

## EXECUTIVE SUMMARY

The goal of the site visit team was to evaluate the progress in year six of the Center for Behavioral Neuroscience (CBN), a Science and Technology Center (STC) funded by the National Science Foundation. The CBN is a comprehensive enterprise that includes two public institutions and six private institutions in the Atlanta metropolitan area. Overall, the Team was extremely impressed with the progress of the program and many aspects of the program were especially noteworthy. First, the fundamental goal of the Center in developing science as a truly collaborative enterprise moving beyond individual laboratories to multiple investigators, often from multiple institutions at multiple sites provides a model for execution of science that can be generalized to other areas of bioscience- from behavioral ecology to biomedical research. Second, the outreach efforts to the broader metropolitan Atlanta community through programs at Zoo Atlanta, Fernbank Museum and the new Georgia Aquarium are truly impressive in bringing science to the people. Third, the integration of research and education between the major research universities and the AUC institutions has made significant progress. Not only have AUC institutions moved toward a model of teacher/researchers for their faculty and provided significant support for neuroscience at their institutions, students and faculty from the major research institutions have become sensitized to the value of diversity and see institutions like the AUC as opportunities for future careers. Finally, the Team continues to be impressed by the tireless and effective leadership of the director Professor Elliott Albers. The recruitment of Professor Walter Wilczynski to be Associate Director for Research promises to be an asset for the future leadership of the Center.

In addition to these positive strengths of the CBN, the Team also identified three areas where more progress is warranted. First, there is a need to develop a clear strategic plan for guiding the future of the Center and preparing the Center for seeking new support after the termination of NSF funding. The Center should evaluate and prioritize their current efforts in research, education and knowledge transfer to identify what they do best and where they can continue to add greatest value in the future. This involves choice among research collaboratories to focus on those that will lead to the greatest advancement of behavioral neuroscience through the unique collaboratory process developed by the Center. Some programs may be better suited for R-01 or program project funding. Three new "collaboratories" were proposed in learning and cognitive processes, reward and reinforcement and sex differences that make good use of the strengths of the faculty, but these areas have been well studied in the past and the Center needs to articulate what new advances are to be expected from their collaborative approach to these areas. Similarly in education the attempt to cover the gamut from kindergarten through postdoctoral training would benefit from setting priorities to determine the best use of the Center's energies. Second, we were disappointed with the information provided about educational effort. Although large numbers of undergraduates of great diversity are involved in

research to some degree, we had no information on the quality and intensity of the research experience. There is a big difference between washing glassware and testing animals to a student collaborating with a faculty member in the entire scientific process from conceptualizing a problem to writing a publishable paper. We think participation in the latter process is more likely to yield students interested in professional scientific careers. We noted relatively less diversity among the graduate and postdoctoral students. More effective recruitment is needed. Finally, some students indicated they had little contact with one another after the initial courses. More mechanisms for bringing students together especially across different laboratories would be valuable.

In conclusion, the team feels that the CBN represents a genuine success in the broad range of STCs supported by the NSF. We applaud its goals and successes to this point and unanimously recommend continued support.

## **INTRODUCTION**

A team of external reviewers and NSF officials visited the CBN at Georgia State University on November 2 – 4, 2005. This is the sixth evaluation of the CBN and is associated with oversight prior to its 7<sup>th</sup> year of funding. The team included the following participants:

### **External members:**

Dr. Charles Snowdon, University of Wisconsin  
Dr. Jeffrey Blaustein, University of Massachusetts  
Dr. Cole Gilbert, Cornell University  
Dr. Shaila Mani, Baylor College of Medicine  
Dr. Glenn Schafe, Yale University  
Dr. Jennifer Swann, Lehigh University

### **NSF members:**

Dr. Bruce Umminger, Senior Staff Scientist, OIA  
Dr. Thomas Brady, Division Director, IOB / BIO  
Dr. Diane M. Witt, Program Director IOB / BIO

The team met at Spelman College with the PI-and CBN Director, Professor H. Elliott Albers (Georgia State University, GSU), co-director of Research Professor Walter Wilczynski (GSU), co-director of Knowledge Transfer Professor Stuart Zola (Emory University, EM) co-Director of Education Dr. Paul Leonard (EM), Deputy Director of Education Ms. Ericka Reid (EM), Dr. Lily McNair (Provost, Spelman College) the Associate Director Dr. Kelly Powell (GSU) as well as several faculty members from Spelman College, Morehouse College, Morehouse School of Medicine, Clark-Atlanta University, Morris Brown College, Georgia Institute of Technology, Georgia State University and Emory University.

Formal presentations were made by the director and each of the co-Directors and the Deputy Director of Education. Brief formal presentations of research were made by Professor Matthew Grober (GSU) and Professor Jocelyn Bachevalier (EM). In addition we had informal discussions with some faculty hired with support of CBN, met with most of the faculty from the AUC and other HBUC institutions and with the four new hires made in the a past year. The team was graciously welcomed by Dr. Lily McNair, Vice Provost for Research at Spelman College.

## **CENTER ACHIEVEMENTS AND PLANS**

### **Research**

#### ***Strengths***

The CBN has continued to make progress in fulfilling their original mission. The members of CBN continue to become increasingly collaborative in their research. The many cross-laboratory and cross-institutional collaborations are an obvious strength of the Center. The collaboratories have, in some cases, responded to the recommendations of last year's site visit. The Reproduction Collaboratory is moving away from a narrow view of reproduction, and they are looking more broadly at how reproductive hormones influence social systems. This collaboratory is doing an excellent job at making connections to the other collaboratories. The Affiliation Collaboratory is doing some very exciting, ground-breaking work on molecular bases of individual variation and the cellular bases of attachment, and the site visit team was encouraged by the recent adoption of imaging technologies by this collaboratory. The team continues to be pleased with the Aggression Collaboratory, which is making the most progress in bridging to investigators at other institutions. The team is encouraged to learn that a new Learning and Cognitive Processes Collaboratory is progressing and looks forward to this collaboratory bridging to other institutions, as it develops. The team recognizes that the Fear Collaboratory has made an attempt to collaborate with GSU faculty on conditioned defeat, and more attempts at interaction with other collaboratories and institutions are strongly encouraged.

It is clear that the Center structure has catalyzed a great deal of new research, as evidenced by the increasing numbers of publications from CBN labs. The team continues to think that the quality and caliber of the trainees is excellent and a continued strength of the Center.

#### ***Concerns and Recommendations***

It still needs to be elaborated how the collaboratories are involving other institutions. While some progress has been made recently by the Fear Collaboratory, it continues to be less integrative than the others. Every attempt

should be made for the Fear Collaboratory to reach out to other collaboratories and institutions to increase their impact on the entire CBN and the field. The Affiliation Collaboratory still has to do more to reach out to other institutions.

The team did not feel that the comparative approach was being used to its best advantage. A concern regarding comparative behavioral neuroscience persists. Although excellent research is being done on many species, it would be advantageous to use the tremendous strengths of the CBN to attack problems from a comparative point of view, as opposed to merely using a variety of species in the research of the individual members. The team encourages the members to select species studied based on the value of those species for addressing a particular topic. For example, evolutionarily conserved processes within a particular model could be emphasized. They might pick a behavior or system and compare and contrast it in species selected for variance on a particular trait, such as social structure. For example, how does conditioned defeat differ in social vs. asocial species?

The CBN has proposed new “Collaboratories” to propel them into the next phase. While this is a strength, the CBN needs to articulate how these new “Collaboratories” are going to move the field forward. It is also essential to articulate how the AUC faculty will fit into the proposed new themes.

## **Education**

### ***Strengths***

The CBN has extensive commitment to K-12 education through a wide and varied collection of programs. They have begun a longitudinal study at a local charter school that will provide valuable, rare information about the impact of educational outreach on students’ academic success. The graduate students appear to be aware of the outreach opportunities and have participated in them. A portion of the venture grants has been dedicated to outreach. One of these grants supported a novel study that will determine if students learn better as research teams or individual investigators.

The Director and Co-director are aware that their current programs are too large and varied to be sustained. Their plan to evaluate, prioritize and pare down their efforts will provide for a more efficient outreach program.

The CBN has initiated a proposal to support undergraduate research modeled after the RISE program. This will extend and enhance the current undergraduate research. To its credit the CBN has articulated its program among the institutions so that undergraduate credits are now able to transfer seamlessly among institutions.

## **Concerns**

### *Management*

Although the hiring of the Deputy Director with a background in education is laudable, the Deputy Director seems to lack direction and focus. More guidance and a more proactive role should be provided by the Co-Director. The program is large and spans many levels and the Co-Director's input is essential to prioritize the programs so they can be efficiently executed. The majority of the undergraduates are coming from the AUC and the Deputy Director should spend more time at these institutions.

A major concern of the team was that the Co-Director and Deputy Director have little or no data about the number of undergraduates in the program and the extent of their involvement in research (e.g. senior theses, co-authorship on papers, abstracts, presentations) after 6 years of funding. There is no tracking of students in the program to determine where they go once they graduate. Such data are critical for evaluating the success of methodologies and programs of the CBN.

### *Mentoring*

There is concern that the graduate program will not be allowed to grow in some years due to a lack of available slots. A funding strategy should be developed that ensures availability in each year. This should include mandatory submission of NSF fellowships, NRSAs, etc.

We did not see obvious evidence of quality mentoring. Students need to be involved in intellectual processes from development of ideas through the publication process. Discussions with graduate students revealed disparity in timely progress towards the degree. Although there is difficulty in coordinating the graduate program across three schools, the CBN should take an active role in establishing a timeline for its students' progress (see below). CBN students should be encouraged to investigate educational opportunities at institutions outside of the Atlanta area to broaden their exposure at different stages of their career.

## **Recommendations**

The team expects that a thorough database documenting the progress of the students, the location of their research in CBN labs, cores and collaboratories and their home institutions etc. will be available at the time of the next site visit. We expect to see a more detailed description of the CBN undergraduate fellows program, including funding levels, selection criteria and expectations for student accomplishments. We encourage the CBN to set its own standards for graduate student progress to maintain funding from the CBN. Such standards

could include annual review of students, oral presentations and timeline for progress (scheduling of qualifying exam, dissertation proposal etc.) This provides additional incentive for students to move along at a rapid pace.

## **Diversity and Development of Human Resources**

### ***Strengths***

The CBN is committed to diversity as evident in its maintenance of the membership and communities served. The current population of graduate fellows (22% minorities and 74% females) is close to and above the national average and remains particularly impressive. Of particular note is CBN's increased visibility in Agnes Scott College by the initiation of seminar series, which has a potential to increase diversity among under represented minority women.

### ***Concerns and Recommendations***

The number of minorities in graduate studies could be vastly improved with stronger recruitment efforts. While a strategy was articulated, it is not being executed. For example, the Co-Director and Deputy Director of Education missed a clear opportunity by not attending the annual biomedical research conference for minority students, which occurred in Atlanta. It is also unclear whether they attended SACNAS and HACU, which occurred in October. The team was disappointed that the undergraduate trainees of CBN were not encouraged to attend these meetings and serve as conduits for recruitment.

The summer program BRAIN can also serve as a recruitment tool if the attendees were from outside of Atlanta geographical area. In general, there is a lack of recruitment within and outside of the Atlanta metropolis and no attention is being paid to the local HBCUs or those in the southeast corridor.

The team is immensely concerned with the disappointingly low numbers of postdoctoral trainees from underrepresented groups. Out of 42 CBN postdoctoral trainees to date, there have been only 3 from under represented groups (1 Native American, 1 Hispanic, 1 African-American).

## **Knowledge Transfer and Outreach**

### ***Strengths***

The Team was very impressed with the level of commitment to, and implementation of, a variety of mechanisms for presenting concepts in behavioral neuroscience to the lay community. Past involvement with the Fernbank

Museum of Natural History and Zoo Atlanta has continued. The proactive involvement of several laboratories with displays in the soon-to-be-opened Georgia Aquarium is outstanding. These year-round static exhibits have the opportunity for continued exposure to hundreds of thousands of visitors. The yearly Neuroscience Exposition was also a great success, and partnering the basic science of the CBN with associations focused on applied aspects of neuroscience was good to help the public see the value of basic research. It is important that all these outreach activities continue to include CBN faculty, post-docs, graduate students, and undergraduate students. Students should be encouraged to participate in these activities (see below), as it is critical that scientists develop early in their career the sense that participation in community outreach is important and expected.

The former CPI/PETNet (Siemens) imaging center represents a valuable facility for all researchers in the CBN. Several new initiatives are also progressing well: The Center for Conservation and Behavior at Georgia Institute of Technology could become a valuable repository for application of research results on non-human primates; Partnering with the NIH/NCRR-sponsored Biomedical Informatics Research Network will provide access to a network critical for sharing bioinformatic information. We look forward to evidence of CBN's involvement in this network at the next site visit.

Full implementation of the Center for Discovery of Effective Knowledge Transfer CDEKT will be a long overdue step toward the development of sorely needed assessment tools to be used by the CBN to evaluate whether certain activities or types of display are effective at communicating information and changing opinions.

### ***Concerns and recommendations***

The team is encouraged that CBN continues the involvement of AUC undergraduate students in these outreach programs. It is essential for their training (as well as for students at majority institutions) as mentioned above, and they can serve as especially salient role models for underrepresented youth in the Atlanta area. We also recommend the required participation of all CBN students and faculty members in at least one outreach event per year.

### **Product Development**

#### ***Strengths***

The team continues to be impressed with the cutting-edge technologies under development by the CBN Innovative Technology initiative. The software packages that have been developed are novel and the Team encourages CBN to move on to the next phase of distribution to a wider scientific community.

Technology for testing animals in their home environments has potential for dramatically changing the way that behavioral studies are conducted in future. The video-tracking system developed in collaboration with Georgia Tech is another great innovation and has wide ramifications to the community at large.

### ***Concerns and Recommendations***

The team is concerned with the *status quo* condition of the video-tracking system developed at Georgia Tech and encourages further development and distribution to the general scientific community. This tool could be used in development of assessment methods in outreach activities, such as at Zoo exhibits and should be actively pursued and put to use.

### **Shared Experimental Facilities**

#### ***Strengths of Cores***

The team continues to be impressed with the efforts to disseminate information regarding the core facilities via workshops. The microarray core at Morehouse Medical School is progressing well. Further, the behavior core has developed innovative software and hardware, which could be useful to a wide scientific community. The team is also pleased that the imaging core has continued to fulfill its promise and served as a “recruitment magnet” for the faculty. The addition of the 9.4 T magnet will be a big advantage for the “value added” nature for this core.

#### ***Concerns & Recommendation***

Based on information that was provided, the team was unable to evaluate the overall usefulness of the cores. For example, a question was raised regarding the extent to which the junior faculty is incorporating the core technologies into their research programs. There was concern over the fee structure for CBN members for using the imaging facility. We encourage a fee structure that provides reduced fees to CBN members, particularly junior faculty. It was also unclear how the three microarray cores at different institutions are being integrated in the training and use by PIs. Furthermore, it is still unclear how each of the cores is serving the various collaboratories, and whether there is balanced usage by the different cores. There is concern that there was limited investment in workshops, manuals, etc. While it is commendable that Dr. Ford is extremely productive in the usage of his core, there is concern that the facility is not being used in the true spirit of a multi-user core. We encourage development of cores that would be useful to a wide range of PIs across institutions. We expect to see evidence of usage of cores by junior faculty and AUC faculty at the next site visit.

## Strategic Plan

The Team received a draft copy of a strategic plan that listed all of the current goals of CBN and provided metrics for monitoring achievement. A SWOT analysis was applied for the Center overall, but a similar SWOT analysis should be applied to each of the major areas. The major threat identified was the loss of funding after NSF support terminates in 2009. However this threat was not addressed explicitly in the plan.

A more detailed and specified strategic plan is essential to provide direction for the future of the Center and to provide specific details that can be used in external fund-raising and working with the provosts and deans that constitute the internal advisory board. Such a strategic plan should include:

1. An explicit evaluation of each of the three main parts of the Center: research, education and outreach to prioritize each of those.
2. Within the research area an explicit evaluation of the current collaboratories as well as the three new proposed areas with respect to how each area is strengthened by the unique collaborative process developed by the Center, how newly proposed areas will strengthen connections with existing collaboratories, which areas are likely to produce the greatest yield in significant results for the future, which areas will continue in the strengthening of relationships with faculty at the AUC and related institutions, and the balance of future work of the center between basic and translational research.
3. Within the educational area which programs at which levels have the highest and which have the lowest priorities. Are Center resources best used at the undergraduate and graduate level or earlier in development? How can the educational resources be best maximized for meeting the Center goals of increasing diversity in behavioral neuroscience? What types of experience-special events, courses, and research experiences are most critical for recruiting to increase diversity?
4. Within knowledge transfer, where are resources best used and which agencies and institutions are most likely to yield high influence given the limitations on the Center resources?
5. Assessment measures to be applied to each aspect of the plan.
6. Specifically addressing the potential resources to support each part of the plan.

The development of a comprehensive strategic plan should involve all stakeholders in the Center: participating faculty from all institutions, representatives of undergraduate, graduate and postdoctoral students and some from the community.

The development of a strategic plan should have high priority, since it will be important in determining the legacy and future of the Center.

## **Rationale and Value Added**

### ***Strengths***

The team agrees with the previous site visits' reports regarding the rationale for the CBN. At end of its sixth year, the CBN continues to refine and fulfill its mission. In many cases, the investigators have moved on from single laboratory research to true collaborative work. The community approach to science has paid off in these laboratories.

The integration of Emory and Georgia State University with AUC continues to progress. A distinct cultural change at AUC is evident in terms of increasing opportunities for research, involvement of students at higher levels of research and with increased diversity of approaches. The reciprocal side of this is that students at Emory and Georgia State are seeing the value of increasing diversity, and they understand the value of teaching in the AUC as being important in their professional development. Despite some enduring asymmetries, it is unlikely that this integration of AUC with Emory and Georgia State would have happened without the development of the CBN.

The CBN is to be commended for many things. First and foremost, research, education and knowledge transfer have become extremely well-integrated. The CBN is an evolving model for real interactions among different labs across campuses that would not have collaborated in the past. The CBN has provided the structural network that typically does not exist and continues to focus on the needs of collaborations and to motivate the collaborations. Without the structural network that has been developed, it is expected that this community type of science would not have happened. The experience of the CBN can be used as a model/prototype of science that will hopefully extend to other institutions and to other levels of analysis, including biomedical and behavioral/ecological science. Finally, they have successfully extended science into other community institutions. The result of many of these positive features is that their national visibility continues to increase.

### ***Concerns and Recommendations***

While the concerns are minimal, it is important to articulate the rationale for identifying these new areas and the process which was used to come to these choices. Similarly, it will be necessary for the CBN to articulate the scientific value expected from each of these new themes. A broader mission and vision statement is critically needed to indicate the distinctive value that this Center adds to behavioral neuroscience.

## **Institutional and Other Sector Support**

The Team was very impressed with the strong commitment by most of the individuals (students, faculty and administration) with whom it met. The Team was pleased that issues relating to credit for faculty doing outreach activities, and parking issues have been worked out.

### **Commitment from the Lead Institution**

We were particularly impressed with the new commitment from GSU to 50% of the salaries of some of the administrative staff as fixed items in the university budget. Between this commitment and cost-sharing for the administrative time for the Director and the Co-Director for Research, as well as space, Georgia State has made a major long-term commitment to the program.

### **Commitment from the Partner Institutions**

We were also especially pleased with the commitment from the faculty and from administrators from Spelman College and Morehouse College. Both institutions have created a number of new faculty lines, and the development of a new Biology curriculum at Spelman with emphasis on Neuroscience is a new strength developed from this STC. We noted a cultural change on the part of AUC institutions since the beginning of the Center to recruit and evaluate faculty as teachers and scientists and with increased support of mentored research of undergraduates, improved laboratory facilities and long term commitment to the Center Goals. AUC faculty members are encouraged to buyout teaching time and to increase research productivity. An unresolved issue is providing technical support for AUC faculty until they are able to obtain independent funding.

Emory University has expressed a commitment to Neuroscience into the future, but the specific details of this commitment were not known at the time of the review.

### **Other Partners**

The Georgia Research Alliance (GRA) is a major supporter of the Center and has provided or committed \$16,000,000 to date. In addition the GRA has created a 501 (c)(3) account to serve as a bank for private funds coming into the CBN that will allow future funds to be distributed to all institutions that are part of the CBN.

Another partner (Siemens) has enhanced the development of a state of the art imaging center at the Yerkes Primate Center.

**Budget**

The Director is listed as 30% academic year effort. However, it is absolutely clear to the Team that the Director is putting far more effort into this project, and he is doing a superb job at managing a very complex center. This figure seemed inappropriately low and irreconcilable to the Team. It is essential that the true level of effort be recognized if the Director is expected to create a legacy and transition into the post-NSF funded era.

**Recommendation**

Despite the reservations mentioned above, the Site Visit Team supports continuation of funding for the Center for Behavioral Neuroscience for Year 7.