

Final Report: IUPAC Project No. 2004-014-1-020

International Research Funding in the Chemical Sciences

Objective: To explore ways by which organizations and agencies responsible for funding chemical research in various countries might exchange information on international trends in funding and develop partnerships for projects of mutual interest.

Procedure: At a planning meeting of task group members in July 2004, in London, it was agreed that the objective could best be met by means of a 1½ day workshop at the IUPAC General Assembly in Beijing, August 18-19, 2005. [Progress report: <http://www.iupac.org/projects/2004/2004-014-1-020.html>] Attendance of about 15-20 was considered optimal. Individuals were identified in 20 countries and invited to participate. Although 19 acceptances were eventually received, during the weeks immediately preceding the workshop six participants were forced to withdraw. These cancellations were primarily due to scheduling conflicts, and each of these prospective attendees expressed interest in continuing to participate in future endeavors by this group.

Workshop: The workshop was built around the agenda given in *Attachment 1*. An advantage of the smaller number of participants was that session chairs could ask each participant to speak at greater length on major topics, and the discussion could be conducted very informally. Prior to the workshop each potential participant was asked to complete a short questionnaire [*Attachment 2*] that elicited information on national research funding philosophies, conditions, and guidelines. A presentation summarizing this information served to catalyze discussion of similarities and differences among various countries and organizations.

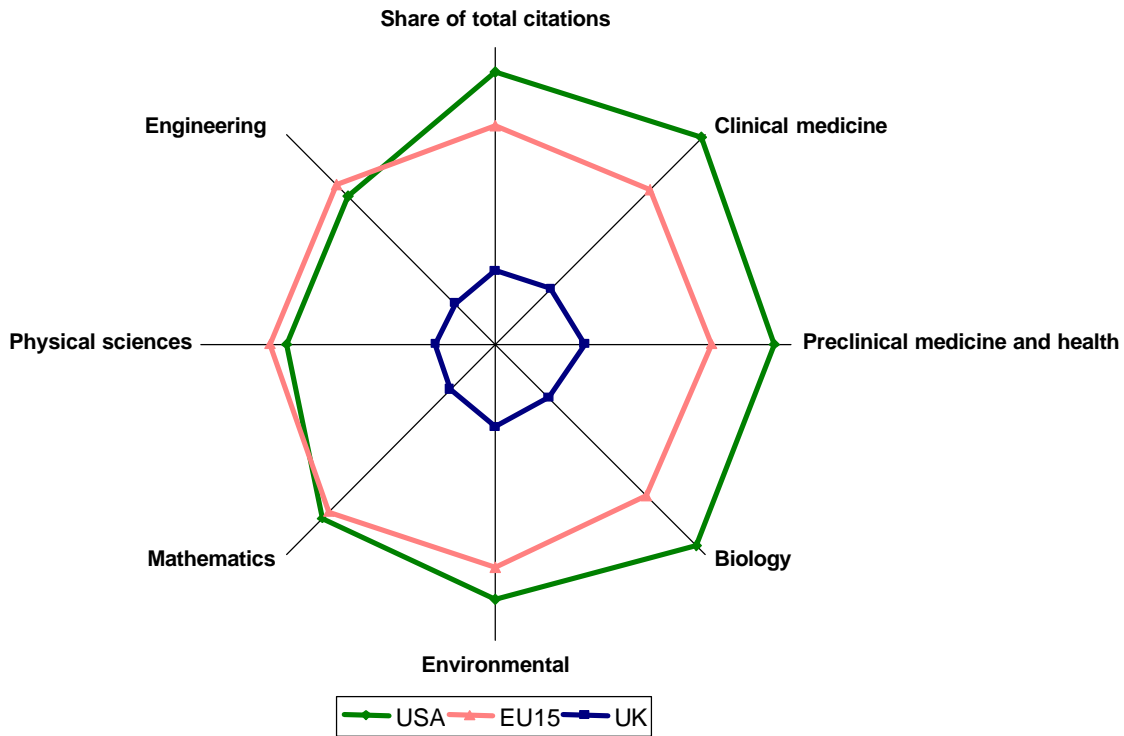
IUPAC Past President Pieter Steyn welcomed participants on behalf of President Sydnes, who was chairing a meeting elsewhere in Beijing. Prof. Steyn expressed IUPAC's pleasure at being able to facilitate this exchange of views, which should lead to expanded international research in chemistry. He remained for the first session and contributed information on research funding in South Africa.

A list of participants is included as *Attachment 3*.

Highlights and Outcomes: Participants agreed that chemistry is international, and ideally anyone in the world could collaborate with anyone else. However, funding is almost entirely national. One objective for this group is to identify ways by which trans-national research can be initiated and carried out more easily and more widely. A second objective is to use international research experience to validate the assumptions and conclusions within each country regarding priorities used to establish the "science drivers" that are needed to obtain financial resources.

Tracking research and measuring its impact is an important activity in each of the countries represented. Participants exchanged information on their procedures. Most organizations require annual reports, but the nature and extent of their content and other evaluation methods varied considerably.

Metrics for measuring research output nationally, by discipline and relative to financial support, were discussed at some length. New methods of displaying data and mapping results were of particular interest. For example, Figure 1 shows a plot of literature citations based on a study covering 1993- 2002, commissioned by the UK Office of Science and Technology [D.A. King, *Nature*, 430, 311-316 (2004)]. The plot shows that the United States still has a bigger disciplinary footprint than the EU15, largely owing to its strength in the life sciences. The EU15 footprint is more symmetrical, being a little stronger than the United States in the physical sciences and engineering, but weaker in life and medical sciences. Such plots can illustrate important aspects clearly by their size and symmetry properties.



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Figure 1 [from D.A. King, *Nature*, 430, 311-316 (2004)]

Likewise, mapping methods can be used to classify research output and relate it to other factors, such as financial support by various agencies. An example, shown in Figure 2, by Kevin Boyack, Sandia National Laboratory, USA, and his collaborators examined 1.07 million papers with 24.5 million references in 7300 journals [see <http://ella.slis.indiana.edu/~katy/events/05-iu-tech-transfer.ppt>]. Their methods found

671 clusters (*i.e.*, disciplines, indicated by dots), as depicted in the plot, which demonstrated the interconnections among major field of research. Figure 3 superimposes the research portfolio of one funding agency, the US National Science Foundation. These mapping processes offer promise in the analysis of international funding trends.

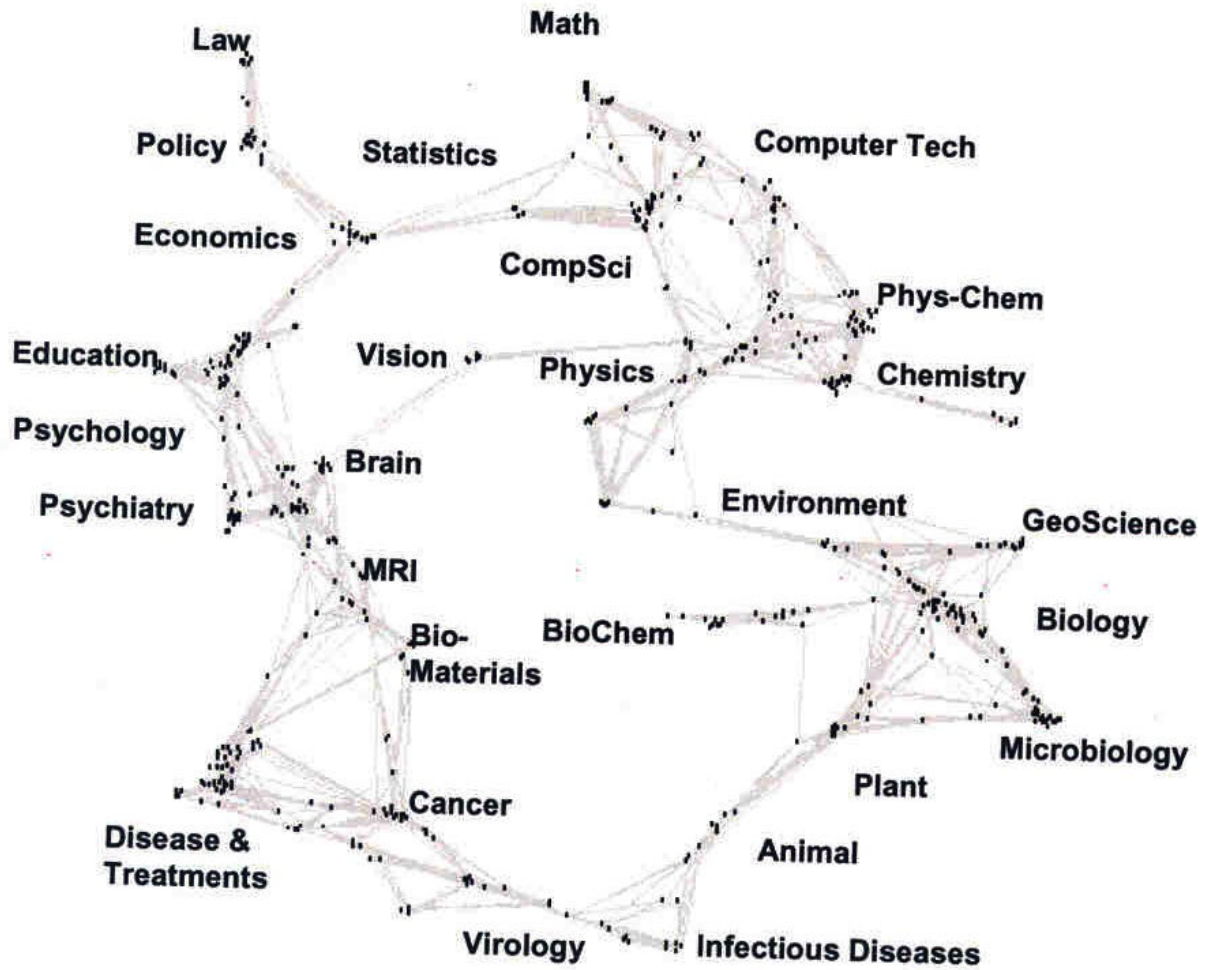


Figure 2 [<http://ella.slis.indiana.edu/~katy/events/05-iu-tech-transfer.ppt>]

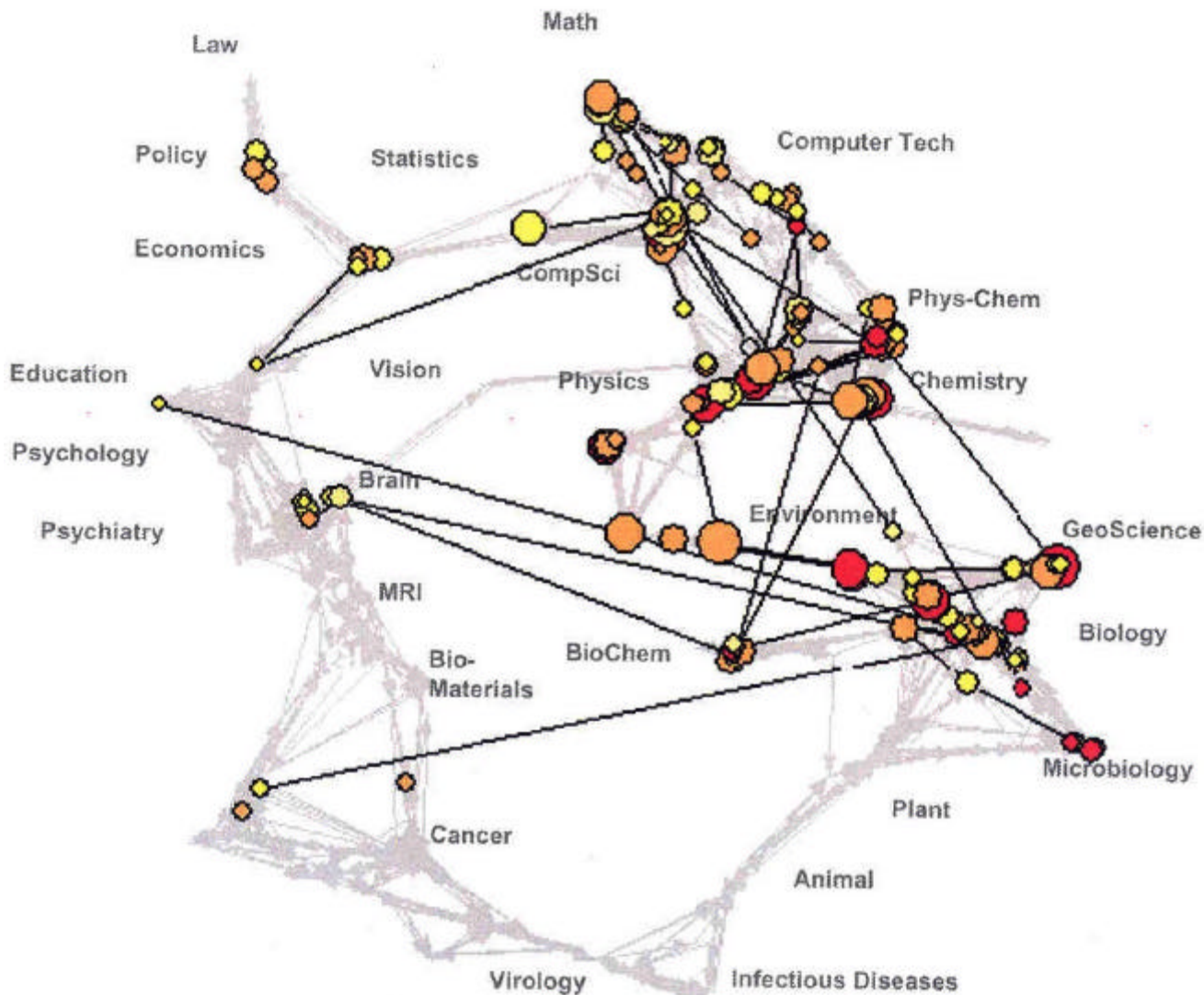


Figure 3 [<http://ella.slis.indiana.edu/~katy/events/05-iu-tech-transfer.ppt>]

ERA-Chemistry, a project of the European Research Area, was described in some detail as an example of international cooperation in chemical research [www.erachemistry.net]. This initiative includes funding organizations in ten European countries [Austria, Belgium, Finland, France, Germany, Ireland, Netherlands, Portugal, Spain, Switzerland] aimed at supporting new cooperative projects, primarily between young researchers in different countries. Common procedures are being developed for submission and evaluation of proposals and for funding from a single source, built around administrative simplicity and flexibility. It is expected that the process will be rapid, involving about six months between announcement and funding decisions. The first round was in progress at the time of the workshop, with 78 eligible pre-proposals involving 189 applicants already

received and final proposals due in October. Total funding over three years is planned at €3.4 million. Individual grants are expected to run about €60,000 / year / applicant, including funds for one graduate student or postdoctoral, consumable supplies, travel costs and possibly small instruments (< €30,000).

Policies for ERA-Chemistry have been developed following wide consultation and workshops among researchers and administrators. The eligibility requirements include:

- primarily young researchers (PhD thesis less than 10 years ago)
- maximum of one senior researcher per joint project
- two or three new collaborators with no joint publications during the last five years
- requirement of novel and innovative topics *and a clear trans-national added value*
- maximum of three applicants per joint project (maximum one per country), one proposal per applicant

Issues such as overhead and taxing policies in different countries, along with intellectual property rights, must be negotiated in individual cases.

It is hoped that ERA-Chemistry will expand within the European Research Area. It could potentially be expanded or its tools could serve as a model for other trans-national cooperation arrangements beyond Europe. In this connection, it was noted that a recently established program between the DFG and the NSF is set up to permit the use of existing NSF electronic review procedures in which the DFG serves as a “guest reviewer.” Thus, applicants from Germany and the US can submit a single linked research proposal that receives a single review. This program is currently limited to new cooperation between German and U.S. applicants who have not previously published together and is described at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13627&org=CHE&from=home. The Division of Chemistry at NSF is receptive to creating additional binational funding arrangements based on this model if the pilot project with the DFG works well. Also presented was a trilateral funding arrangement involving China, South Korea, and Japan: funding in the form of a “glue grant” can be obtained by a trio of PIs from these three countries.

The group discussed *resources that can be shared across national borders*. Examples included such traditional matters as exchange of chemical samples, which has become increasingly problematic because of national import regulations, and use of specialized instrumentation [such as mass spec and NMR], which is becoming less difficult as a result of computer-based methods for remote operation. Unlike physics and astronomy, chemistry has traditionally been more of a “cottage industry” that has little dependence on large shared instrumentation. However, that situation could be changing, as very expensive facilities such as neutron scattering, synchrotron x-ray sources, and very high field NMR become essential for some aspects of structural and dynamic investigations in chemistry.

Particular attention was given to the emerging *cyber-enabled chemistry*, the term given to the use of the broad use of world-wide computer networks, so-called *cyberinfrastructure*,

to permit not only such activities as remote control of instruments, but to bring together a vast array of databases, modeling capabilities and high speed communications that can be used to attack chemical problems of great complexity. Some resources related to cyber-enabled chemistry, including a workshop report, may be found at www.nsf.gov/chem/cyber.

The final topic addressed, *education and workforce in the chemical sciences*, elicited a wide range of observations from different countries. The attractiveness of chemistry as a career choice and the number of students in the field varies greatly from country to country and changes over time with demographic and perceived economic benefits. For example, Germany experienced lower enrollment in chemistry 8-10 years ago as a result of an employment downturn in the chemical industry, but now there appears to be a trend upward in chemistry students. In most countries, a foreign educational experience, either as part of graduate education or as a postdoctoral, is considered highly desirable. However, many chemists are concerned about the practical difficulties in obtaining suitable employment after returning from foreign training. This problem is often exacerbated for female scientists. Strategies for increasing the number of women and underrepresented minorities in academic faculty positions were discussed. The NSF is supporting several initiatives to address this problem.

Reports: This report will be distributed to all participants and to those individuals who had expressed interest but were unable to attend. Additional material may be made available on the IUPAC web site. An article describing the workshop will be offered to *Chemistry International*, the bimonthly IUPAC news magazine, and participants indicated that information about the workshop and future plans might be published in several national chemistry news magazines. In recognition that chemistry funding organizations provide an important leadership role, Art Ellis and Karlheinz Schmidt summarized the outcomes of the workshop at the World Chemistry Leadership Meeting, held as part of the IUPAC General Assembly, on August 19, 2005.

Future Actions: The participants were unanimous in feeling that this exchange of information had been valuable and that a mechanism should be found to permit continuing interaction. There was a strong feeling that IUPAC is needed as an umbrella, both to emphasize the truly international flavor and to use the Union's broad reach to engage participants from additional countries, eventually including those from the developing world. Karlheinz Schmidt [DFG] agreed to lead an effort, along with other volunteers among the participants, to continue this forum. Ted Becker agreed to consult the President and President-elect of IUPAC and to prepare a project proposal to IUPAC that will address the feasibility of continuing IUPAC sponsorship of this effort.

Art Ellis suggested that some future discussions might be held via the Access Grid, which permits wide-scale meetings using advanced computer technology for teleconferencing. The Access Grid has currently some 3400 certificates to users across 47 countries [<http://www.accessgrid.org/>]. He will investigate the possibility of a discussion centered around the use of information visualization (mapping) technology for tracking chemical

research. It would not be feasible for individuals in all time zones to participate in a “live” discussion simultaneously, but a video record could permit additional access.

The group recognized that face-to-face meetings will also be important. They tentatively plan to meet at the site of the 1st European Chemistry Congress in Budapest, 27-31 August, 2006, with Prof. George Horvai handling local arrangements. In addition, to cement a continuing relationship with IUPAC, a meeting should be held at the next IUPAC General Assembly in Torino, 4-12 August, 2007.

Financial Aspects: Most travel expenses were covered by participants from national funding agencies and other national organizations. IUPAC provided about \$5000 for some travel and organizational expenses of the workshop and the previous planning meeting.

Acknowledgments: Dr. Wenping Liang, National Natural Science Foundation of China [NSFC], handled all local arrangements in Beijing. The NSFC generously covered all expenses of meeting room and facilities and hosted both a welcome reception and a banquet at the end of the first day’s meeting.

Workshop on International Research Funding in the Chemical Sciences

August 17-19, 2005
Beijing Foreign Experts Building
Beijing, China

*Held in conjunction with the IUPAC General Assembly and Congress
and with sponsorship of the National Natural Science Foundation of China*

Wednesday, August 17

16:00 Registration *Lobby*

19:00 Reception *Coffee Room*

Thursday, August 18 *First Meeting Room*

8:00 Introductions and Remarks by the Task Group and IUPAC representatives

8:30 Session I
National research funding philosophies, conditions, and guidelines
Trends and priorities in chemical research

10:30 Break

11:00 Session II
Tracking chemical research and measuring its impact

12:00 Lunch

13:00 Session III
Programs in chemical research that encourage international partnerships

15:30 Break

16:00 Session IV
Resources that can be shared through international partnerships

17:30 Summary of discussion

18:00 Group Dinner

Friday, August 19 *First Meeting Room*

8:00 Session V
Education and workforce in the chemical sciences

10:00 Break

10:30 Session VI
Conclusions and plans for further cooperative international programs

12:00 Lunch

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Questionnaire

Surname (last name/family name):

First Name:

Job Title:

Institution:

Address:

Postal Code:

City:

Country:

Telephone:

Fax:

E-mail:

Web address:

Your national research council/research funding organization/institution/ministry in charge of chemical research:

Questionnaire:

Please respond to as many questions as you feel comfortable answering. Also, please answer for the aforementioned organization within your country that supports chemical research whether or not you are part of that organization.

1. What is the yearly average funding budget for chemistry of your organization (figures in US \$ or € please)?
2. Does your organization fund basic and/or applied research? If your organization funds applied research, how do you define "applied"?
3. Are there other important national funding organizations in charge of chemistry funding in your country? Which? Where applicable: Are there general guidelines for which areas of chemistry are supported by the different funding organizations?
4. Does your organization fund individual researchers and/or teams of researchers?
5. Does your organization fund research facilities/institutes/laboratories (institutional funding)?
6. If applicable: What is the share between individual and institutional funding?

7. Are international referees/panel members used?
8. Are there deadlines for submission of proposals?
9. Do you have electronic submission of proposals?
10. How long is the average processing time between submission of a proposal and when a decision is made on it?
11. What are eligible costs (permanent/nonpermanent staff salaries, consumables, equipment, ...)?
12. What is the success rate of proposals, where success rate is defined as the percentage of proposals receiving funding relative to the total number of proposals reviewed?
13. For proposals that are funded, what percentage of the funding amount requested by the proposer(s) is actually awarded?
14. Do you have methods for coding your investments and/or for assessing the impact (scientific achievements) of your investments?
15. What experience does your organization have with transnational research funding?
16. Is your organization interested in participating in transnational research funding programs? If so, in which kind of programs (individual and/or collaborative projects, research facilities)?
17. Are there national/governmental/research council priorities in research that you are supporting or plan to support? If yes, who defines/selects these priorities? Can you give some examples?
18. Are there national initiatives or existing national programs for which you would be interested in having foreign partners with complementary expertise?
19. How is research supported by your organization at the interface of chemistry with other fields of research (e.g., biology, physics, materials and engineering research)?

IUPAC Workshop on International Research Funding in the Chemical Sciences

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