N A T I O N A L C E N T R E F O R B I O L O G I C A L S C I E N C E S (N C B S)

Tata Institute of Fundamental Research (TIFR)

Report on the Scientific Review (January 5-7 2010)

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Report on the scientific review of the National Centre for Biological Sciences, Tata Institute of Fundamental Research
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The following Board Members, *ad hoc* reviewers and international science advisors were at the NCBS Annual Talks and review meeting 2010. Drawn from the best institutions around the world, these scientists combine excellence in science with experience in mentoring, institutional management and research- policy.

1	Shin Aizawa, RIKEN-CDB, Kobe
2	Utpal Banerjee, University of California, Los Angeles
3	Mary Beckerle, University of Utah, Salt Lake City
4	Gautam Desiraju, Indian Institute of Science
5	John Kuriyan University of California, Berkeley
6	Scott Edwards Harvard University, Cambridge
7	Albert Libchaber, Rockefeller University, New York
8	Madhav Gadgil, Agarkar Research Institute, Pune
9	L. Mahadevan, Harvard University, Cambridge
10	Vivek Malhotra, Centre for Research in Gene- regulation, Barcelona
11	Eve Marder, Brandeis University, Waltham
12	Mani Ramaswami, Trinity College, Dublin
13	Sriram Ramaswamy, Indian Institute of Science, Bangalore
14	Satyajit Rath, National Institute of Immunology, New Delhi
15	Andrej Shevchenko, Max- Planck Institute for Cell Biology and Genetics, Dresden
16	Benny Shilo Weizmann Institute, Rehovot
17	Jim Spudich, Stanford University, Palo Alto
18	Mriganka Sur, Massachusetts Institute of Technology, Cambridge
19	Arthur Wingfield, Brandeis University, Waltham

The reviewers received, two weeks in advance, the curriculum vitae and research outline of all groups at NCBS. During the 3- day retreat, the reviewers heard scientific talks by all group leaders and facility heads, and interacted with students and post- doctoral fellows at poster sessions. In addition, discussion groups at dinner with students, post- doctoral fellows and new group leaders brought up topics that should be addressed for future improvement.

In addition to evaluation of individual research groups, the general topics of future directions, growth, recruitment, faculty mentoring, student programs etc. were jointly- discussed by the entire group. This report represents a synopsis of these discussions.

General philosophy of NCBS

As an offspring and part of the Tata Institute, NCBS is a research institute. The decisions on faculty hiring, which eventually impinge on research directions and style, are based on scientific excellence. This is essential since realistically most, if not all, faculty members are of Indian origin. There are outstanding Indian post docs abroad who are anxious to return to India, and the question is how to make the most of this unique situation. This has been done at several levels:

1. The primary selection of new recruits was based on excellence of the prospective PI, rather than on the topic of work.
2. The sources of novelty and strength in science that can be carried out at NCBS vs. the rest of the world were carefully analyzed and identified. It is futile to try and compete with other labs by the volume of work. Science at NCBS is carried out by small to medium sized groups. This maintains a close interaction of the PI with the subject matter and people working at the lab. The strength lies in the ability of individual labs to carry out novel and innovative research, on the one hand, and on the ability to forge powerful, and sometimes unexpected, collaborations between different research groups on the other. Having diverse biological disciplines together within a highly interactive setting is a special feature. For example, the collaborations between cell biology groups working on intracellular trafficking, genetic groups working on whole organisms such as *Drosophila*, and computational experts, has generated a remarkable conceptual output that is recognized worldwide.
3. Another source of novelty that has been recently emphasized is the ability to utilize the highest quality of computational and molecular biology which are present at NCBS, to tackle problems of plant and animal ecology, particularly with respect to the Indian ecosystems.
4. Modern scientific work requires sophisticated and expensive equipment, which should be continuously updated, and even more important should be used to push the envelope of its capacity by applying innovative modifications. The NCBS has established a centralized facility, initially for microscopy and lately also for protein mass spectrometry and for transgenic mice. By establishing a central facility that is available to everybody, maintained by dedicated experts and continuously updated, the most efficient utilization was assured.
5. From the outset, its founders viewed NCBS as an organization that can serve as a role model, not only with respect to the scientific output. The scientific culture of excellence, a focus on science, facilitation of collaborations encouragement of open discussion and debate, and training of students, post-docs and faculty are values which serve not only the NCBS itself, but are also carried over by new institutes that are currently incubated by NCBS, and by people who pass through the NCBS.
6. NCBS has also become to a large extent the window of India to the international scientific community in Life Sciences. Through an extremely active meetings and course program that gradually evolved over the years, scientists who came through were genuinely "infected" by the special scientific culture that was developed, the scientific excellence and the novelty of approaches carried out.
7. At the administrative level NCBS has also established a culture of efficiency, and a focus on service to the scientists at all levels.

Progress During the Past Five Years:

NCBS has undergone dramatic growth since the last review in 2003. The faculty (group leaders, young- investigators, adjunct and visiting faculty) has doubled in size from 20 to 41 and the number of trainees has increased from 130 to over 300. The review team sensed the excitement and enthusiasm of the NCBS community and at all

levels of the organization there was both a palpable optimism for the future and an appreciation for the special environment that has been created at NCBS. The scientific sessions held at the review session were equivalent to the quality of a high level international scientific meeting.

Perhaps one of the most important determinants of the ongoing success of NCBS is related to the quality of the faculty who are recruited to join the Center. The faculty is characterized by a commitment to excellence, innovation, trans- disciplinary research, and a culture of collaboration that are the hallmarks of the science at NCBS. Current faculty members participate actively in the review of potential new candidates and this contributes to the strong sense of community and shared commitment to, and accountability for, the continued success of the institution. Individual and group interviews with faculty and students uniformly revealed a high level of pride in association with NCBS, a recognition of the unique and especially productive environment, and the institutional support for taking scientific risks which are, of course, critical for the most transformative scientific discoveries. One indication of the high quality of the faculty is the group's competitiveness in obtaining extramural funding to support its work; since 2003 the support for the faculty has increased dramatically from Rs. 360 to 1200 Lakhs, outpacing the rate of faculty growth.

The Director of NCBS, Dr. K. VijayRaghavan, is a visionary and inspirational leader who, along with the Dean, Dr. Mayor, and the NCBS community, has created an exceptional environment for the conduct of highly creative and collaborative research. Standards are high and there is a culture that supports development of the next generation. Initiation of two relatively new programmatic areas, in theory and computational biology and in ecology and evolutionary biology, demonstrate the foresight of the leadership. These have blossomed over the last few years. The ability of these two areas to integrate and enrich the activities at NCBS illustrates the collaborative and trans- disciplinary culture of NCBS.

NCBS attracts some of the finest students in the country and its success in the future requires that it continue to do so. Continuing efforts on enhancing its teaching, courses, and workshops while advertising this and its open and vibrant research environment is of course essential. NCBS may also want to consider joint PhD programs with leading laboratories and institutions across the world. While NCBS students already have all the flexibility to collaborate, these new schemes, if well advertised, may recruit excellent students attracted to research by the possibilities in exciting collaborative ventures.

Since the time of the last review, the NCBS administration has been significantly enhanced in a number of areas. Mr. Pradip Pyne and his team have developed an on-line procurement system, which has increased tracking capability and reduced delays in ordering critical research supplies. Accounting has been computerized, internal standards have been developed, and a meeting office has been established to support the many scientific gatherings, both courses and meetings, held at NCBS. This support has enabled NCBS to be a visible convener of international gatherings. Overall, the increased efficiencies developed in administrative processes have contributed to NCBS's global competitiveness. Future development of a research administration office will further accelerate research productivity. In addition, it will be important to retain the valuable, highly trained staff now in place at NCBS, and

encourage their activities by timely promotions. The flexibility of NCBS in carrying out these promotions will be beneficial. Occasional review of the activities of the management and secretarial staff may provide useful insights, and increase the commitment of the staff.

NCBS has made substantial investments in development of state-of-the-art scientific infrastructure including shared resources for Cell Imaging and Flow Cytometry, Mouse Genetics, Mass Spectrometry, the *Drosophila*- genetics and the High-throughput Screening Facility. Substantial consultation has taken place as these shared resources have been developed, thus capitalizing on best practices and knowledge regarding optimal equipment choices; the directors of the resources are highly committed, passionate, and well informed in their areas of oversight. The impact of the shared resources on both the quality and the capacity for innovation was clearly evident in the scientific presentations. These shared resources support the breadth of the science being conducted at NCBS and represents an exceptional resource that encourages scientific creativity that is unfettered by technical hurdles, provides exceptional environment for training, and facilitates trans- disciplinary collaboration.

An important strategic approach of NCBS has been to identify areas in which investigators can access unique resources for the conduct of original research while creating unique educational opportunities. Two examples are the wildlife conservation program led by Dr. Ajith Kumar and the scholarly research in the area of indigenous medicine and Natural History of Botanical Medical knowledge originating from India spearheaded by Dr. Annamma Spudich. Both of these efforts have already brought recognition to NCBS through research output, exhibits, workshops and courses. Moreover, they both represent initiatives for further engagement of the local Bangalore community in the scientific enterprise and for highlighting unique scholarly contributions based on Indian resources. It will be highly desirable to continue such educational efforts.

The extensive investment in shared resources has positioned NCBS to assume a leadership role in the development and dissemination of new investigational strategies and technologies in India and beyond, something that is clearly apparent in the Microscopy course that has been taught at NCBS in 2009 and is planned again for 2010. This course attracted an exceptional group of instructors from the international community and provides a means to highlight the scientific advances occurring at the NCBS and the potential of Indian science to prosper with continued investment. Importantly, the financial commitment of the Indian government coupled with the vision of the NCBS leadership has made these shared resources freely available to the scientific community throughout India, thus providing a critical resource of both technology and knowledge that can be leveraged to support science in many institutions. The review group believes that these shared resources will also provide a mechanism to facilitate further international collaborations, which will ultimately contribute to greater international recognition of the outstanding work being conducted at NCBS.

Outlook and suggestions for the next five years

The critical issue for the Institution for the next five years will be to continue with the culture of developing excellence in science that has been achieved during the last several years and to use this a springboard for making further enhancements to the Center. In particular, as there is ample opportunity to significantly increase the size of the institute as new buildings and facilities become available, NCBS will become even more attractive for scientists with high promise and distinction. This expansion must not happen for the sake of expediency alone and at the cost of quality and excellence. As with the current system, the entire NCBS faculty, including its newly hired faculty should be expected to participate in the decision making process that leads to new hiring. It will also be critical to maintain the philosophy of making new appointments based on quality while keeping in mind the topics of specialization in the chosen sub-fields in which NCBS has made considerable investment. In order to maintain the highest quality of the faculty it is important to have a rigorous review at the time of tenure. To ensure that NCBS can properly evaluate the candidate at a time when the candidate has been allowed the time necessary to complete a significant body of original work, we recommend that the current five-year tenure clock be extended. An effective way to gauge progress will be to have a fourth year review followed by a tenure portfolio to be prepared at the end of the sixth year.

As discussed above, the review committee was extremely impressed by the visionary approach of Director K. VijayRaghavan and Dean Satyajit Mayor. Looking at the future, it will be important to involve some of the other productive members of the Center within the senior administrative process, while keeping decision- making simple and interactive. This is a major reason for the amicable relationships evident within the faculty. As NCBS expands, the Academic administration should still remain simplified and autonomous. The financial center under the leadership of Mr. Pyne is another model for simplified, yet effective administrative setup. It would make sense to add a grants office to his arsenal to aid in the growing number of extramural applications and awards. As NCBS expands, once again, any expansion of the finance office should not interfere with the non-hierarchical structure that has been put in place.

The core facilities developed over the last five years have made it possible to attract bright new faculty and have also fostered collaborations between different groups, particularly between bench scientists and theoreticians who are adept at interpreting quantitative data. It will be extremely important to maintain the expansion of these facilities. Such centrally located core facilities that are shared between laboratories at NCBS and laboratories from all over India are a valuable National resource. NCBS should be encouraged to foster greater collaborations, both Nationally and Internationally that make full use of these state of the art facilities. We recommend adding a Computation facility to handle the wealth of data being acquired by current and future faculty.

NCBS is now a mid-sized Center, soon to become one of the larger scale institutes. The culture that has characterized NCBS, and contributed to its current vitality, is one in which all stakeholders have been actively involved in providing input on the institute's future. NCBS has grown rapidly in the past five years and is positioned for even more dramatic growth in the future. This growth is well justified based on the strong performance of the institute to date and its remarkable potential for continued

leadership in fundamental biological research. As plans are developed for future growth at NCBS and for the BioCluster, it will be important to communicate openly and regularly with the current faculty and staff. This will provide opportunities to solicit their valuable opinions, further reinforce their sense of "ownership" of NCBS, and reduce the potential anxiety that can plague a rapidly growing institution where there is lack of full transparency. The review group urges the NCBS leadership to be attentive to this important communication issue as the future plans are being developed. Scheduling regular faculty meetings in which faculty members are informed and discussion is encouraged would be one of the means of enhancing transparency.

The graduate program at NCBS produces trained scientists that will add to the strength of the scientific base of the country. The educational agenda seems appropriate and can be expanded as deemed necessary. A current challenge is to identify and attract students and post- docs with a background in the Physical Sciences and Mathematics. The increase in the number of faculty working on quantitative approaches necessitates recruitment of students and post- docs trained in these fields that are willing to work in the life sciences. A continuous effort to improve mentoring will be advisable. Development of a mechanism, such as appointing a student representative, for obtaining student feedback will be valuable. An opportunity for improvement in the next five years is to the postdoctoral program. As a minority group within the Center, the postdoctoral fellows could feel a little lost, not quite in training as the students nor as independent as they could perhaps be. Expanding the postdoctoral fellow program, particularly by attracting international fellows, and creating an identity and mentoring program will be valuable. Career advice for post- docs should be a priority. In fact, as NCBS expands, a more formal approach for mentoring junior faculty as they set up their own laboratories for the first time will also be important.

Not all talented and bright PhDs want to become independent investigators. Many aspects of NCBS' functioning will be greatly enhanced by the use of talented PhDs seeking career- paths that are 'unusual'. The management of dedicated teaching-laboratories, the intellectual and academic aspects of organizing courses and meetings, laboratory- and grant- management are some obvious examples where bright PhDs can be transformative. NCBS could consider using attractive contractual positions that recruit such staff in these and other such roles. If carefully chosen and nurtured by NCBS, these scientists can have a fulfilling 'parallel' career and be of immense value to the NCBS community in general and to its faculty in particular.

To facilitate networking and scientific exchange among NCBS scientists and their international colleagues, NCBS should seek ways to provide support for students and faculty, particularly young faculty, to attend international scientific meetings and present their work. This would provide opportunities for broad input and feedback on NCBS science and would facilitate the establishment of international collaborations, while simultaneously enhancing recognition of NCBS investigators. Currently, the cost of international travel and meeting registration is often prohibitive. The current NCBS visiting scholar program is an excellent example of the power of this type of outreach.

With the development of the new BioCluster in contiguous space within the same campus, endless opportunities for collaborations will become a real possibility. The tremendous strength and vitality of NCBS will provide a foundation for development of these institutes even as they initially have a limited number of faculty- members. It will be wise for the BioCluster management to rely heavily on the collective experience of NCBS leadership during the initial phases of their development. Although agencies that support these institutions may vary, they should come to an agreement allowing free exchange of ideas, resources, core facility use, ordering and other activities. At the same time, it will be important for NCBS to retain its unique mission, vision, values, and institutional identity within the BioCluster.

NCBS has already achieved recognition as a premiere biological research institute in India. The next stage in evolution will be enhanced recognition of the excellence at NCBS on the international stage. It will be important for NCBS to actively participate in international collaborations and outreach during the coming period to facilitate broad awareness of its scientific capacity and unique assets. For example, support for formal interactions with scientific societies would facilitate cooperative teaching and scientific exchange that would, at once, inform the global scientific community about the excellent science being conducted at NCBS and enrich the NCBS environment; the NCBS leadership should actively pursue development of these opportunities.

Summary of Specific Recommendations:

1. Maintain and enhance the collaborative intellectual environment.
2. Timing and strategic priorities for growth should be maintained under the autonomous control of NCBS leadership.
3. Ensure rigorous tenure review to maintain high quality of faculty. Extend time to tenure decision.
4. Institute a formal mentoring program for new junior faculty.
5. During the expansion phase of NCBS, maintain the scientific and administrative culture that has developed over the past years.
6. Enhance efforts to increase international visibility of NCBS.
7. Expand the foreign visiting scholar program.
8. Develop a robust Postdoctoral Fellows Program. Develop a mechanism to attract international post-docs. Develop mechanisms to attract graduate students and post-docs trained in the physical sciences and mathematics.
9. Enhance core facilities, increase faculty input, and develop a computational core center.
10. Utilize the expertise of NCBS in planning the gradual growth of the Bioscience Cluster.