The Research Offices are the obvious route for disseminating information about EMBL activities but at present they receive little or nothing to distribute.

EMBL officials themselves recognise that some of their activities may need better advertisement in Ireland to attract an even larger number of Irish participants. They identified some mechanisms that have worked well in other countries:

- for undergraduate students: identify local champions at Irish universities, possibly EMBL alumni and/or the university career office, as point of contact for undergraduate students that are looking for opportunities for graduate school. EMBL would regularly provide promotional materials such as posters, leaflets and brochures. They have organised events such as small symposia in other member states to advertise EMBL's PhD Programme and postdoctoral training opportunities;
- for postdoctoral fellows a special Irish funding scheme could be considered to fund a number of postdocs at EMBL directly (for a limited amount of time); This scheme has been successfully adopted by Spain;
- for services provided by EMBL: EMBL would liaise with the research officers at the Irish universities to provide information about the services available at EMBL and how they can be accessed by Irish scientists.

Sweden recently ran a conference for young researchers which was addressed by the EMBL Director General and by a number of Swedish scientists who were then in EMBL or who had worked there in the past. It proved a successful way to bring EMBL to the notice of a large group of people.

Barriers to Greater Use

Lack of awareness is obviously the greatest barrier. There is a 'Catch 22' involved as the usual access method to such scientific centres of excellence is through research collaborations. These collaborations are difficult to establish without people actually going to the centre, either to work or to visit. Any mechanism to increase the usage of EMBL is likely to have cumulative impact in terms of future usages.

In other countries EMBL alumni often play an active role in encouraging their peers or younger colleagues to make greater use of EMBL. The absence of an Irish alumni group means that this mechanism is not available here.

The recently announced new IRCSET scheme ('INSPIRE') is a funding mechanism to assist Irish researchers obtain positions in foreign laboratories such as EMBL. The SFI Short Term Travel Fellowship award enables Irish researchers to collaborate on research projects outside the Republic of Ireland for a period of up to 3 calendar months. Such mechanisms exist in most other countries, as part of national strategies to encourage greater internationalisation of the research systems.

International Collaborations

EMBL identified several on-going collaborations between Irish researchers and individual researchers or research groups in EMBL. The Focus Groups identified a range of other informal collaborations; EMBL alumni are particularly aware of the advantages of such relationships and their potential for developing a wider network.

Council Membership

The EMBL Council guides EMBL strategy and hence plays a key role in determining the organisation's future direction.

Ireland is represented on the EMBL Council by an official from the Office of Science and Technology in the Department of Enterprise, Trade and Employment and by a senior executive of Science Foundation Ireland (Director of Biotechnology). Of the nineteen other member countries fourteen also have a two person delegation – in their cases an academic researcher and a representative from a State administration body, either the relevant Ministry or a research council. The exceptions to this are:

- Israel, France and Luxembourg each have only one representative from a State body;
- Greece has two research scientist representatives;
- The UK has two representatives from the Medical Research Council.

5.2 Conclusions

The conclusions of the study are summarised below in relation to the three broad themes in the Call for Tender document.

Impact on Irish Researchers

EMBL has the potential for a positive impact on Irish researchers in terms of providing a package of benefits including a multi-disciplinarity learning environment, providing essential technological infrastructure, high level training, fostering technology transfer, promoting the development of enabling technologies. By engaging with EMBL, Irish researchers can gain valuable international experience and identify potential collaboration partners. This may facilitate forging international linkages that will not only benefit the individual researcher but also the country as a whole. For example, the SFI Short Term Travel Fellowship award enables Irish researchers to collaborate on research projects outside the Republic of Ireland for a period of up to three calendar months. Such a programme could facilitate the building of collaboration links between Irish laboratories and EMBL and the building of researcher capability and competence. Indeed, the importance of international researcher mobility for

achieving research excellence at all levels of the research career is outlined in the Advisory Science Council Report: "Towards a Framework for Research Careers".[8]

However, this potential is currently not being fully realised, mainly because researchers are largely unaware of the facilities and services on offer from EMBL. Nevertheless, EMBL is being used by some Irish scientists and the numbers are on a par with other small EMBL member states.

EMBL is a major base of international research excellence, and has particular expertise and facilities in areas in which Ireland is currently seeking to build research competence and activity, e.g. structural biology and bio-informatics. Access to the facilities and expertise in EMBL is available to pre and post-doc trainees, visiting scientists and research partners. All of these options are available to Irish researchers and are highly praised by those who have taken up the opportunity. EMBL funded programmes are available to member states only. However, researchers from non-member states can avail of some of the services at EMBL if they provide their own funding. There is no reason to suppose that these services would not be more widely used if the research community was better informed of the opportunities which exist, and encouraged to take advantage.

Impact on PhD students and post-docs

There is a unanimous view among the research community that experience of EMBL is a major benefit to researchers during their training. The potential impact of EMBL on training of Irish researchers is therefore significant.

The impact on PhD students is relatively limited in terms of overall numbers. The major EMBL PhD training programme accepts approximately 50 students per year and there is currently only one Irish student in this programme. A major increase in this number is not feasible given the realities of the competitive process, and Ireland's relative size within EMBL. EMBL will never be a major educator of Irish PhDs but it can continue to be a training centre in areas of research in which Irish expertise is lacking.

An issue here is competition for PhD students. By definition, only the very best students will be accepted by EMBL and a rigorous evaluation process has been established to ensure that this is the case. However, Irish research groups will understandably wish to retain these high-quality students within their own groups. This phenomenon is not unique to Ireland and was also reported from other EMBL member countries. In other words, students are not in any way prevented from applying to EMBL, but equally they may not be encouraged to do so.

A second opportunity is for PhD students within Irish Universities to visit EMBL during some part of their studies to avail of the equipment or expertise available. This may be done as a

[8] Towards a Framework for Research Careers. Advisory Science Council (October 2008).

visiting scientist (typically using one of the core facilities which are specifically available to visiting scientists) or to any of the other laboratories, which would typically be done as part of a collaboration between an Irish and EMBL research group. Exposure to the environment of EMBL, even for a short period, can only be a beneficial part of PhD training. Students from NUIG have attended EMBL Summer Schools in the past and there may be opportunities to expand this type of activity.

The impact on post-doc training is potentially greater than for PhD students. Ireland is seeking to develop expertise in certain areas in which research activity has historically been weak or absent and EMBL has expertise in many of these areas. There are therefore clear advantages to encouraging PhD graduates to work in EMBL in these areas. Ireland is relatively well represented by post-docs and there are currently four within EMBL groups. Although there are internal EMBL funds for employment of post-docs, the number of Irish post-docs could be increased by external funding. During the course of this study, IRCSET launched the Inspire Programme which provides mobility funding for post-doctoral fellows. This fund could be used to encourage post-doctoral fellows to work at EMBL. It also offers the possibility for strategic use of these funds to encourage post-docs to work in EMBL research groups in which Ireland is seeking to develop or enhance competence.

Industrial impact

At the moment, there is little or no direct impact on Irish industry by EMBL. However, it should be noted that EMBL is by definition a basic research facility and direct commercial interest in its research programmes would not be expected. The awareness of EMBL by Irish company representatives usually derives from their period as researchers within academia. There was no expectation of using EMBL core facilities among the companies surveyed.

One Irish company (Triskel) has intellectual property which derives from collaborative research involving EMBL, although the major partner in this consortium was an Irish University. Other than this, there was no awareness of the possibility of IP from EMBL/EMBLEM.

The National Strategic goals outlined in the National Development Plan (2000-2006) and Technology Foresight reports identified Biotechnology and Information Technologies as important industrial sectors where Ireland is trying to build competence and capacity. The Georgia Tech report highlighted that these two fields are highly internationalised and networked. Therefore it was envisaged that membership of EMBL may contribute to the research base of these sectors and in particular the Biotechnology sector. The report also highlighted that the pathway for commercial exploitation would be through an increase in the number of Irish researchers engaged in research, training and networking at EMBL and that opportunities for Irish based industry would be through licensing, collaboration and human capital networks. However, the take-up of these opportunities depends on the strength of the Biotechnology research and enterprise environment in Ireland. The Georgia Tech report also highlighted the fact that pre and post-doc programmes and alumni would be important in enhancing the research, commercialisation and enterprise development in the relevant

sectors in Ireland and that visitor programmes would enable researchers from industry to collaborate and network with other researchers at EMBL.

Irish firms could benefit by hiring EMBL alumni and utilising their expertise and associated networks and in addition, could benefit through collaborations and researcher visits to EMBL. In this study, the industry survey showed that EMBL membership has had little industrial impact to-date. However, in terms of a timeframe, the Georgia Tech report mentions 5 years or more before EMBL membership impacts may be realised in industry.

5.3 Steering Group Recommendations

Almost all of the recommendations in this report are centred on the need to greatly enhance the awareness of EMBL within the research community. This probably reflects the relatively short amount of time that Ireland has been a member of EMBL and the extent of EMBL promotional activity in Ireland to date. At the moment, almost the only researchers in the country which have a useful understanding of EMBL are those who have worked or studied there. Many top researchers were unaware that Ireland was a member of EMBL, while most could not identify the agencies which currently represent Ireland at EMBL. In addition, most researchers were only superficially aware of the services offered by EMBL and almost none were aware of all of its benefits and services. Research offices within universities were also unaware of the full range of services, and none received any information from EMBL or from any other source.

The clear support for EMBL membership among the research community, apparent from the focus groups and the benefits outlined by the researchers who travelled to EMBL in April 2003 indicate that promoting and raising awareness of EMBL will positively impact on Irish researcher engagement with EMBL.

Promoting membership of EMBL

Funding agencies and HEIs should actively promote EMBL programmes and opportunities to the relevant researchers in Ireland. It is recommended that SFI should be responsible for coordinating the awareness raising activities and should, taking into account and depending upon their current available resources consider the following activities:

- SFI should develop and promote an Irish EMBL website (perhaps by providing links on its existing website), and other relevant forms of information, which will inform Irish researchers of the full range of EMBL services and opportunities. Case studies of Irish researchers who have been to EMBL could be included on such a website.

- SFI should coordinate certain elements of EMBL interaction with other Irish agencies so as to promote funding opportunities within their promotional information. Specifically, the Inspire fund offered by IRCSET can be used to fund Post-Doc visits to EMBL; and Grants offered by EI to Irish companies could equally be used to fund company visits, although could not be expected to be a major need.
- SFI should ensure that EMBL circulate named individuals in the research administrations of the higher education institutions with regular updates on EMBL activities and calls.
- Targets should be set for indicators of Irish interaction with EMBL. These targets must be related to the level of promotion and information made available to the researcher. They could include numbers of visiting scientists, numbers of collaborations, and numbers of PhD applications to the EMBL International PhD Programme. These targets should be agreed by the Department of Enterprise, Trade and Employment and reviewed on an annual basis.
- A conference should be organised to widen the visibility of EMBL to young Irish researchers and students. The Director General of EMBL and researchers from representative units should be invited to speak.

Develop and Support an EMBL Alumni Association

EMBL report that a major element of their interaction with the scientific communities in member countries is through Alumni. Alumni are generally enthusiastic about the potential of EMBL, they have detailed knowledge of research interests within the organisation, and they also have personal contacts. They are therefore in a good position to act as ambassadors within national research communities. EMBL have therefore been active in supporting local EMBL associations in member countries and provide certain supports to encourage their establishment and sustainability.[9] There are currently six such associations (Austria, Germany, Greece, Spain & Portugal, UK and the USA) and more are planned. EMBL supports the associations (through a dedicated Alumni office) in organizing and promoting meetings, funding for board meetings and the costs of an EMBL scientist to present an update on EMBL activities at such meetings.

It is recommended that SFI encourage the establishment of such an association in Ireland, and provide additional administrative supports to facilitate the use of this pool of knowledge as a resource for Irish researchers. It is recognised that the success of such an initiative is dependent on the enthusiasm of the 21 EMBL alumni currently in Ireland.

Profiling of EMBL alumni within the above mentioned SFI web-pages on EMBL would be a useful way of highlighting the opportunities available.

[9] The details of these supports are on the EMBL site at: www.embl.org/aboutus/alumni/aboutus/index.html.

Pre-Meeting Advisory Panel

In order to optimise the representation of research interests at EMBL Council and to help Irish Council members prepare positions and talking points in advance of Council meetings, the EMBL delegates could consider the establishment of a panel of leading scientists in the field of molecular biology who would be consulted before council meetings. The objective would be to allow greater involvement of the research community in the decision making process and also provide a greater range of options for disseminating information about EMBL. Ireland is represented at the Council by an official from the DETE and a representative from SFI.

The research community in relevant disciplines should be more pro-active in identifying and taking up, where appropriate, opportunities to use EMBL facilities and services in carrying out their research programmes and projects

It is important that researcher leaders in Ireland, in the relevant fields, including those who visited EMBL in April 2003, actively take part in raising awareness of the array of opportunity available at EMBL. Researchers through their interactions may influence potential PhD students, post-docs or young researchers in their selection of research career development opportunities. The Advisory Science Council (ASC) report on research careers highlights the importance of international mobility both for the development of the Irish research system and also for the development of the career of the individual researcher. As members of EMBL, Irish researchers have the opportunity to enrich their skill set at many stages of their career.

5.4 Implementation of Recommendations

Arising from this review of Irish membership of EMBL discussions have been undertaken between the Office of Science, Technology & Innovation at the Department of Enterprise, Trade and Employment and Science Foundation Ireland on how to implement some of the recommendations proposed. It has been agreed that efforts to progress the following, subject to available resources, will be made during the course of 2010.

Science Foundation Ireland as national contact point

Science Foundation Ireland (SFI) will act as the national agency contact point for Ireland regarding EMBL related activities. During 2010 SFI, using their existing channels of communications, primarily through the Research Offices of the Higher Education Institutes, will undertake a series of actions in order to increase awareness across Ireland's national research system of Irish membership of EMBL.

It is envisaged that this work, with the assistance of EMBL where required, will outline the potential that exists for Irish based researchers with regard to the world-class EMBL facilities, their various training programmes, the opportunities for developing new scientific methods and the increased networking opportunities with other leading researchers based in EMBL. It is envisaged that deepening the level of awareness of EMBL within the Irish research community will help to further underpin the quality of the Biotechnology sector in Ireland.

In 2010 such SFI awareness raising activities regarding EMBL will include, subject to available resources, the following:

- Amendment of SFI website to provide information specific to EMBL offerings and also provide a direct link to the EMBL website. The DETE website will also be updated to provide some information regarding Irish membership of EMBL;
- Designation of specific responsibility for EMBL awareness/related activities within SFI to a Scientific Programme Officer in the Life Sciences Directorate;
- With the assistance of EMBL, SFI will co-ordinate efforts to establish an Irish EMBL Alumni Association;
- SFI will look to co-ordinate at least one EMBL related event in Ireland during 2010 at which the benefits of Irish membership will be outlined. Such an event(s) could also involve, where appropriate, a SFI hosted workshop or webinar, or as an agenda item at the annual SFI Science Summit or at another suitable SFI event;
- SFI with the assistance as appropriate of DETE, will look to raise awareness at agency level of Irish membership of EMBL, particularly on the industry side. Such efforts should include IDA Ireland and Enterprise Ireland amongst others.

Increasing participation rates of Irish researchers of EMBL facilities

SFI, in conjunction with DETE during 2010, will put in place rigorous measurement of the benefits and metrics that EMBL membership has for Ireland. It is envisaged that this will involve monitoring the level of applications for, and subsequent participation rates, in EMBL courses and facilities usage. The metrics are likely to involve measurement of the number of PhDs (pre-doc), Post-docs, visiting scientists, Irish Course/Conference Participants and the use of EMBL facilities eg. EBI Database. In this regard it must be borne in mind that EMBL is the leading facility of its type in Europe and competition for PhD and Post-docs placements at EMBL are extremely competitive.

Annual EMBL Council Summer & Winter Meetings

The DETE and SFI commit to meeting in advance of each Summer and Winter EMBL Council meetings to discuss agenda items and the Irish position, where relevant. A significant portion of the typical EMBL agenda items are administrative [eg: financial contributions of Member states, pension entitlements for EMBL fellows etc] and would not require specific scientific expertise that would warrant discussion with the proposed Pre-EMBL Council Advisory Panel. However during 2010 the DETE, through the Office of Science, Technology & Innovation will, with SFI, and as appropriate, look for specific scientific guidance/expertise where required on EMBL Council agenda items.

Review of progress

At the end of 2010 the OSTI and SFI will review progress on EMBL related activities undertaken during the course of the year. It is envisaged that this will then be followed up by a further review of Irish membership of EMBL at the end of 2011.

Appendices

Appendix 1: Objectives of Evaluation as specified in Terms of Reference

The objectives of this project are to undertake a cost benefit review of Irish membership of EMBL with particular focus on:

- the impact on Irish molecular biology researchers in the higher education (HE), industry and public research sectors including:
  - their use of EMBL facilities;
  - their engagement in international research projects as a result of EMBL membership;
  - the amount, type and relevance of training of Irish researchers as a result of membership of EMBL; and
  - the level and type of interdisciplinary interaction for Irish researchers in areas including biology, physics, chemistry, mathematics and computer science.
- the impact on the graduate students and post-doctoral researchers including:
  - number and sources of funding of Irish graduate students at EMBL;
  - number of Irish students participating in EMBL PhD programmes; and
  - the number and duration of postdoctoral positions taken up by Irish researchers and their next destinations after EMBL (relative to other member countries)
  - the number of international researchers attracted to Ireland through EMBL.
- the impact on industry including:
  - access to research and underlying technologies at EMBL;
  - engagement in licensing, research collaboration and human capital networks providing access to leading edge technology;
  - access to EMBL's early stage investment fund for biotechnology start-ups;
  - employment of researchers who have worked in/are working with EMBL;
  - potential for skills development relevant to Irish industry;
  - collaborative activities with Irish researchers associated with EMBL and engagement in international research networks.
  - the alignment of EMBL research with industry needs.

- the impact of EMBL membership to date in terms of achieving the goals of the Strategy for Science, Technology and Innovation (2006-2013);
- the degree to which the facilities accessed and activities undertaken as a result of membership of EMBL complement and/or duplicate those which Irish researchers can access through other channels;
- the extent to which EMBL membership has helped in the raising of awareness of molecular biology in Ireland, promoted debate and contributed to the culture of science in Ireland;
- the availability and effectiveness of support structures in promoting EMBL to industry and academia;
- overall value for money of Irish membership of EMBL;
- The consultant should present recommendations and possible measures as to how Ireland can maximise its membership of, and investment in, EMBL.

Appendix 2: Steering Group Members

Department of Enterprise, Trade and Employment	Mr. Aidan Hodson Mr. Fergal Cullen
Science Foundation Ireland	Dr. Stephen Simpson
Irish Universities Association	Dr. Conor O'Carroll
IDA	Mr. Barry O'Dowd
Higher Education Authority	Dr. Eucharia Meehan
Forfás	Ms. Karen Hynes

Appendix 3: Acronyms

ASC	Advisory Science Council
CVI	Cost Variation Index
DETE	Department of Enterprise,Trade and Employment
DIT	Dublin Institute of Technology
EBI	The European BioInformatics Institute
EI	Enterprise Ireland
EMBC	The European Molecular Biology Conference
EMBL	The European Molecular Biology Lab
EMBO	The European Molecular Biology Organisation
FP5	European Commission's 5th Framework Programme
HEA	Higher Education Authority
HEI	Higher Education Institute
HRB	Health Research Board
IDA	Industrial Development Agency
IoT	Institute of Technology
IP	Intellectual Property
IRCSET	Irish Research Council for Science, Engineering and Technology
NUIG	National University of Ireland Galway
OST	The Office of Science and Technology
PI	Principal Investigator
R&D	Research and Development
S&T	Science and Technology
SFI	Science Foundation Ireland
TCD	Trinity College Dublin

TRAIL	TNF-related apoptosis-inducing ligand
UCC	University College Cork
UCD	University College Dublin