

# ***The IDEAS Work Programme***

## ***EUROPEAN RESEARCH COUNCIL WORK PROGRAMME 2008***

**ERC Work Programme agreed by the ERC Scientific Council and  
transmitted to the Commission  
15 October 2007**

**Version 15-10-07**

**This Work programme will be implemented by the Dedicated  
Implementation Structure of the ERC which the Commission intends to  
establish in the legal form of an Executive Agency.**

***(European Commission C(2007) XXXXX)***

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# 1. Introduction

The European Research Council (ERC) has a unique position in European research funding to support the best science and scholarship. It is operating at the highest level of ambition to generate the maximum benefit to European research from the activities it pursues. The ERC will not be hostage to the conventional wisdom; instead, it will take the best practice wherever it can be found.

The fundamental principle for all ERC activities is that of stimulating investigator-initiated frontier research across all fields of research, on the basis of excellence. Awards will be made and grants operated according to simple procedures that maintain the focus on excellence, encourage initiative and combine flexibility with accountability.

By using competition on the basis of excellence at the European level, the ERC aims to add value to other funding schemes, such as those of Research Funding Agencies operating at the national level. The ERC also complements other research activities under the 7<sup>th</sup> framework programme managed by the European Commission, including the Marie Curie schemes, strategic basic research in support of thematic priorities, and support for European infrastructures.

The ERC aims to create leverage towards structural improvements in the research system of Europe. For example, since many investigators who will be involved in the funded activities are likely to be working within universities, academies, research centres and similar establishments, the ERC can have a strong incentive effect on these institutions by:

- Offering greater independence to early stage (starting) investigators as an investment in the next generation and towards enhancement and sustainability of the institutions' research capacity.
- Setting quality benchmarks, allowing institutions better to judge their research performance.
- Revealing in a bottom up manner the availability of top talent in various fields and emerging areas, and thus assisting the institutions' strategic thinking and priority setting.
- Promoting interaction of European research institutions with similar institutions around the world on the basis of the participation of individual researchers from these institutions in ERC activities.

The Scientific Council of the ERC establishes the ERC's strategy. It has full authority over decisions on the type of research to be funded and acts as guarantor of the quality of the activity from the scientific perspective. Its tasks cover, in particular, the development of the annual work programme, the establishment of the peer review structure and process, as well as the monitoring and quality control of the programme's implementation from the scientific perspective including the development of the ERC's strategy regarding international cooperation.

## 2. ERC Grants

Two types of ERC grant are available at present. These two funding streams, operating on a “bottom-up” basis, across all research fields, without predetermined priorities, are expected to be the core of the ERC’s operations for the duration of the 7<sup>th</sup> Framework Programme.

- The ERC Starting Independent Researcher Grants (ERC Starting Grants). The objective is to provide adequate support to the independent careers of excellent researchers, whatever their nationality, located in or moving to the Member States and associated countries, who are at the stage of starting or consolidating their own independent research team or, depending on the field, establishing their independent research programme.
- The ERC Advanced Investigator Grants (ERC Advanced Grants). The objective is to encourage and support excellent, innovative investigator-initiated research projects by leading advanced investigators across the Member States and associated countries. This funding stream will complement the Starting Grant scheme by targeting the population of researchers who have already established themselves as being independent research leaders in their own right.

The Grants will support projects carried out by individual teams which are headed by a single **principal investigator (P.I.)** of any nationality and, if necessary, include additional **team-members**. These teams could be of national or trans-national character. With the focus on the Principal Investigator, the concept of individual team is fundamentally different from that of a traditional “network” or “research consortium”; **proposals of the latter type will not be acceptable.**

To encourage interdisciplinarity, as an exception, when an interdisciplinary proposal is grounded in the necessary combination of knowledge and skills from more than one discipline ("co-investigator project"), a Principal Investigator (PI) may identify members of his/her individual team, who are active in these disciplines, as co-Investigators. The contribution of Principal Investigators and co-investigators must be carried out in the EU or associated countries. In order to appropriately cover the disciplines, the evaluation panel (see below) may, if necessary, invite one or more members of a complementary panel to contribute to the evaluation of the proposal. The evaluation panel will carefully assess the scientific added value of any co-investigator to the project; in particular the participation of any additional legal entity will only be permitted if it is clearly necessary from the scientific perspective.

Each Grant will be awarded to the institution (Applicant Legal Entity) that will be engaging and hosting the Principal Investigator, with the attached **commitment that this institution will offer him/her appropriate conditions independently to direct the research and manage its funding for the duration of the project.** These conditions, including provisions related to the "*portability*" of the project, will be the subject of an agreement between the principal investigator and the host institution (supplementary to the ERC Grant Agreement) and they are described in the ERC Model Grant Agreement (C (2007)1625, 16/04/2007).

It is a condition for all ERC funding that the host institution commits to the following conditions of independence for the P.I.:

- apply for funding independently
- manage the research and the funding for the project and make appropriate resource allocation decisions
- publish independently as senior author and invite as co-authors only those who have contributed substantially to the reported work
- supervise team members, including research students or others
- have access to reasonable space and facilities for conducting the research

Any type of legal entity, including universities, research centres and undertakings can host the Principal Investigator and his/her team as long as the principles indicated above are respected and the Principal Investigator and his/her activity are not constrained by the research strategy of the enterprise.

As experience and the portfolio of funded projects builds up, the Scientific Council will be in a position to evaluate the programme achievements, adjust mechanisms and procedures as needed, and elaborate its scientific strategy as this is seen to be appropriate.

This update of the Work Programme introduces the ERC Advanced Investigator Grant scheme (*ERC Advanced Grant*). The ERC Scientific Council has incorporated some new elements in the evaluation process. These are based on the experience gained from the first ERC Starting Grant Call and aim to assure high quality evaluation even in case of heavy oversubscription to the Call.

## 3. ERC Advanced Investigator Grants

### **3.1 Background**

ERC Advanced Grants provide an opportunity to established scientists and scholars to pursue frontier research of their choice. Being highly competitive and awarded on the sole criterion of excellence without restriction to particular areas of research, these grants will support the very best of European research, adding value to research investments at the national level.

Advanced Grants are intended to promote substantial advances in the frontiers of knowledge, and to encourage new productive lines of enquiry and new methods and techniques, including unconventional approaches and investigations at the interface between established disciplines.

The peer review evaluation of proposals will therefore give emphasis to these aspects, in full understanding that such research has a high-gain/high-risk profile, i.e. if successful the payoffs will be very significant, but there is a higher-than-normal risk that the research project does not entirely fulfil its aims.

### **3.2 Objectives of the scheme**

The aim is to fund individual teams<sup>1</sup> led by established, innovative and active Principal Investigators, regardless of nationality, age or current location. They will include, for example, leading contributors to research advances in Europe, leading scientists of the European "Diaspora" or non-EU nationals who wish to establish themselves in Europe and pursue ground-breaking, high-risk research that opens new directions in their respective research fields or other domains.

Applicants must have a track record of research achievements and recognised as such. Assessment of their scientific leadership profile and track record, therefore, will be a significant component of the evaluation. Research proposals of a multi- and inter-disciplinary nature are strongly encouraged.

The ERC Advanced Researcher Grant (ERC Advanced Grant) scheme intends to support research projects to be performed in any Member State or associated country to the Framework Programme.

During the period of the 7<sup>th</sup> Framework Programme, this scheme is expected to become the largest funding activity of the ERC.

### **3.3 Size of ERC Advanced Grants**

Depending on the subject, the level of these grants may be up to EUR 3 500 000 for a period of 5 years<sup>2</sup> (pro rata for projects of shorter duration). Normally, however, grants will be limited to a maximum of EUR 2 500 000 unless the application involves specific features requiring a higher level of support: "co-investigator project" (see section 2); a proposal which requires the purchase of major research equipment, or the Principal Investigator is coming from a third country to establish a research team and activity at a host institution in a member state or associated country. In all cases, the evaluation panels will review the requested grant and, as appropriate, suggest adjustments using rounded figures.

The Community financial contribution shall be in the form of a grant to the budget corresponding to 100% of the total eligible and approved direct costs and a contribution of 20% of the total eligible direct costs (excluding sub-contracting) towards indirect costs.

The level of the grant offered will be determined by the peer review evaluation, on the basis of the needs of the project, judged by the panel (see Annex 4 for panel structure and descriptions) against the requested grant to the budget<sup>3</sup>.

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<sup>1</sup> It is recognised that in certain fields (e.g. in the humanities and mathematics), research is often performed individually, aside from guiding research students. The term "team" is used in the broadest sense, including cases where a single individual works independently or conversely in cases when several investigators are working so closely together as to constitute a single team.

<sup>2</sup> The level of the grant represents a maximum overall figure – payments must be justified on the basis of the amounts actually disbursed for the project.

<sup>3</sup> The requested grant should reflect the Principal Investigator's estimation of the real project cost, taking account of the nature of the project and team and whether it is intended to set up a new team or add support to an established team. Evaluation panels will review the requested grant and, as appropriate, suggest adjustments using rounded figures (increments of EUR 10 000).

### **3.4 Profile of the ERC Advanced Grant Applicant**

Applicants for the prestigious ERC Advanced Grant are expected to be active researchers and to have a track-record of significant research achievements in the last 10 years which must be presented in the application. There is little prospect of an application succeeding in the absence of such a record, which identifies investigators as exceptional leaders in terms of originality and significance of their research contributions.

Thus, in most fields, Principal Investigators of Advanced Grant proposals will be expected to demonstrate a record of achievements appropriate to the field and at least matching one or more of the following benchmarks:

- Normally 10 publications as senior author (or in those fields where alphabetic order of authorship is the norm, joint author) in major international peer-reviewed multidisciplinary scientific journals, and/or in the leading international peer-reviewed journals of their respective field.
- Normally 3 major research monographs, of which at least one is translated into another language. This benchmark is relevant to research fields where publication of monographs is the norm (e.g. humanities and social sciences).

Other alternative benchmarks that may be considered (individually or in combination) as indicative of an exceptional record and recognition in the last 10 years:

- Normally 5 granted patents
- Normally 10 invited presentations in well-established internationally organised conferences and advanced schools
- Normally 3 research expeditions led by the applicant
- Normally 3 well-established international conferences or congresses where the applicant was involved in their organisation as a member of the steering and/or organising committee
- International recognition through scientific prizes/awards or membership in well-regarded Academies

### **3.5 Submission procedure and peer review evaluation**

#### **3.5.1 Proposal Submission**

Proposals are submitted by the Principal Investigator (PI), who has scientific responsibility for the project, on behalf of the host institution which is the "applicant legal entity"<sup>4</sup>.

The proposal contains the following separate elements:

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<sup>4</sup> Exceptionally, the Principal Investigator may himself/herself act as the "applicant legal entity", if he/she is acting in the capacity of the legal entity in his/her own right.

## **Section 1**

**Scientific leadership profile:** A description of the applicant's scientific leadership profile should include:

- a "*self-evaluation*" of research career achievements demonstrating the applicant's capacity to go significantly beyond the state of the art;
- a presentation of the content and impact of the major scientific or scholarly contributions of the applicant to his or her own research field and/or neighbouring research fields and, if applicable, their wider societal impact;
- the international recognition and diffusion that these major contributions have received from others (publications, citations or appropriate equivalents/additional funding/ students/international prizes and awards/ institution-building/other);
- evidence of efforts and ability to inspire younger researchers towards high quality research (highlights of research mentoring record, information on the careers of supervised graduate and post-doctoral students, etc.);
- where applicable: proven ability to productively change research fields and/or to establish new interdisciplinary approaches;

**Curriculum Vitae:** In addition to the standard academic and research record, the CV should include a succinct "funding ID" which must specify any current research grants and their subject, and any ongoing application for work related to the proposal.

**10-year track-record:** The applicant should list his/her activity over the past 10 years (dated from the deadline of the call) as regards:

1. The **top 10 publications, as senior author** (or in those fields where alphabetic order of authorship is the norm, joint author) in **major international peer-reviewed multi-disciplinary scientific journals** and/or in the **leading international peer-reviewed journals** of their respective research fields, also indicating the number of citations (excluding auto-citations) they have attracted.
2. **Research monographs and any translations thereof** (if applicable).
3. **Granted patents** (if applicable).
4. **Invited presentations to peer-reviewed, internationally established conferences and/or international advanced schools** (if applicable)
5. **Research expeditions** that the applicant has led (if applicable).
6. Organisation of **International conferences** in the field of the applicant (membership in the steering and/or organising committee) (if applicable)
7. **International Prizes/Awards/Academy memberships** (if applicable)



The applicant will be asked to introduce a summary of the data above as well as a short summary of his/her scientific leadership profile using an electronic template that will be provided.

**Co-investigator(s):** In exceptional cases (“co-investigator projects”) the scientific leadership profile, the CV and the 10-year track-record should also be produced for each designated co-investigator.

**Extended Synopsis:** concise presentation of the scientific proposal, with particular attention to the ground-breaking nature of the research.

### **Section 2:**

**Scientific Proposal:** description of scientific and technical aspects of the project, demonstrating the ground-breaking nature of the research, its potential impact and research methodology.

### **Section 3:**

**Research Environment:** description of the research environment and its contribution to the research project/activity.

The host institution must confirm its association with and its support to the project and the Principal Investigator; the institution must provide a binding statement that the conditions of independence are already fulfilled or will be provided to the Principal Investigator if the application is successful<sup>5</sup>, using the template that will be provided. Proposals that do not include this statement will not be considered for evaluation.

In fairness to all applicants, strict limits will be applied to the length of proposals which must respect the indicated page limitations:

#### **Section 1**<sup>6</sup>

*Scientific leadership profile: 2 pages*

*Curriculum Vitae: 2 pages*

*10-year track-record: 2 pages*

*Extended Synopsis: 5 pages*

#### **Section 2**

*Scientific Proposal: 15 pages*

#### **Section 3**

*Research Environment: 2 pages*

Only the material that is presented within these limits will be evaluated.

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<sup>5</sup> ERC Model Grant Agreement (C (2007)1625, 16/04/2007).

<sup>6</sup> In the case of the “co-investigator projects”, the scientific leadership profile, the CV and the 10-year track-record should also be produced for each designated co-investigator, focusing on research achievements and publications. The maximum is set to 6 pages per co-investigator.

Proposal submissions will be done electronically via the Electronic Proposal Submission System (EPSS). Pre-registration of the proposals is strongly recommended and should be done as early as possible in advance of the call deadline.

### 3.5.2 Peer review evaluation

A **single submission of the full proposal** will be followed by a **two-step evaluation**. The evaluation will be conducted by means of a structure of high level peer review panels as listed in Annex 3<sup>7</sup>. The Panels may be assisted by referees.

The applicant must submit the proposal to a primary evaluation panel before the submission deadline of this panel. The proposal will be allocated to this panel. In case that the applicant has indicated a secondary evaluation panel, the primary panel will determine whether the proposal is indeed cross-panel or cross-domain interdisciplinary and may request additional reviews by appropriate members of other panel(s) or additional referees who act as reserve evaluators. If the primary panel decides that the proposal is well within the panel's scope then it will only be evaluated by this panel.

#### Call budget:

The ERC Scientific Council has established the following indicative percentage budgets<sup>8</sup> for each of the 3 main research domains:

***Physical Sciences & Engineering: 39%***

***Life Sciences: 34%***

***Social Sciences & Humanities: 14%***

and an ***Interdisciplinary***<sup>9</sup> domain with an indicative budget of **13%**.

#### Step 1:

Following the submission of the proposal, **Section 1** will be assessed and marked.

If necessary, and in order to assure the quality of the evaluation in the case of heavy over-subscription to the call, the evaluation panels may identify the less competitive applications which do not reach the minimum quality threshold(s) by assessing the proposals on the basis of the Principal Investigator's **10-year track-record** (requested summary), the summary of the **Scientific Leadership Profile** and the project's **Extended Synopsis**. With the agreement of the individual reviewers to whom the proposals have been allocated, these proposals will not be further evaluated and will be rejected, allowing the panel focus on thorough evaluation of the retained proposals.

At the end of this evaluation of step 1, the panel will rank the proposals according to their marks.

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<sup>7</sup> Panel members will be compensated on the evaluation tasks they perform. Additional reimbursement of travel and subsistence will be made for assignments involving travel. Referees who may assist the evaluation panels will not be compensated.

<sup>8</sup> In the case of the ERC, indicative budgets may permit a variation of the budget for each domain by a maximum of 20% of the total budget for the call; however for this call the budget proportions allocated to projects in the three main research domains will be no lower than the percentages indicated

<sup>9</sup> Including cross-panel and/or cross-domain research projects and research with the potential to open new fields

In addition, an indicative budget will be allocated to each panel, in proportion to the budgetary demand of its assigned proposals. This indicative budget is calculated as the cumulative grant request of all proposals to the panel divided by the cumulative grant request of all proposals to the domain of the call, multiplied by the total indicative budget of the domain.

Each panel will determine its budgetary cut-off level as a multiple of its indicative budget. The budgetary cut-off level should be at least 3 times the panel's indicative budget.

Proposals with a mark passing the quality thresholds and which lie above the budgetary cut-off level will be retained and pass to step 2 of evaluation (all proposals with identical marks at the cut off level will pass through to the second step of evaluation).

Those proposals failing to reach the quality threshold on any of the evaluation criteria or ranked below the budgetary cut-off described above will be rejected.

### **Step 2:**

The complete version of the retained proposals will be assessed and ranked by the panels during step 2 of the evaluation. Interdisciplinary proposals within a domain or across domains will be flagged as such, and the panel may request additional reviews by appropriate members of other panel(s) or additional referees who act as reserve evaluators.

Following the conclusion of the panel evaluations the following additional steps will be taken with the participation of the peer review evaluation panel chairs:

**Step 2a:** Acting in concert, the peer review evaluation panel chairs of each research domain or their deputies, representing their panels, will prepare a consolidated ranked list for the domain's proposals which are above the quality threshold and can be funded in order of priority from the respective domain budgets<sup>10</sup>.

**Step 2b:** Acting in concert across the 3 main research domains, taking account of the forward looking and innovative nature of the programme, all the peer review evaluation panel chairs or their deputies will bring forth and specifically discuss, from an interdisciplinary perspective, the scientific added value of proposals above the quality threshold which are of interdisciplinary nature. In order to establish the ranked list of the *Interdisciplinary Research* domain, all peer review evaluation panel chairs will further assess these proposals on the basis of the second evaluation criterion (*Research project*).

Any funds still available in any of the 4 domains, after exhausting the list of proposals over the quality threshold, will be distributed to the other 3 domains according to the initial call budget breakdown.

Finally, a number of proposals (over the quality threshold) in the 4 domain lists may also be kept in reserve to allow for eventualities such as the failure of negotiations on projects, the withdrawal of proposals, budget savings agreed during negotiation, or the availability of

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<sup>10</sup> In accordance with the ERC rules for the Submission of Proposals and the related evaluation, selection and award procedures relevant to the Ideas Specific Programme

additional budget from other sources. Additional funds will also be distributed according to the initial call budget breakdown.

Based on the information that the peer review evaluation panel chairs will provide, the ERC Scientific Council will act as the guarantor of the quality of the activity from a scientific perspective and ensure that the establishment of the 4 domain lists are in accordance with the Advanced Grant scientific strategy and priorities it has established in the Work Programme.

Information on the first **ERC Advanced Grant Call for Proposals** is provided in Annex 1.

The proposed research activities shall respect fundamental ethical principles<sup>11</sup>.

### **3.6 Reapplications and multiple applications**

Rules will apply to reapplications by Principal Investigators for ERC grants whose proposals are not judged to meet the threshold of quality, as well as for multiple applications within the same or different type of ERC grants. These rules, which may subsequently be modified by the Scientific Council in light of experience, are as follows:

- No principal investigator or co-investigator may be associated with more than one proposal for an ERC-Advanced Grant to either of the first two Advanced Grant calls (ERC-2008-AdG or ERC-2009-AdG).
- A Principal Investigator or a co-investigator associated with a proposal for an ERC-Advanced Grant to either of the first two Advanced Grant calls (ERC-2008-AdG or ERC-2009-AdG) may not apply for the third ERC-Advanced Grant call (ERC-2010-AdG, expected in 2010) unless the proposal to the first or second call has met the quality threshold on both evaluation criteria - Principal Investigator, Research Project - at the end of step 1 of evaluation (see section 3.9).
- A principal investigator or co-investigator who has submitted a proposal for an ERC-Advanced Grant in either of the first two Advanced Grant calls may not apply for an ERC Starting Grant during the same period (2008-2009)
- Only one ERC grant managed by a Principal Investigator can be active at any time.

### **3.7 Eligibility Criteria**

Incomplete proposals (missing parts, forms, and the host institution's commitment statement) are considered ineligible and will not be evaluated<sup>12</sup>.

#### **Eligible Scientific Fields**

Applications may be made in any field of research<sup>13</sup>.

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<sup>11</sup> In accordance with article 3 of the Ideas SP and including those fundamental ethical principles reflected in the Charter of Fundamental Rights of the European Union. The opinions of the European Group on Ethics in Science and New Technologies are and will be taken into account. Research activities should also take into account the Protocol on the Protection and Welfare of Animals, and reduce the use of animals in research and testing, with a view to ultimately replacing animal use.

<sup>12</sup> See also "eligibility check" in *ERC rules for the submission of proposals and the related evaluation, selection and award procedures relevant to the Ideas Specific Programme*

Funding of human embryonic stem cell research will be possible within the ethical framework defined in the EC 7<sup>th</sup> Framework Programme<sup>14</sup> as well as the "Ideas" Specific Programme.

### **Eligible Principal Investigator**

The ERC actions are open to researchers of any nationality who would like to establish their research activity in any Member State as well as any associated Country.

The Principal Investigator can be of any age and nationality and he/she can reside in any country in the world at the time of the application

### **Eligible Host Institution (Applicant Legal Entity)**

This institution will host and engage the Principal Investigator for at least the duration of the grant. It must be situated in one of the Member States, or one of the associated countries. It may also be an International European Interest Organisation (such as CERN, EMBL, etc.) or the European Commission's Joint Research Centre. Normally, the applicant legal entity will be the only participating legal entity. Other legal entities, including those located in third countries, may however be involved and receive funding to support the work of additional team members, if so specified in the grant award or subsequent amendments to the original grant.

## **3.8 Evaluation criteria**

**Excellence is the sole criterion of evaluation.** It will be applied to the evaluation of both the Principal Investigator and the research project. The evaluation will also assess the extent to which the research environment enables the excellence of the project to be achieved.

The detailed elements applying to the 3 sections of the proposal are as follows:

### **1. Principal Investigator**<sup>15</sup>

***Quality of research output/track-record:** How well qualified is the Principal Investigator (and any co-Investigator if applicable) to conduct the project (reviewers are expected to evaluate the quality of the prior work such as published results in top peer review journals as well as other elements of the Principal Investigator's CV).*

*To what extent are the publications and achievements of the Principal Investigator ground-breaking and demonstrative of independent creative thinking and capacity to go significantly beyond the state of the art? To what extent does the quality and quantity of funding the Principal Investigator has attracted during the last ten years demonstrate his/her reputation as a performer of ground-breaking research?*

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<sup>13</sup> Research proposals within the scope of Annex I of the EURATOM Treaty, namely those directed towards nuclear energy applications, should be submitted to relevant calls under the EURATOM 7th Framework Programme.

<sup>14</sup> In accordance with Commission statement, OJ L 412 of 30.12.2006, p. 42., proposals which will include research activities which destroy human embryos, including for the procurement of stem cells, will not be submitted to the Regulatory Committee. The exclusion of funding of this step of research will not prevent funding of subsequent steps involving human embryonic stem cells.

<sup>15</sup> Evaluation panel members should also take into consideration the benchmarks set in section 3.4 and the proposal's elements such as the "Scientific leadership profile" in section 3.5

**Intellectual capacity and creativity:** To what extent does the Principal Investigator's record of research, collaborations, project conception, supervision of students and publications demonstrate that he/she is able to confront major research challenges in the field, and to initiate new productive lines of thinking?

## **2. Research project**

**Ground-breaking nature of the research:** Does the proposed research address important challenges at the frontiers of the field(s) addressed? Does it have suitably ambitious objectives, which go substantially beyond the current state of the art (e.g. including inter- and trans-disciplinary developments and novel or unconventional concepts and/or approaches)? How well conceived and organized is the proposed activity?

**Potential impact:**

- (a) Does the research open new and important, scientific, technological or scholarly horizons?
- (b) Will the project significantly enhance the research environment and capabilities for frontier research in Europe (including the host institution)?

**Methodology:**

- a) is the outlined scientific approach (including the activities to be undertaken by the individual team members) feasible?(step 1)
- b) is the proposed research methodology (including when pertinent the use of instrumentation, other type of infrastructures etc.) comprehensive and appropriate to the project? Will it enable the goals of the project convincingly to be achieved within the timescales and resources proposed and the level of risk associated with a challenging research project? (step 2)

**High-gain/High-risk balance:**

- a) does the proposed research involve highly novel and/or unconventional methodologies, whose high risk is justified by the possibility of a major breakthrough with an impact beyond a specific research domain/discipline?

## **3. Research Environment (to be assessed only during step 2 of the evaluation)**

**Contribution of the research environment to the project:** Does the host environment<sup>16</sup> provide most of the infrastructure necessary for the research to be carried out? Is it in a position to provide an appropriate intellectual environment and infrastructural support and to assist in achieving the ambitions for the project and the Principal Investigator?

**Participation of other legal entities<sup>17</sup>:** If it is proposed that other legal entities participate in the project, in addition to the applicant legal entity, is their participation fully justified by the scientific added value they bring to the project?

<sup>16</sup> The term "research environment" corresponds to the immediate setting of the research team, such as Department (rather than the sponsoring institution as a whole), and when appropriate, the wider "milieu" of the team's operation, including collaborating laboratories, groups, departments etc.

<sup>17</sup> As the AdG scheme is addressed to individual investigators, usually the participation of more than one legal entity will not improve the chances of success. Participation of investigator(s) from another legal entity would be acceptable if they clearly and substantially enhance the scientific value of the proposal.

### **3.9 Application of Criteria**

Panels and referees will evaluate and mark numerically the proposals under the criteria of Heading 1: *Potential of the Principal Investigator* and Heading 2: *Quality of the proposed research project*. The proposals will be evaluated under Heading 3 on a "pass/fail" basis and commented but not marked during step 2 of the evaluation. The evaluation panels will review the level of the requested grant and, as appropriate, suggest adjustments.

Each proposal will receive a mark on a scale of 1 to 4 for each of the 2 evaluation criteria (Heading 1 and 2):

**4: Outstanding**

**3: Excellent**

**2: Very Good**

**1: Non-fundable**

A quality threshold of  $\geq 2$  will be applied on these evaluation criteria used to establish the "retained list" of proposals which will be ranked in order of priority for funding. If a proposal is marked below the quality threshold on any of the 2 evaluation criteria, it will not be further evaluated and will be rejected.

At the end of each evaluation step, the proposals will be ranked by the panels on the basis of the marks they have received and an overall appreciation of their strengths and weaknesses.

If a panel decides, during step 1 of the evaluation and in case of over-subscription, to follow the assessment procedure described in section 3.4.3, proposals submitted by less competitive Principal Investigators will be immediately rejected.

## **4. Coordination & Support Actions (CSA)**

### **4.1 ERC support via open calls**

#### **Background**

The ERC is a new, ambitious and autonomous entity which aims to establish itself as a "world-leading institution for science funding". Expectations about what it can and will achieve are very high. It will therefore be necessary for the ERC to develop methods to assess progress towards its objectives.

The Scientific Council has, inter alia, the role of overseeing and ensuring quality control of ERC operations. The establishment of an appropriate monitoring, assessment and evaluation framework will provide the Scientific Council with relevant information to ensure longer-term objectivity in their decision-making relating to ERC activities.

In the preparation of a monitoring and assessment strategy, the Scientific Council intends to develop a broad ranging understanding of quality standards and contributing topics and methodologies for assessing the qualitative and quantitative impacts of the ERC activities. It can draw on good practice and experience from Member States' evaluation activities of

national research systems, international research institutions' activities, as well as other existing studies<sup>18</sup>.

Through the Ideas Specific Programme, the ERC has the opportunity to conduct its own strategic studies to prepare for and support its operational activities. The Scientific Council proposes to support independent exploratory work to analyse the impact of the ERC, analyse the functioning and performance of the ERC and to assist in the development of a strategy for the monitoring and assessment of ERC activities. This will be done by using the funding scheme "Co-ordination and Support Actions" (CSAs), which gives financial support aimed at co-ordinating or support research activities and policies. These actions may be implemented by calls for proposals, calls for tender (public procurement), appointment of independent experts and identified beneficiaries.

The Co-ordination and Support Actions will be subject to the standard procedures (grant agreement and financial implications regarding reimbursement of direct and indirect costs) for such actions in FP7.

### **Objectives**

A monitoring and assessment strategy for the ERC should:

- assist in future strategy development,
- provide for ongoing improvement/ refinement of the operations and quality assurance,
- contribute to ex-post evaluation (e.g. at mid-term and prior to the next funding round).

This strategy will be developed in liaison with other programmes of FP7, both to draw experience from the latter and to meet, in a co-ordinated way, the Commission's obligations for programme monitoring and evaluation, as well as the specific evaluation requirements established in the legislation for the ERC (including the mid term review of structures and mechanisms).

The work foreseen will assist the ERC in engaging in creative and exploratory thinking, from a broad and diverse set of perspectives, to arrive at a mature and well-considered position on this important set of issues and to establish data collection, and monitoring and assessment tools both to assure inputs to longitudinal studies from the outset and to assist in the process of "learning by doing". The outcome will be the establishment of an appropriate monitoring, assessment and evaluation framework, providing the Scientific Council with relevant information to ensure longer-term quality of decision-making.

### **Types of activities**

The ERC will provide financial support for establishing a first set of projects, studies, services and associated initiatives for the monitoring, assessment and evaluation of the ERC Activities.

#### ***i. Development of a portfolio of projects to understand the impact of the ERC based on exploratory, state-of the art, scholarly work on broadly defined topic areas and questions.***

Projects would be sought by means of a **Call for Proposals for CSA (support)** and focus on:

- Exploratory and preparatory studies addressing the possible impacts of the ERC on the functioning and quality of the research environment in Europe,

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<sup>18</sup> for example: Frontier Research: The European Challenge, High-Level Expert Group Report, February 2005, EUR 21619, European Commission



including on policy and research culture in European research, as well as addressing future developments of the ERC in a global context and relevant indicators;

- Exploring novel and innovative methodologies and preliminary data collection for longitudinal assessment and evaluation of the direct and indirect impacts of the ERC.

***ii. Preparation for robust longer term monitoring and evaluation by building up sufficient evidence to enable an evaluation of the functioning, performance and processes of the ERC.***

The following studies and services would be sought by a **Call for Tender**:

- Commencement of data collection to provide the basis for the effective longitudinal monitoring and assessment of the implementation of the IDEAS programme and performance evaluation of the ERC operations in the global context;

The procurement procedure will be launched during the first half of 2008. It is expected that 1-2 grants (service contracts) will be awarded to successful applicants who will collect and analyse data.

Note that the activities proposed above are complementary to the statistical data that will be available for analysis following the calls.

***iii. Organisation of an event to analyse the ERC initial achievements (in cooperation with the French Presidency of the European Union)***

The project would be sought by means of a **Call for Proposals for CSA (support)** and focus on:

- The organisation of an event to take stock of the ERC operation and analyse its initial achievements. The event will be held in France while having the Presidency of the European Union with the active involvement of the competent National Authorities and ERC.

*Indicative budget for CSA call for proposals (i. and iii.): EUR 2 500 000 for 2008.*

*Indicative budget for CSA call for tenders (ii.): of EUR 500 000 for 2008.*

## **4.2 CSA to Named beneficiaries**

It is foreseen that CSAs (Support Action)<sup>19</sup> will be used to provide support and assistance to the Chair and vice-Chairs of the Scientific Council, hosted by Imperial College of Science, Technology and Medicine (London, UK) [up to EUR 200 000], Vienna Science and Technology Fund (Vienna, AT) [up to EUR 50 000] and Commissariat à l'énergie atomique

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<sup>19</sup> In conformity with the provisions of the Specific Programme "Ideas" (annex 1) and in compliance with Article 14(a) of the Rules of Participation and Article 168 of the Implementing Rules of the Financial Regulation.

(Paris, FR) [up to EUR 50 000], to have dedicated local support for their tasks of preparing the plenary and other meetings of the Scientific Council, or tasks related to the process of developing and projecting its policies and activities in interaction with the scientific community and other stakeholders<sup>20</sup>.

The principal activities will be:

- to support and assist the Chair in his diverse responsibilities including the preparation of meetings, the efficient and effective functioning of the ScC, its integrated operation together with the ERC's dedicated implementation structure and effective interfacing with the scientific community, other funding agencies and the political institutions of the EU.
- To support and assist the vice-Chairs to ensure their contributing to the efficient operation of the ScC, and the efficient and timely achievement of its objectives in preparing and managing ERC operations under FP7

The named institutions hosting the Chair and vice-Chairs would therefore be direct beneficiaries of up to EUR 300.000 CSAs (Support Action) in compliance with Article 14(a) of the Rules of Participation<sup>21</sup>.

*Indicative overall budget of EUR 300 000 for 2008.*

### **4.3 CSA Eligibility Criteria**

Proposals for co-ordination and support actions must be focused on requirements specified in the work programme and/or call for proposals.

Co-ordination and support actions (Support) are open to legal entities situated in Member States, or associated countries. Applications from International European Interest Organisations (such as CERN, EMBL, etc.) or the European Commission's Joint Research Centre, and legal entities established in third countries are also eligible. Legal entities established in third countries can receive funding if their participation is essential for carrying out the action.

The minimum participation is 1 independent legal entity (CSA-Support).

The active involvement of the National Authorities concerned is required for the organisation of the event under the French presidency and which will be funded by a CSA (Support).

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<sup>20</sup> Activities funded under this CSA must not overlap with the administrative support provided directly by the Dedicated Implementation Structure to the chair and vice-chairs of the ERC Scientific Council, or with any support that is foreseen in the Commission Decision establishing the ERC (2007/134/EC, 02/02/2007).

<sup>21</sup> Regulation 1906/2006/EC of 18 December 2006, concerning the rules for participation of undertakings, research centres and universities in the European Community Seventh Framework Programme (2007-2013)

#### **4.4 CSA Evaluation Criteria**

Proposals for Coordination and Support Actions (CSA) will be evaluated on the basis of the following criteria:

##### **1. Objectives and impact (award):**

Are the objectives of the proposed project consistent with the requirements specified in the work programme and/or call for proposals? Will the project have a substantial impact in the context of the ERC strategic objectives?

##### **2. Quality and effectiveness (award):**

Is the proposed methodology and work plan effective in reaching the goals of the project? Does it ensure the highest quality and/or utility of results? Does it, where appropriate, correspond to, or go beyond, best current practice?

##### **3. Resources (selection):**

Are the resources (personnel, experience, equipment, other) appropriate for the goals of the project? Will they be used effectively? Are they properly justified?

#### **4.5 Application of CSA Evaluation Criteria**

Each evaluation criterion will be marked on a scale of 0 to 5 (with half-point resolution) and an overall quality threshold of 80% will be used to establish the "retained list" of proposals which will be ranked in order of priority for funding.

## 5. Indicative budget for the revised ERC Work Programme

Call	2008* in EUR million
<b>ERC-2008-AdG</b>	516.95
<b>OTHER ACTIVITIES:</b>	
CSA: ERC SUPPORT CFP	[2.50]
CSA: ERC SUPPORT CfT	[0.50]
CSA: NAMED BENEFICIARIES	[0.30]
<b>EVALUATION COSTS</b>	[4.50]
<b>ESTIMATED TOTAL BUDGET ALLOCATION (rounded)</b>	<b>[524.75]</b>
* Under the condition that the preliminary draft budget for 2008 is adopted by the budgetary authority without modifications by the budget authority	

# Annex 1 Advanced Investigators Grant Call Information

**Call Title:** Call for proposals for *ERC Advanced Investigators Grant*

**Call identifier:** ERC-2008-AdG

**Date of publication<sup>22</sup>:** .... November 2007

**Electronic proposal submission deadlines<sup>23</sup> (single submission of full proposal):<sup>24</sup>**

**Call Closure Dates for proposals submitted to:**

**Panels: PE1 - PE10 (Physical Sciences & Engineering),** 28 February 2008, 17.00.00 (Brussels local time)

**Panels: SH1 – SH6 (Social Sciences & Humanities),** 18 March, 17.00.00 (Brussels local time)

**Panels: LS1 – LS9 (Life Sciences),** 22 April 2008, 17.00.00 (Brussels local time)

**Indicative budget:** EUR 516 950 000<sup>25</sup> from 2008 budget

**N.B. N.B.:** The ERC Scientific Council has established the following indicative percentage budgets for each of the 3 main research domains:

Physical Sciences & Engineering: 39%

Life Sciences: 34%

Social Sciences & Humanities: 14%

and an Interdisciplinary<sup>26</sup> domain with an indicative budget of 13%.

In the case of the ERC, indicative budgets may permit a variation of the budget for each domain by a maximum of 20% of the total budget for the call; however for this call the budget proportions allocated to projects in the three main research domains will be no lower than the percentages indicated

**Activity:** European Research Council Advanced Grant

**Minimum number of participants:** At least 1 independent legal entity established in one of the Member States, or one of the associated countries (in the case of the participation of more than one legal entity the participants are not obliged to establish a consortium agreement)

**Restrictions on participation:** see eligibility criteria in the Work Programme

**Topics:** Applications may be made in any field of research, other than those specifically excluded from the 7<sup>th</sup> framework programme

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<sup>22</sup> The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication

<sup>23</sup> At the time of the publication of the call, the Director-General responsible may delay this deadline by up to two months

<sup>24</sup> please consult Annex 3 of the "Ideas" Work Programme for the panel description

<sup>25</sup> Under the condition that the preliminary draft budget for 2008 is adopted without modifications by the budgetary authority

<sup>26</sup> Including cross-panel and/or cross-domain research projects and research with the potential to open new fields

**Grant "Portability":** applicants should be aware of the portability features of ERC grants as described in the ERC model grant agreement ([http://cordis.europa.eu/fp7/calls-grant-agreement\\_en.html](http://cordis.europa.eu/fp7/calls-grant-agreement_en.html))

**Eligibility criteria<sup>27</sup>:**

Incomplete proposals (missing parts, forms, and the host institution's commitment statement) are considered ineligible and will not be evaluated<sup>28</sup>.

**Eligible Scientific Fields**

Applications may be made in any field of research<sup>29</sup>.

Funding of human embryonic stem cell research will be possible within the ethical framework defined in the EC 7<sup>th</sup> Framework Programme<sup>30</sup> as well as the "Ideas" Specific Programme.

**Eligible Principal Investigator**

The ERC actions are open to researchers of any nationality who would like to establish their research activity up in any Member State as well as any associated country.

The Principal Investigator can be of any age and nationality and he/she can reside in any country in the world at the time of the application.

**Eligible Host Institution (Applicant Legal Entity)**

This institution will host and engage the Principal Investigator for at least the duration of the grant. It must be situated in one of the Member States, or one of the associated countries. It may also be an International European Interest Organisation (such as CERN, EMBL, etc.) or the European Commission's Joint Research Centre. Normally, the applicant legal entity will be the only participating legal entity. Other legal entities, including those located in third countries, may however be involved and receive funding to support the work of additional team members, if so specified in the grant award or subsequent amendments to the original grant.

**Evaluation procedure:**

- The evaluation will take place **in two steps** following the **single submission of a full proposal**.
- The evaluation is carried out through evaluation panels that may be assisted by referees.
- The allocation of the proposals to the various panels will be based on the expressed preference of the applicant. In case of interdisciplinary proposals the panel may request additional reviews by appropriate members of other panel(s) or additional referees who act as reserve evaluators.
- Proposals may be evaluated remotely.
- An indicative budget will be allocated to each panel, in proportion to the budgetary demand of its assigned proposals. This indicative budget is calculated as the cumulative grant request of

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<sup>27</sup> See also "eligibility check" in *ERC rules for the submission of proposals and the related evaluation, selection and award procedures relevant to the Ideas Specific Programme*

<sup>28</sup> See also "eligibility check" in *ERC rules for the submission of proposals and the related evaluation, selection and award procedures relevant to the Ideas Specific Programme*

<sup>29</sup> Research proposals within the scope of Annex I of the EURATOM Treaty, namely those directed towards nuclear energy applications should be submitted to relevant calls under the EURATOM 7th Framework Programme

<sup>30</sup> In accordance with Commission statement, OJ L 412 of 30.12.2006, p. 42, proposals which will include research activities which destroy human embryos, including for the procurement of stem cells, will not be submitted to the Regulatory Committee. The exclusion of funding of this step of research will not prevent funding of subsequent steps involving human embryonic stem cells.

all proposals to the panel divided by the cumulative grant request of all proposals to the domain of the call, multiplied by the total indicative budget of the domain.

- Each panel will determine its budgetary cut-off level as a multiple of its indicative budget. The budgetary cut-off level should be at least 3 times the panel's indicative budget. Proposals with a mark passing the quality threshold and which lie above the budgetary cut-off level will be retained and pass to step 2 of evaluation (all proposals with identical marks at the cut off level will pass through to the second step of evaluation). Those proposals failing to reach the quality threshold on any of the evaluation criteria or ranked below the budgetary cut-off described above will be rejected.
- The complete version of the retained proposals will be assessed and ranked by the panels during step 2 of the evaluation. Interdisciplinary proposals within a domain or across domains will be flagged as such, and the panel may request additional reviews by appropriate members of other panel(s) or additional referees who act as reserve evaluators.
- Following the conclusion of the panel evaluations the following additional steps will be taken with the participation of the evaluation peer review evaluation panel chairs:

**Step 2a:** Acting in concert, the peer review evaluation panel chairs of each research domain or their deputies, representing their panels, will prepare a consolidated ranked list for the domain's proposals which are above the quality threshold and can be funded in order of priority from the respective domain budgets<sup>31</sup>.

**Step 2b:** Acting in concert across the 3 main research domains, taking account of the forward looking and innovative nature of the programme, all the Evaluation peer review evaluation panel chairs or their deputies will bring forth and specifically discuss, from an interdisciplinary perspective, the scientific added value of proposals above the quality threshold which are of interdisciplinary nature. In order to establish the ranked list of the *Interdisciplinary Research* domain, all peer review evaluation panel chairs will further assess these proposals on the basis of the second evaluation criterion (Research project).

Any funds still available in any of the 4 domains, after exhausting the list of proposals over the quality threshold, will be distributed to the other 3 domains according to the initial call budget breakdown.

Finally, a number of proposals (over the quality threshold) in the 4 domain lists may also be kept in reserve to allow for eventualities such as the failure of negotiations on projects, the withdrawal of proposals, budget savings agreed during negotiation, or the availability of additional budget from other sources. Additional funds will also be distributed according to the initial call budget breakdown.

**Evaluation criteria:** See the work programme for the applicable criteria

Information on the modalities of the call and guidance to applicants on how to submit projects is available on:

<http://erc.europa.eu>, [http://cordis.europa.eu/fp7/ideas/home\\_en.html](http://cordis.europa.eu/fp7/ideas/home_en.html)

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<sup>31</sup> In accordance with the ERC rules for the Submission of Proposals and the related evaluation, selection and award procedures relevant to the Ideas Specific Programme

## Annex 2 CSA Call Information

**Call Title:** Call for proposals for *ERC CSAs (Support Actions)*

**Call identifier:** ERC-2008-Support

**Date of publication<sup>32</sup>:** .....November 2007

**Call deadline<sup>33</sup>:** 06 March 2008, at 17.00.00 (Brussels local time)

**Indicative budget:** EUR 2 500 000 <sup>34</sup> from 2008 budget

**Activity:** European Research Council Co-ordination and Support Actions

**Topics called:**

- i. Development of a portfolio of projects to understand the impact of the ERC based on exploratory, state-of-the art, scholarly work on broadly defined topic areas and questions
- ii. Organisation of an event to analyse the ERC initial achievements (in cooperation with the French Presidency of the European Union)

**Minimum number of participants:** At least 1 independent legal entity established in one of the Member States, or one of the associated countries (in the case of the participation of more than one legal entity the participants are not obliged to establish a consortium agreement)

**Restrictions on participation:** see eligibility criteria in the Work Programme

**Topics:** Applications must address topics specified in the work programme

**Eligibility criteria**

Proposals for co-ordination and support actions must be focused on requirements specified in the work programme and/or call for proposals.

Co-ordination and support actions (Support) are open to legal entities situated in Member States, or associated countries. Applications from International European Interest Organisations (such as CERN, EMBL, etc.) or the European Commission's Joint Research Centre, and legal entities established in third countries are also eligible. Legal entities established in third countries can receive funding if their participation is essential for carrying out the action.

The minimum participation is 1 independent legal entity (CSA-Support).

The active involvement of the National Authorities concerned is required for the organisation of the event under the French presidency and which will be funded by a CSA (Support).

**Evaluation procedure:**

- The evaluation is carried out through evaluation panels.
- Proposals may be evaluated remotely.

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<sup>32</sup> The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication

<sup>33</sup> At the time of the publication of the call, the Director-General responsible may delay this deadline by up to two months

<sup>34</sup> Under the condition that the preliminary draft budget for 2008 is adopted without modifications by the budgetary authority



**Evaluation criteria:** See the work programme for the applicable criteria  
Information on the modalities of the call and guidance to applicants on how to submit projects is available on:

<http://erc.europa.eu>

[http://cordis.europa.eu/fp7/ideas/home\\_en.html](http://cordis.europa.eu/fp7/ideas/home_en.html)

## Annex 3 Panel structure and description

### Physical Sciences & Engineering (28 February 2008, 17.00.00 Brussels local time)

- PE1 **Mathematical foundations:** all areas of mathematics, pure and applied, plus mathematical foundations of computer science, mathematical physics and statistics
- PE2 **Fundamental constituents of matter:** particle, nuclear, plasma, atomic, molecular, gas, and optical physics
- PE3 **Condensed matter physics:** structure, electronic properties, fluids, nanosciences
- PE4 **Physical and analytical chemical sciences:** analytical chemistry, chemical theory, physical chemistry/chemical physics
- PE5 **Materials and synthesis:** materials synthesis, structure-properties relations, functional and advanced materials, molecular architecture, organic chemistry
- PE6 **Computer science and informatics:** informatics and information systems, computer science, scientific computing, intelligent systems
- PE7 **Systems and communication engineering:** electronic, communication, optical and systems engineering
- PE8 **Products and processes engineering:** product design, process design and control, construction methods, civil engineering, energy systems, material engineering
- PE9 **Universe sciences:** astro-physics/chemistry/biology; solar system; stellar, galactic and extragalactic astronomy, planetary systems, cosmology, space science, instrumentation
- PE10 **Earth system science:** physical geography, geology, geophysics, meteorology, oceanography, climatology, ecology, global environmental change, biogeochemical cycles, natural resources management

### Social Sciences & Humanities (18 March 2008, 17.00.00 Brussels local time)

- SH1 **Individuals, institutions and markets:** economics, finance and management
- SH2 **Institutions, values and beliefs and behaviour:** sociology, social anthropology, political science, law, communication, social studies of science and technology
- SH3 **Environment and society:** environmental studies, demography, social geography, urban and regional studies
- SH4 **The Human Mind and its complexity:** cognition, psychology, linguistics, philosophy and education
- SH5 **Cultures and cultural production:** literature, visual and performing arts, music, cultural and comparative studies
- SH6 **The study of the human past:** archaeology, history and memory

## Life Sciences (22 April 2008, 17.00.00 Brussels local time)

- LS1 Molecular and Structural Biology and Biochemistry:** molecular biology, biochemistry, biophysics, structural biology, biochemistry of signal transduction
- LS2 Genetics, Genomics, Bioinformatics and Systems Biology:** genetics, population genetics, molecular genetics, genomics, transcriptomics, proteomics, metabolomics, bioinformatics, computational biology, biostatistics, biological modelling and simulation, systems biology, genetic epidemiology
- LS3 Cellular and Developmental Biology:** cell biology, cell physiology, signal transduction, organogenesis, evolution and development, developmental genetics, pattern formation in plants and animals
- LS4 Physiology, Pathophysiology and Endocrinology:** organ physiology, pathophysiology, endocrinology, metabolism, ageing, regeneration, tumorigenesis, cardiovascular disease, metabolic syndrome
- LS5 Neurosciences and neural disorders:** neurobiology, neuroanatomy, neurophysiology, neurochemistry, neuropharmacology, neuroimaging, systems neuroscience, neurological disorders, psychiatry
- LS6 Immunity and infection:** immunobiology, aetiology of immune disorders, microbiology, virology, parasitology, global and other infectious diseases, population dynamics of infectious diseases, veterinary medicine
- LS7 Diagnostic tools, therapies and public health:** aetiology, diagnosis and treatment of disease, public health, epidemiology, pharmacology, clinical medicine, regenerative medicine, medical ethics
- LS8 Evolutionary, population and environmental biology:** evolution, ecology, animal behaviour, population biology, biodiversity, biogeography, marine biology, ecotoxicology, prokaryotic biology
- LS9 Applied life sciences and biotechnology:** agricultural, animal, fishery, forestry and food sciences; biotechnology, chemical biology, genetic engineering, synthetic biology, industrial biosciences; environmental biotechnology and remediation;