

NSF COMMITTEE OF VISITORS FOR EMERGING FRONTIERS/BIO
RESPONSE TO THE COV REPORT
SEPTEMBER 11-13, 2006

Introduction.

The CoV commended Emerging Frontiers (EF) for its efforts with respect to the quality and effectiveness of its merit review procedures, recognizing it as *“informative”*, *“extensive”*, and *“effective”*. In particular, the CoV noted that the Microbial Genome Sequencing Program *“has succeeded in getting the reviewer community to take a large-scale view in evaluation of MGS proposals”*. The CoV recognized the review process for the Assembling the Tree of Life Program as *“exemplary”*, and commended the Frontiers in Integrative Biological Research working group for their choice of reviewers.

The CoV was extremely positive about project quality and portfolio balance in all activities under review, noting that the overall quality of AToL projects is *“exceptional”*; that the BIO/Math activities are supporting research and education *in “an area of considerable importance”*; that FIBR projects are *“excellent, novel and integrative”* and *“relevant to national priorities and to NSF’s mission”*; that RCN *“provides a mechanism for breaking down disciplinary stovepipes”*; and that MGS is a *“good model for interagency activity to advance scientific fields of mutual interest and importance”*.

The CoV also recognized EF for its responsiveness to emerging research and education trends, noting these activities as having been *“highly successful in generating data, establishing networks of research, promoting collaborations among disciplines, providing new and diverse educational opportunities, and providing exceptional return on the NSF investment”*. The CoV recommended that new NSF-wide and BIO-wide activities be managed in EF *“to ensure BIO-wide participation of internal and external communities”*. The report noted that EF awards *“have provided a model for the scientific community to cross disciplinary boundaries and to form productive collaborations that allow novel insights into biological systems”*.

***Response.** Emerging Frontiers appreciates the CoV’s support and endorsement of this experimental way of managing cross-NSF and cross-BIO activities. Emerging Frontiers also appreciates the CoV’s recognition of the dedication of the BIO Program Directors in ensuring that the merit review process operates with the highest standards possible in terms of both quality and quantity of feedback to the scientific community.*

PART A. INTEGRITY AND EFFICIENCY OF THE DIVISION’S PROCESSES AND MANAGEMENT

A.1 Questions about the quality and effectiveness of the division’s use of merit review procedures.

Recommendation 1. The review process for the AToL proposals is considered exceptional both in the quantity and quality of reviews. This is exceptionally helpful to investigators in further developing successful projects. There are no data on the timing of review return to investigators for this particular program, but given the annual (instead of biannual) deadline for this competition, the 6 month return time is less critical and the Division is certainly close to the goal of 70% return within 6 months across the programs evaluated. Thus the recommendation is to continue the exceptional review process for the AToL proposals.

Response 1. *Emerging Frontiers appreciates the CoV's recognition of the careful attention paid to both quality and quantity of reviews. We are committed to continue our efforts to ensure that proposals receive the very best review in terms of both numbers of reviews received and the quality of comments.*

Recommendation 2. Continued attention needs to be paid to providing enough critical discussion of strengths and weaknesses in panel summaries for the PI's benefit. In addition, broad impacts must be sufficiently emphasized.

Response 2. *Emerging Frontiers will increase its efforts to encourage panelists to write panel summaries that provide more extensive discussion of strengths and weaknesses of both merit review criteria. Science Assistants will be tasked with reading panel summaries as they are being drafted at panel and alerting the Program Directors to any panel summaries that do not adequately address both merit review criteria.*

Recommendation 3. RCN: Need to more effectively inform reviewers of the special review criteria within the merit and broader impact framework.

Response 3. *The RCN working group has drafted a set of special instructions to inform reviewers of the special review criteria for these proposals; this group has also drafted a set of instructions that will be read to panelists before discussion of RCN proposals. Both of these instruction sets emphasize the NSF criteria for intellectual merit and broader impacts as well as the particular goals of the RCN program. The RCN working group is considering a variety of mechanisms to ensure that reviewers actually read these specialized instructions before reviewing RCN proposals; mechanisms under consideration include forwarding the RCN instructions separately from the proposal assignments and making telephone calls to reviewers to remind them that there are special review instructions for RCN proposals.*

A.2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers.

Recommendation 1. AToL: Continue the emphasis on review criterion 2 and encourage investigators to develop ideas that go beyond the standard efforts associated with university professors (mentoring students and postdocs) and museum curators (developing exhibits). The diversity of broader impact activities across the funded (and unfunded) AToL projects is impressive and should be showcased by NSF. For example, at the all PI meeting for the AToL projects, NSF might consider a special session on the outreach activities and invite experts in science education, etc.

Response 1. *Emerging Frontiers appreciates the CoV's recognition of the diversity of broader impact activities funded through the AToL program. The recommendation for inclusion of a special session on outreach activities at the AToL PI meeting is also appreciated. While the first meeting of AToL awardees did include a session on outreach activities, a special session with invited experts will be recommended to the organizer(s) of subsequent meetings of this nature.*

Recommendation 2

FIBR: It is essential that panel summaries discuss broader impacts at a reasonable length. If only one or two sentences are included, it sends a message to PIs that they too should give it scant consideration. Perhaps summaries could reflect fairly closely the more balanced analysis of both review criteria as seen on the Form 7s. Perhaps instructions should emphasize that discussions of broader impacts should touch on each of the five components of broader impacts: teaching, underrepresented groups, infrastructure, dissemination, and societal benefits.

Response 2. *Emerging Frontiers will increase its efforts to encourage panelists to write panel summaries that provide more extensive discussion of strengths and weaknesses of*

both merit review criteria. Science Assistants will be tasked with reading panel summaries as they are being drafted at panel and alerting the Program Directors to any panel summaries that do not adequately address both merit review criteria.

A.3 Questions concerning the selection of reviewers.

Recommendation 1

AToL: We recommend that the AToL reviews continue in the excellent fashion that they currently use. NSF runs the risk of reviewer burnout with such high numbers of reviews from a relatively limited community, but they should continue as a goal to receive 8-10 reviews for each proposal.

Response 1. Emerging Frontiers appreciates the CoV's recognition of the dedication of the Program Directors in ensuring a high quality review of these proposals and will continue to strive for receipt of 8-10 reviews for each AToL proposal.

Recommendation 2

FIBR, RCN, MGS: Reviewer selection is generally very good. Careful attention to the diversity of the reviewer pool needs to be emphasized.

Response 2. Emerging Frontiers appreciates the CoV's recognition of the dedication of the Program Directors in reviewer selection and will increase our efforts to increase diversity in the reviewer pool for FIBR, RCN, and MGS proposals.

A.4 Questions concerning the resulting portfolio of awards under review.

Recommendation 1

AToL: Continue to encourage collaborative proposals with broad incorporation of a diversity of institutions and investigators. Place more emphasis on the incorporation of underrepresented groups in all levels of the proposals (PI, co-PI, postdocs, graduate students, undergraduates, K-12).

Response 1. Emerging Frontiers shares the CoV's desire to increase participation of diverse institutions and investigators in AToL proposals. Increasing diversity at all levels is a major commitment across the BIO Directorate and across the Foundation. We will continue to encourage Reviewers, Panelists, and Program Directors to give considerable weight to this merit review criterion at all stages of the review process. This requirement will be emphasized with the scientific community in new program solicitations and in Program Directors' outreach activities.

Recommendation 2

Bio-Math: It was notable that the types of institutions as well as the diversity of investigators who received research awards differed considerably from those who received UBM awards. Although it is possible that this is due to a failure to award bio-math research grants to a range of PIs in diverse institutions, it seems equally or more likely that it is due to a lack of applications in this area from those investigators and institutions. (It was not possible to determine this based on the information that we had available.) If this is the case, then it is particularly important to keep funding the UBM proposals, and to expand this initiative, putting particular emphasis on funding a broad array of investigators and institutions, as well as encouraging these programs to include a wide array of students. This may increase the chances that a larger group of investigators interested in and capable of working at this interface will be available to conduct this type of research in the future.

Response 2. Emerging Frontiers appreciates the CoV's enthusiasm for the Undergraduate BIO-Mathematics activity, which provides valuable insight and will be considered seriously as the BIO Senior Management team develops funding priorities and operating plans for FY

2008 and beyond. EF will undertake a study to compare the diversity in UBM awards with the diversity of applications received to determine if the underlying problem is in fact lack of diversity in the applicant pool.

Recommendation 3

Overall, UBM has supported only 24 projects, and is expected to fund another 8 this year. If this program is to serve as a catalyst for change at additional institutions, it is clear that the existing projects need to be evaluated carefully, new ones funded, and the elements that contribute to successful programs need to be described and disseminated. To make this effort truly successful, it seems likely that a program to foster adaptation of successful programs at other institutions will be necessary.

Response 3. *Emerging Frontiers agrees with the recommendation that evaluation is important and recognizes the need to develop quantitative and qualitative assessment tools for UBM and other EF activities, and understands the importance of sharing information about successful programs with other institutions. Dr. Jim Collins, Assistant Director for Biological Sciences, shared some of his thoughts about Program Directors as “scholar administrators” with the CoV; one aspect of this emphasis could include public dissemination of successful innovations funded through the UBM Program. Another possibility we will explore is revision of the UBM Program Solicitation to include PI outreach to other institutions as a possible “broader impact” activity.*

Recommendation 4

RCN: This program could be expanded well beyond BIO, and include interagency and additional international support.

Response 4. *Emerging Frontiers shares the CoV’s enthusiasm for the RCN Program and will explore the possibility of including other NSF Directorates, other Federal agencies, and international partners.*

Recommendation 5

MicGenSeq: A workshop or other gathering for program guidance would be appropriate to consider the future strategy for directions of the MicGenSeq activity.

For example, where are the gaps in genomes in the growing Tree of Life with respect to the bacterial and archaeal organisms?

Utilize the results from surveys of prokaryotic diversity to gain a sense of what “out there” remains to be captured and for which whole genome sequences would be desirable or essential to fill in the branches of the ToL.

Consider incorporating a list of targets to construct goals for future sequencing projects. The sense of this is for the program to remain open to individual initiative but nudge the field to close identifiable gaps in needed information. This may include a focus on genomic sequence of uncultured organisms.

Devise an approach to learn from the awardees the extent of participation of underrepresented minorities and women who are U. S. citizens.

Response 5. *We agree completely that workshops for program guidance are appropriate. Indeed, since the inception of the program, the interagency NSF/USDA Microbial Genome Sequencing Program (MGSP) has held an annual two-day workshop involving representatives from each project funded through the program. Each year at these workshops program directors from the two agencies engage in a dialogue with workshop participants to consider the evolving needs of the field and strategies for future directions for the MGSP. EF will ensure that gaps in the Tree of Life with respect to sequenced genomes will be discussed at this year’s PI meeting.*

We agree that utilizing the results from environmental surveys of prokaryotic diversity is essential for a successful MGSP program. The extensive proposal evaluation process will

continue to take into account the opportunities in this area in deciding funding priorities for the MGSP. The MGSP will continue to encourage proposals on uncultured microorganisms and communities.

We agree that broadening participation of underrepresented groups in MGSP-funded projects is a high priority. During every step in the proposal evaluation process, the extent of participation of underrepresented minorities and women is considered by ad hoc reviewers, panelists and program directors as important elements of broader impact. This will be further stressed at annual PI meetings.

A.5 Management of the division under review.

Recommendation 1

The one shortcoming of a program like this is that there may not be clear information about assessment available in one place (for one program manager) so that ongoing quality management can be assured. This issue should be addressed in future reorganizations.

***Response 1.** Emerging Frontiers appreciates this recommendation and will increase our efforts to include assessment strategies in the management plans for all new EF activities.*

Recommendation 2

The Agency needs to ensure that panelists are well informed of the program's goals and objectives before they prepare their reviews. It should then become rare that the working group's recommendations would appear to be at odds with the panelist scores.

***Response 2.** Emerging Frontiers will increase its efforts to provide detailed information about program goals and objectives to both internal and external reviewers at the time that reviews are requested. However, the CoV is reminded that because Program Directors are charged with considering a variety of diverse factors (e.g., beginning vs. established investigators, and institutional type) some proposals rated highly by panels may not be funded.*

Recommendation 3

RCN: In the three years under review there seemed to be three somewhat different management models. The recommended structure would be "EF" office director, working group, central RCN panel, disciplinary panel, and ad hoc review. Rotators should be included on working group to maintain ties to the research community.

***Response 3.** Emerging Frontiers appreciates this advice from the CoV. Many of these recommendations are already being implemented, including: EF office director; working group, which includes two permanent Program Directors and two rotators; and disciplinary panels. As the CoV correctly notes, we have experimented with a variety of management models, including both the recommended central RCN panel and the use of ad hoc reviewers. We will take the other suggestions into consideration prior to development of the management plan for the next RCN competition in 2007.*

PART C. OTHER TOPICS

C.1 Division areas in need of improvement or gaps (if any) within division areas.

Recommendation 1

A five year review cycle should be implemented to determine what programs should remain in EF, what programs should be terminated, and what programs should move to one of the existing BIO divisions. For each program, a clear rationale should be developed explaining (to the community broadly) why a given program is part of the EF portfolio.

***Response 1.** The Directorate has developed a set of criteria that is used to determine each of the important issues raised by the CoV. These criteria will be re-examined each fall at the BIO Senior Management Retreat and adjusted as deemed appropriate to guide decisions regarding which activities should become and/or remain part of the EF portfolio. Adoption of these criteria is expected to provide a framework for communications with the scientific community regarding rationale for inclusion of a specific activity within EF.*

Recommendation 2

The office must draft a new mission statement. It should encapsulate the office's goals and mission and clearly state its dual purpose as BOTH an incubator AND as a coordinating center for BIO's centers.

***Response 2.** Emerging Frontiers appreciates the importance of this recommendation and has already begun work on such a statement.*

Recommendation 3

The panel recommends a name more in keeping with the expectations for the office.

***Response 3.** Creation of a name for this collection of activities has been a challenge, as the CoV apparently discovered when they attempted to develop a list of suggested names. As noted in the response to the previous recommendation (above), we have begun work to prepare a mission statement. We anticipate that any new name for these collected activities will come out of that activity.*

Recommendation 4

We strongly recommend that the new division strongly emphasize assessment and that the assessment plans highlight workforce issues prominently.

***Response 4.** Emerging Frontiers shares the CoV's concerns about these critical issues and anticipates inclusion of an emphasis on assessment in the goals and objectives being developed for EF and will develop a process to respond to this recommendation.*

Recommendation 5

This is the ideal time to re-think the management model for EF. The cycling of personnel through the director job needs to be timed correctly (is one year adequate time to make progress?). The rewards to the staff (titles and salary) should reflect the importance that the Directorate attaches to EF type activities.

***Response 5.** Refinement of the management model for EF is an ongoing activity in the Directorate. Current plans are for the EF Director to serve a two year term. We appreciate the suggestion that the title and salary should reflect the importance of EF activities within the Directorate.*

C.2 Please provide comments as appropriate on the division's performance in meeting division-specific goals and objectives that are not covered by the above questions.

Recommendation 1

We recommend that EF follows its new mission statement with a more detailed account of its objectives and goals. For operational reasons we will assume that EF has four major objectives. We believe that these should be EF's functions in its novel reincarnation:

- EF should serve as an incubator for new and interesting areas that are likely to cut across biology and that are sometimes (albeit not exclusively) interdisciplinary – this will allow them to be funded and looked after for a number of years by program officers from multiple disciplines. They may then move to another division, potentially be renewed in EF, or be eliminated if they have served their purpose and are no longer in need of support.
- EF should serve as a longer-term home for programs that are interdisciplinary and cut across all of the divisions, such as the RCN program.
- EF should manage a series of programs such as the Centers, that may be more disciplinary in content, but differ from the usual programs and can benefit from interacting with one another in terms of management and ways of structuring activities that are inherent to that type of program.
- Finally, we believe that EF should serve as an incubator for novel mechanisms of collaborative management modes, initiative and grant assessment, and dissemination of results. Adopting an adaptive approach to these themes should not be take place exclusively within EF, but the incubator nature of this office appears to suit it well as an arena for experimentation.

Response 1. Emerging Frontiers appreciates these detailed suggestions by the CoV and plans to include an expanded discussion of objectives and goals after the new mission statement is drafted.

Recommendation 2

RCN is a successful initiative. We recommend RCN as one of the division's, and perhaps the directorate's, flagship programs.

Response 2. Emerging Frontiers shares the CoV's obvious enthusiasm for the RCN Program and appreciates its recognition as a critical activity within the Directorate. We will advertise this program more broadly during outreach visits and at professional meetings.

Recommendation 3

Given the success of the RCN initiative, we propose a similar one for education on the biological sciences. The Science Education Coordination Networks (SECN). The objectives of this proposal would parallel those of the RCNs.

Response 3. This interesting recommendation may be appropriate for exploration with the Directorate for Education and Human Resources (EHR). Program Directors from BIO and EHR meet regularly to discuss areas of common interest; this recommendation will be forwarded to that group for consideration as a possible joint activity.

Recommendation 4

Our recommendation to begin to solve the problem of appropriate evaluation is two-fold. First, new initiatives recommended for incubation and nurturing in EF must have well defined objectives and goals at their onset and a mechanisms that permits assessment of those. Second, we recommend that EF begins experimenting with quantitative

assessments of broad impacts. Many of the elements of these broad impacts, including work force development (gender balance, inclusion of minorities, and RUI participants), education (courses developed, number of participants), and outreach (website and exhibit development), can be evaluated quantitatively with relative ease.

Response 4. *Emerging Frontiers shares the CoV's concerns about these critical issues and is planning to address this recommendation in several ways. The management plans for all new EF activities will be expected to include means for assessment. Emerging Frontiers has initiated a detailed analysis of outcomes related to broader impacts from both RCN and FIBR awards. This will involve review of the annual project report for each funded project and manual export of relevant information. This analysis should provide baseline information on achievements with respect to broader impacts in these two programs. In addition, NSF is redesigning the annual and final project report templates; the revisions are expected to include requirements of the PI to provide both quantitative and qualitative information on progress with respect to both of the NSF merit review criteria in a form that will be readily retrievable.*

C.3 Please identify agency-wide issues that should be addressed by NSF to help improve the division's performance.

Recommendation 1

The COV recommends a mixture of rotators and permanent staff in the EF initiatives.

Response 1. *Emerging Frontiers will ensure that EF activities continue to include involvement of both rotators and permanent staff.*

Recommendation 2

The COV recommends that the UBM program be maintained and expanded and that appropriate objectives coupled with ongoing assessment be integral parts of this continuation. The COV further recommends that for these cross-directorate activities can be "rewarded" (leveraged) with existing "Director's Reserve" funds – especially where the participating programs have relatively small budgets to start with. However, the COV would not recommend any additional taxation of core programs to create or augment such a reserve.

Response 2. *Emerging Frontiers acknowledges the CoV's enthusiastic support for the UBM activities and will take this recommendation under consideration as the FY2007 operating plan is being developed.*

Recommendation 3

The COV recommends that NSF develop an annual report format that allows for the retrieval of data related to research AND broader impacts in an automated fashion.

Response 3. *Emerging Frontiers agrees with the CoV that the current template for annual and final project reports creates considerable challenges for NSF staff in extracting useful quantitative and qualitative information on outcomes from NSF awards. Because this is a Foundation-wide template, Emerging Frontiers will convey these recommendations to the group that is developing the new reporting templates for the Foundation.*

Recommendation 4

The COV recommends that EF set the bar for expectations in the area of broader impacts across not only the directorate but across the foundation.

Response 4. *Emerging Frontiers recognizes the critical importance of investing in projects that are as outstanding in addressing the broader impacts criterion as they are in scientific merit and will strengthen language on this topic in all revisions to EF solicitations.*

Recommendation 5

The COV recommends that the management team keep a close eye on the administrative burden of the EF and EF-associated activities on the program officers and develop an FTE distribution plan to assure a reasonable distribution of this burden.

***Response 5.** Emerging Frontiers acknowledges the CoV's concerns in this area and will monitor workload issues related to participation in EF activities to ensure the recommended "reasonable distribution".*

C.4 Please provide comments on any other issues the COV feels are relevant.

Recommendation 1

Conduct comprehensive "EF" COV reviews to better enable the Committee to develop a coherent picture of the EF portfolio and address more fully Division-wide issues.

***Response 1.** The next CoV review of EF activities is scheduled for FY 2009; this recommendation will be implemented at that time.*

Recommendation 2

Explore the possibility of expanding the ATOL practice of fostering collaboration amongst PIs submitting proposals with overlapping goals and scope.

***Response 2.** Encouragement of collaboration among PIs who submit proposals with overlapping goals and scope is already a common practice across the Directorate.*

C.5 NSF would appreciate your comments on how to improve the COV review process, format and report template.

Information Supplied Prior to the COV meeting

Recommendation 1

In general, accessing information before coming to NSF for the COV was not as easy as is desirable. Many of the documents required going to one document, copying URLs, pasting them into a browser and finding another document, so that individual members of the committee easily spent an hour or more just downloading and printing documents. Compiling them as a single file (or two to three files) would have made preparation more efficient.

***Response 1.** Emerging Frontiers regrets the inconveniences encountered in moving between documents in the eJacket CoV module and will incorporate these suggestions into preparations for future CoVs in BIO.*

Recommendation 2

Provision of a self-study document was extremely helpful in getting the COV committee started. In our particular case, it would have been especially helpful if there had been some breakdown of the data by each individual program – even if it was aggregate information for three fiscal years. (In fact, such aggregate information is probably more useful than breakdowns by fiscal year when looking at individual programs.) However, it is important to emphasize that the data in the self study were very clear and helpful.

***Response 2.** Emerging Frontiers is pleased that the CoV found the self-study document to be clear and helpful. Additional breakdown of data by individual activities will be available to the next EF CoV in 2009.*

Recommendation 3

The data summaries of BIO dollar investments and proposal numbers were very helpful. In cases where there is additional programmatic investment from outside BIO it is important to see some similar summary statistics. If proposals were on the books as funded by other parts of NSF, that data were not included and led to skewed and erroneous information. We

imagine these might be difficult to obtain, but they would be strategically valuable for the Directorate and the COV.

Response 3. *Emerging Frontiers is pleased that the CoV found the summaries of investments helpful. Information on joint activities funded by other NSF organizations will be included in information provided to the next EF CoV.*

Recommendation 4

The content of the self-study document could be improved. The history of the virtual division, perceived needs and directions, how programs were selected for inclusion, data disaggregated by program, and particular points of consensus and non-consensus would be informative, as would inclusion of the program's mission statement.

Response 4. *The information noted in this recommendation will be included in the self-study document prepared for the next EF CoV in 2009.*

Information during Panel

Recommendation 5

The COV would have been more efficient if the very clear verbal description of this virtual division, including its history, purpose, recent changes and future, that was presented by Judy Verbeke on the second morning in response to questions (and confusions) at the end of the first day of the meeting had been presented on the first morning, before we heard from the other groups and examined jackets.

Response 5. *This recommended change in the agenda will be adopted for the next EF CoV in 2009.*

Recommendation 6

Having a very short review of each program by the involved program officers (working groups) would have been helpful at the start of each session. In some cases we had to spend a considerable amount of time getting to issues that were important to the Program Managers. In some cases, the data provided were refuted by the Program Managers as incomplete or not the most relevant data set. We also did not have an opportunity to ask other program officers their opinion of these programs.

Response 6. *These recommended changes will be adopted for the next EF CoV in 2009.*

Recommendation 7

The ability to access other jackets was limited. Giving the COV electronic access to all jackets in the program from the beginning of the meeting would have been very helpful. The selection of particular jackets to view was "random" selection. However with some of the smaller programs, this led to very uninformative jackets (in one case all withdrawn proposals, in another case all awarded proposals and in a third a case only one award and five declinations). A quick review of these selections would have pointed this out and additional jackets could have been added to make sure the sample was adequate for the COV review. A stratified sample would be a more effective mechanism.

Response 7. *These recommendations will be adopted for the next EF CoV in 2009.*

Recommendation 8

It would be very helpful if there were a way for the panel to move from the e-jacket work space to a page where the COV document can be seen as it is assembled, and/or where files can be shared. On a regular panel, the computers are networked so that the panelists can share information readily rather than printing out hard copies or sending back and forth via home institution web sites as this COV had to do.

Response 8. *This is an excellent suggestion. EF will explore using shareware to enable file sharing the CoV document among CoV members.*