



European Life Sciences Forum

## **Life Sciences in the European Research Council**

Concrete proposals concerning grants, infrastructures and delivery mechanisms

Venice, 28 – 29 May 2003

Introductory and background document

In February 2003, the European Life Sciences Forum (ELSF) organized a meeting in Paris, in conjunction with the European Molecular Biology Organization (EMBO), the Federation of European Biochemical Societies (FEBS) and the UNESCO Division of Basic Sciences and Engineering, to discuss the creation of a European Research Council (ERC). Attended by some 250 scientists and other stakeholders, the meeting

- demonstrated the wide support from the life sciences community for an ERC
- highlighted how an ERC can contribute to the development and the cohesion of the European Research Area (ERA)
- identified domains where action is needed within the framework of an ERC, primarily through the provision of research grants and the support for infrastructures including centres of excellence

These and other elements of the discussion are summarised in the Meeting Report written by Frank Gannon, Executive Director of EMBO (annex 1; [http://www.embo.org/erc/archive/summary\\_paris\\_fg\\_final.pdf](http://www.embo.org/erc/archive/summary_paris_fg_final.pdf)).

In his concluding remarks at the Paris meeting, Julio Celis, President of ELSF and Secretary General of FEBS, highlighted the need for the scientific community, as well as the commitment of the organizers, to further contribute to the definition of the ERC, in order to maintain the momentum and ensure that an ERC, if it is established, can meet the expectations of grass root scientists. This is why ELSF and its allies, joined for the occasion by the European Molecular Biology Laboratory (EMBL), are organising a follow-up meeting on the ERC.

The meeting will be centred on three topics that came up repeatedly during the Paris meeting and which will be the subject of parallel workshops:

1. Research grants
2. Support for infrastructures, including the centres of excellence
3. ERC delivery mechanisms

The objective of the meeting is to come up with clear proposals on how to structure the ERC and organize its instruments so that it would reflect the expectations of the life sciences research community at large; hence, critical and pragmatic approaches will be sought during the meeting. In this respect, several elements should be borne in mind:

- The issues of the founding fathers and of the resources of the ERC, which will determine the structure and the content of the programmes, have yet to be resolved. Several organizations and individuals have contributed opinions on both topics and the make for interesting reading prior to the Venice meeting:
  - ESF Position Paper: New structures for the support of high quality research in Europe (annex 2; <http://www.esf.org/newsrelease/63/ERC.pdf>)
  - Van Dyck, L. (2003) Footing the bill. Where will the money come from for the European Research Council? *EMBO Reports (in press)*. (Annex 3)
  - Philipson, L. (2003) A European Research Council for basic research. *Nature medicine*, **9**, 1.

- Two non-mutually exclusive roles have been envisaged for the ERC: that of advisory board and of funding agency.
- An underlying principle of the ERC is that it should be complementary to the existing funding mechanisms, the EC framework programme and the programmes of the national research councils; it should not replicate or duplicate existing activities.
- The meeting is held within the specific limitation of an ERC for the life sciences. It is, however, expected that the ERC will cover all disciplines, including the humanities and the social sciences. Hence, on the one hand, it may be necessary to clearly define what falls under the term “life sciences” (*i.e.* is it restricted to molecular life sciences?). On the other hand, a trans-disciplinary approach may have to be considered in some case, for instance, for infrastructures that can be shared between disciplines (e.g. nano-biotechnology). Furthermore, the budget of the ERC will be divided between the various disciplines, an aspect that needs to be taken into consideration when contemplating the various figures that are proposed.
- In order to have a significant impact, the ERC should be ambitious, notably in terms of budget. However, irrespective of the source and amount of funding that will be available for the ERC, a pilot phase seems to be favoured by most to test the concept, probably with limited resources. During the discussion on the ERC instruments, it may be advisable to consider various scenarios with respect of the level of funding available, and how they could be scaled up.

The present document contains background information as well as a series of questions for each of the three workshops. This should by no means be seen as an attempt to restrict or direct the discussion, but rather as a way to ensure that issues are tackled systematically and with efficacy, and to help the participants of the meeting review their positions on the topics. Inevitably, there will be some degree of overlap between the sessions, which may also lead to different responses given the specificity of the instrument under consideration. The plenary session will offer participants the possibility of confronting these various approaches and discussing them further.

Our hosts at the UNESCO in Venice have a special brief to foster and support regional cooperation and capacity building in the natural sciences in the European Region, and it is therefore fitting that the Venice meeting will also dedicate a special session to the Eastern and Central European countries. The research systems in some of these countries are in a calamitous condition; however, a number of them will soon join the EU and are already an integral part of ERA, since they fully participate in the EC framework programme (FP). In Paris, most participants in the meeting dismissed the concept of “juste retour”; on the other hand, it seems clear that the chances of scientists in Eastern and Central European countries successfully competing for funding within an ERC would be fairly low. How can an ERC contribute to the development of research in these countries and, hence, to the cohesion of Europe? Should specific support or working mechanisms be implemented for them? Would an ERC contribute to, or could it help to prevent, an East-West brain drain in Europe? What will be the borders of the ERC? Would an ERC be restricted to the enlarged EU or would it also include countries that may be destined to join in the future, like the republics of the former Yugoslavia, Romania, Bulgaria and Turkey, or non-EU countries associated to the FP, such as Norway, Switzerland and Israel? The importance of this should not be overlooked since, if the money for an ERC is to come at least in part from the European Union, accession countries will be part of the decision-making process and association treaties will have to be negotiated for other countries. These are some of the questions that will be addressed in this session.

If the meeting delivers on its objectives, the final document arising from it may constitute a major contribution towards the establishment of an ERC. We, therefore, encourage all participants to read the following sections carefully, especially the one related to their workshop, in order to be prepared to actively contribute to the discussions.

We wish you all a very fruitful meeting in Venice,

**Luc van Dyck**

May 2003

## **Background Paper for Workshop 1**

### **RESEARCH GRANTS AND AWARDS**

The provision of research grants and awards is expected to be one of the core activities of the ERC. There is a general consensus that the programmes should be based on the following principles:

- Support for basic research of the highest level of excellence through open, competitive schemes
- Investigator-driven, bottom-up approach
- Contribution to the European Research Area and the cohesion of Europe and its competitiveness in a global context, notably through complementarities with EC and national programmes

Central to the definition of research grant and award programmes are the following items: (1) scope and characteristics of the programmes (including targeted audience and eligibility criteria), and (2) features of the grants and awards.

#### **1. Scope and characteristics of the programmes**

It is anticipated that the ERC would cover all aspects of the life sciences; however, some constraints ought to be set in place in order to establish manageable programmes, notably with respect to the selection and evaluation process (number of calls and applications). On the basis of the principles announced above, several options based on strategic requirements and/or the selection of priorities can be envisaged. Alternatively, (some) programmes could target a selected population of scientists. Based on this, questions that need to be addressed include:

- (a) Who can apply for ERC funding: groups, individuals or groups of individuals? Other than the quality of the application, what – if any – could be the eligibility criteria used to ascertain the excellence of the applicants? Should there be a focus on young investigators or an age limit? Would the money be formally attached to the host institution or laboratory of the awardees, or would it be transferable with the individual recipient?

- (b) Should (some) ERC programmes be formally based on collaborative and networking approaches with, for instance, trans-national or multi-disciplinary requirements, or should applicants freely decide upon these aspects according to their needs? Can collaboration be established *a posteriori*, with or without additional funding?
- (c) Should ERC programmes cover broad fields or should there be priorities (for instance, new and emerging fields)? In the later case, according to which criteria and by whom can these priorities be defined? Also related to this, should calls for expression of interest – which can equally be seen as a democratic, bottom-up approach or as potentially subject to political interference – be implemented?
- (d) How should programmes be decided upon and reviewed, and by whom? Which criteria should be used for evaluation?
- (e) Should additional, complementary activities be organized or encouraged within the framework of the ERC, for instance, networking through an annual meeting of the awardees? Such an event could raise the profile of the recipients and of the ERC itself; however, it might also divert money and increase the workload of the ERC administration, while also competing with existing events.

## **2. Features of the grants and awards**

ERC grants and awards should aim to provide research freedom and budgetary flexibility over a period of time that is sufficient to deliver on the objectives of the programme. On the other hand, it should not become a form of 'institutional' funding. Moreover, the level and the time period of funding per award will inevitably impact on the number of awards that can be allocated. Based on this, questions that need to be addressed include:

- (a) What is the most appropriate duration of a grant/award? Should it be relatively short, for instance, three years, with the possibility of extension through a reviewing process or re-application, or longer (e.g. five years)?

- (b) What is the appropriate level of funding per award and per year?
- (c) Could the money allocated be used in total freedom or should there be restrictions? If restrictions are imposed, for instance on fixed expenditures, what are the eligible costs: consumables, meeting attendance, publication costs, equipment, personnel costs, etc? Should awards be specifically complemented by student fellowships or are the available schemes sufficient (national, EC, EMBO, HFSP, FEBS and others)?
- (d) How should the awards be reviewed and according to which criteria should they be evaluated *a posteriori*, both from a financial and scientific point of view?

This list of questions is not exhaustive and participants are strongly encouraged to raise additional points to encourage the debate.

**Julio E. Celis (FEBS) and Luc van Dyck (ELSF)**

May 2003

## **Background Paper for Workshop 2**

### **INFRASTRUCTURES AND ERC**

The February 2003 meeting on the proposed European Research Council (ERC), which was organised by the European Life Sciences Forum (ELSF) in Paris, concluded that Research Awards (Grants) and Research Infrastructures were appropriate objectives, while (at least from the perspective of the Life Sciences) fellowships were thought to be well-covered by existing mechanisms. The term Infrastructure was used in four different meanings at that meeting, as reflected in subheadings in the present paper.

#### **1. Large and expensive equipment-based facilities.**

The Life Sciences research community has been less dependent on this type of infrastructure than, say, the astronomy, particle physics and fusion research communities. It is the expensive nature of such large equipment-based facilities (e.g. the proposed spallation source) that has made the member states of the European Union reticent about supporting “Research Infrastructures” through the EU Framework Programmes.

However, the changing nature of research in the Life Sciences is creating new or expanded requirements for such facilities in Europe. Examples are:

- ***Synchrotron Radiation Sources***

Synchrotron Radiation Sources such as these at DESY and ESRF have been utilised by structural biologists for nearly three decades, with assistance by EMBL. This use has expanded tremendously in recent years, to the point that utilisation of home-based X-ray sources has become rather negligible. While new third generation SR sources are being constructed at the national level (Diamond, Soleil...), overall the community depends on extensive access to internationally operated beamlines in Grenoble (ESRF/EMBL) and Hamburg (DESY/EMBL). Conversion of DESY’s PETRA ring into a third-generation SR source will be very valuable for the biological research community.

- ***Other Structural Biology Facilities***

State-of-the-art NMR instruments are approaching the cost level where it may become necessary to fund a centre or centres for the European NMR community, rather than subsidising international access to national NMR facilities (which is the current model). To a limited extent, Structural biologists are also using neutron sources (currently ILL), and are participating in planning for the Free Electron Laser (FEL) facility, which may open up unprecedented opportunities for solving single-particle biological structures.

- ***Other Biological Imaging Facilities***

New generations of imaging facilities are becoming important for addressing biological structure and function, from the subcellular to the whole organism level. While individual state-of-the-art microscopes are affordable by individual institutions, integrated “imaging centres” are considerably more demanding. Electron Tomography is a highly promising new approach for bridging the molecular and cellular levels of organisation, and may require development of a facility for international use, and for generating complete atlases of cell organisation. Similarly, advanced and expensive imaging techniques are important for whole-animal imaging and the neurosciences (e.g. fMRI).

## **2. Databases**

One participant at the Paris meeting stated that the need for the ERC was highlighted by the shortcomings in European funding for biological databases (i.e. for the EBI). Whether or not one shares this view, it is clear that well organised and integrated biomolecular databases are now an essential requirement for the Life Sciences and their applications (in medicine, the drug industry etc.). The core molecular sequence and structure databases are clear examples of infrastructures that only make sense when planned and executed at an international scale, indeed they are coordinated on a world scale. In addition, new types of databases (genome expression, images, phenotypes...) are becoming essential and require common standards, interoperability and strategic decisions about priorities. Finally, robust links between such databases and complementary sources of information

(literature, medical data...) will require strategic planning and developments. Needless to say, databases represent long-term investments that require stable funding models, subject to ongoing assessment of performance and/or satisfaction.

### **3. Centres of Excellence**

In principle, large instrumentation and information infrastructures are separable from centres of research excellence. In reality, infrastructures are well served by being embedded in excellent research environments, which challenge and stimulate their future-oriented developments. The recognised value for Europe of international competitive centres of mixed nature, such as CERN and EMBL, led to suggestions by several participants at the Paris meeting that Europe needs centres in Life Science fields such as the Plant Sciences, Immunology and the Neurosciences (where the requirement for imaging technologies favours a European solution).

A possibility would be to build new research institutes around European stock centres and archives (e.g. serving Plant Biology, Mouse Biology, Insect Biology, Viral/ Bacterial/Fungal Biology or Bio-terrorism defence). Strategic decisions that would be required in this direction would relate to the ease (or otherwise) for obtaining funds for international institutions, the relative value-for-money of dispersed vs. central facilities, and the possibility that federated rather than stand-alone centres may be more cost-effective and better able to provide quality assurance.

### **4. Programme-based Infrastructures**

The example of this type of Infrastructure that was discussed at the Paris meeting was the development of first the Sanger Centre and now ENSEMBL around the human genome project (HGP). It is striking how little public investment the HGP received in Europe. Given Celera's business plan, this could have had serious consequences for biomedical research, if the Wellcome Trust had not been persuaded to become a major player. As for databases, Europe needs to develop flexible mechanisms to respond strategically to new opportunities for large-scale scientific projects, whose costs exceed the capacity of any single national governmental organisation. The mechanisms evolved by the relevant NIH institute for funding and helping

steer the national genome centres in the US are worthy of attention, as are the mechanisms utilised for Genoscope in France.

## 5. **Role(s) for an ERC**

Based on the discussions on the above items, the Venice meeting should consider what an ERC should do in respect to Infrastructures and Centres of Excellence. Some possibilities include:

- **Strategic choices and planning for European research infrastructures.** A significant level of flexibility in responding to challenging opportunities (as exemplified by the HGP) should be ensured. Prioritisation mechanisms will be required. Decisions concerning national, international, dispersed, central, federated solutions will need to be made. If the ERC is to include high-level strategic planning bodies for infrastructures, to whom would these bodies report? Can it evolve flexible mechanisms that utilise available expertise and tailor the solutions to the specifics of each case?
- **Should the ERC fund infrastructures?** Infrastructures need stable (but not automatic) funding mechanisms. This requires a different evaluation procedure than does funding investigator-driven research (whether by individual laboratories or networks). The most-cited example of what people imagine the ERC to become, the National Science Foundation (NSF) in the US funds both types of activity. It is worth considering whether and how ongoing evaluation and funding of infrastructures can be carried out by the same organisation as that entrusted with their strategic planning, without compromising these distinct functions. Whether infrastructures in different sciences (biological, physical, social, human) can be dealt with by the same organisation (or branch of an organisation) will also need to be considered.

**Iain W. Mattaj and Fotis C. Kafatos (EMBL)**

April 2003

## **Background Paper for Workshop 3**

### **ERC DELIVERY MECHANISMS**

One frequently remarked upon characteristic of any future European Research Council (ERC) is that it should have a light and user-friendly administration and management structure. The point of comparison that is used is the Framework Programme. The rigorous definition of the research that should be performed in a Framework Programme project places tremendous emphasis on deliverables and measurables that have been anticipated at the time of the preparation of the proposal. The scientific dynamic frequently leads research to related directions that are more rewarding by all criteria. Framework Programmes are delivered within a legal construction that presumably mandates the procedures followed in that context. The message from the discussions on the European Research Council to date has been that this is a model that will be inappropriate for investigator-initiated research that will characterise the ERC. The challenge is to put in place procedures which respond to this overarching requirement while maintaining the rigour and correctness of procedure which is necessary for all expenditure of public funds and in particular the expenditure of significant amounts of taxpayers' money.

The second characteristic of the ERC, that has been widely accepted, is that all decisions will be made on a scientific basis and that there will be no subsequent influence of such decisions by non-scientific factors related to the concept of "juste retour". The process has to be genuinely competitive as this is viewed as a prerequisite and a driving force towards higher quality within the European scientific community.

Taking these elements into account the general questions that have to be addressed in this session on the delivery of the ERC are:

- How should the peer review process be organized?
- How should the call for proposals be organized?
- How should the decisions be translated into transfers of funds?
- How should the reporting processes to the applicants and from the awardees to the ERC be structured?
- What ongoing monitoring will be necessary?
- How should the ERC be funded?

## **1. The Selection Process by Peer Review**

Peer Review, as the name implies, must engage scientists of stature equivalent to those who are applying for funds. The decisions made by the selection panels must be beyond questioning by the applicants because of their quality. If quality is not the sole criterion for the selection of members of the reviewing panels, then the assertion that quality is the sole criteria for the selection of the awardees for different elements of the ERC's actions will be questioned. The task of identifying the panel members therefore is one that requires delicacy and skill.

One could anticipate that there may occasionally be a very large number of applications and in such circumstances a procedure would have to be put in place for the screening of initial expressions of interest. This process should also be carried out by scientists who are experts and active in the area of research who would screen the pre-submissions in a manner that would allow a safe transfer to the final selection process.

Questions related to the selection process include the following:

1. How should the panels of experts for peer review be established?
2. Should the panels be open to scientists from any part of the world?
3. Is there a merit in considering learned society journal referee databases as a basis for the peer review panels?
4. Is confidentiality in the transferral of documents to the panels a matter of concern?
5. What procedures are appropriate to deal with the balance between being open to all scientific proposals and being faced with an unmanageable number of proposals?
6. How is the challenge of interdisciplinary proposals best handled at the selection stage?

## **2. Call for proposals**

It is obvious that the call(s) for proposals will have to be widely disseminated by the standard mechanisms. It is also clear that the ERC should have a very professional website such that communications can be facilitated and transparency maintained. The process of submission, refereeing, etc. should be totally electronic and the infrastructure should be in place to allow that to happen from start of the ERC.

Questions that derive from these considerations include the following:

1. Should the aim be to have short applications, complete and well-documented applications, or two-step proposals (depending on the type of action)?
2. Should there be a single or multiple calls for proposals annually?
3. Should topics be selected for specific calls for proposals to provide a basis for restricting the number of applicants and directing research to new areas?
4. Should special procedures be put in place to allow for calls restricted either by age, gender or geography?
5. Should projects that are funded by other sources (e.g. national) be available for further funding within the ERC?

### **3. Financial Aspects**

The hallmark of the ERC should be a rapid transfer of funding once a decision is made. Authority should be given to the appropriate officers such that once a scientific debate has taken place on who should be given funding; the money is available for transfer and rapidly made available to the awardees. As the selection process is decisive in fixing the subsequent actions (given that in the absence of “juste retour “ no further manipulation of the outcome is appropriate), the time for action following decisions should be minimal.

Questions that derive from these considerations include the following:

1. What degree of control should be in place on the funds that are given to successful applicants e.g. should they provide a complete detailed budget prior to the funding being transferred? Should payments be in instalments?
2. What degree of monitoring should be required from the successful applicants in how they spend the money?
3. Should there be limitations on e.g. payment of salaries to principle investigators?
4. What responsibilities should the ERC have towards the principle investigators and their teams following the end of a contract?
5. What mechanisms should be in place to permit termination of a contract if there is a failure by the recipient to perform at the promised level?
6. What auditing and reporting mechanisms should the ERC have in place?

#### **4. Reporting processes to the applicants**

It would be highly desirable that all applicants receive feedback following the selection process to highlight potential improvements that could be made in the project that is presented. This is a component of increasing the quality of science in Europe in the long-term and of ensuring that there is transparency in the selection process. At all times, the names of the panels should be available but none of the comments on specific projects should be attributed to any of the panel members.

Questions that derive from these considerations include the following:

1. Will it be practically possible to provide a useful report to all unsuccessful applicants?
2. Will a process of "ticking boxes" to indicate the general weaknesses in the proposal be adequate?
3. Will copies of reports from the reviewing process be made available to the candidates?
4. Will the task of providing the feedback be one that is carried out by the ERC administration or by the selection panels?
5. Will there be an opportunity in the selection process for feedback from the candidates, e.g. to correct or clarify the opinions of the panel members?
6. Should there be an interview in the selection process?
7. If there is an interview in the process, how is this best organized in order to provide useful feedback to the applicants?

#### **5. Monitoring**

Generally, the concept of deliverables will be inappropriate for the ERC. This does not remove a responsibility from the recipient to perform research in a manner that is in keeping with the basis for which the funding is provided. Questions that derive from considerations of the needs for monitoring include the following:

1. If, for example, a grant is given for a three-year period, how frequently should the grantee report on progress?
2. What monitoring of these reports should be in place e.g. should it be carried out by the administration of the ERC or by a combination of the administration and the selection panels?

3. Who should make a judgement on the performance (or otherwise) of the funded projects and by which criteria?
4. Should these reports be published annually?
5. What credit should be given to the ERC for the funding it provides?
6. Should the report be brief (1page) or complete?
7. Should there be the possibility of site visits during the granting period.

## **6. Criteria for success**

The ERC will require a significant level of funding. It follows that it should have in place some elements to measure its success or otherwise.

Questions in this section include the following:

1. Should a goal be established for the number of publications which should come from ERC funded research?
2. Should a goal be established for the number of publications funded by the ERC that are present in high impact journals?
3. Should citation of individual articles be used as a more systematic metric?
4. Should all of these above criterion and others be monitored independent of the ERC's direct engagement? (e.g. to follow changes in Europe in general)
5. Should patents be a metric for the success of the ERC?
6. Should the ERC have formal links with bodies focussed on translational (technology transfer) activities?
7. Should the involvement of those funded by ERC in start-up companies be monitored and encouraged?
8. Should the number of scientists from outside Europe who wish to move to European laboratories be a metric for success of the ERC?
9. Should the decision by industry to locate research activities in Europe be a criterion for success of the ERC?
10. Should the success of the ERC be measured in terms of new PhD students, postdoctoral fellows and students entering science?

## 7. Other activities

Those who receive support in an ERC will be particularly high quality scientists. In addition to performing research, are there other expectations from this group and of the ERC?

1. Should the ERC and its recipients of funding be engaged in outreach activities to improve the image of research in Europe?
2. Should there be an annual meeting of the ERC funded scientists?
3. How much efforts should the ERC make in publicising its successes?
4. Where is the right balance between the ERC as a funding agency and as an advisory group?
5. If the ERC is only an advisory group, is it of interest to establish it?
6. How should the ERC activities integrate with those of other established groups e.g. organisations such as FEBS or ELSO that have annual scientific meetings which may be similar to an ERC meeting?
7. How should an ERC, or the life sciences section, integrate its activities with associated studies from the humanities and social sciences?
8. Should the ERC establish any other activities directed towards the ethical questions that arise from the research that it funds?

## 8. Structural elements

The most general vision of the ERC is an entity that covers all areas of research (including the humanities and social sciences) with a very significant budget. It is time to give thought to the processes under which such a body could be established and function in due course.

Questions for consideration include the following:

1. Should the ERC be a totally new entity? If so, how should it come into existence?
2. Should the ERC have an overall coordinating body composed of existing organizations such as the ESF, the EU, and in the life sciences, the EMBC/EMBO, FEBS, ELSO etc?

3. Should a pilot scheme in the area of life sciences be encouraged as a first step towards establishing an ERC or would that be an impediment on achieving the goal of an ERC for all subject areas?
4. Can the ESF be the context in which an ERC is delivered or should it be an important but not sole component of the structures that come to form an ERC?
5. Who should decide who the founders should be?
6. Who should decide on the level of funding which is appropriate for an ERC?
7. Who should decide on the officers of the ERC?
8. What should the role of the EU be in the formation of an ERC? Is this a task for the Commission, the Council of Ministers or the European Parliament?
9. What is the role for other existing organisations?
10. To what extent is the responsibility of establishing the ERC one which rests with the scientific community rather than with any of the organizations above and, if there is a major responsibility, how can this be best vocalised and organised?
11. Should there be a single ERC, a single ERC with different divisions reflecting different areas of science (including humanities and social sciences), or a series of independent but interacting discipline driven research councils?
12. Presuming that there is a single pool of money for the ERC, who should have the responsibility to decide how this is divided between different discipline areas?

## **Conclusion**

In the session many different aspects will be discussed. These will range from the philosophy that should underlie the selection process through to the structuring of the ERC itself. The discussion has reached a point where it is essential to address all of these topics and give a view from the scientific community such that the ERC is rapidly accepted by the scientific community as being a significant step forward and leads as a consequence to benefits to society as to judged by all criteria.

**Frank Gannon (EMBO)**

May 2003