

Annual Report - Center for Behavioral Neuroscience

I. GENERAL INFORMATION

Date submitted	8/1/01
Reporting period	11/1/00-10/31/01
Name of the Center	Center for Behavioral Neuroscience
Name of the Center Director	Thomas R. Insel
Lead University	Emory University
Contact information	
Address	954 Gatewood Road NE Atlanta, GA 30322
Phone Number	404-727-8625
Fax Number	404-727-8510
Email Address of Center Director	insel@rmy.emory.edu
Center URL	www.cbn-atl.org
Names of participating institutions, role, and (for each institution) name of contact person and other contact information	
Institution 1 Name	EMORY UNIVERSITY
Address	954 Gatewood Rd, Atlanta, GA 30329
Phone Number	(404) 727-8625
Fax Number	(404) 727-8070
Email Address of Center Director	Thomas R. Insel, M.D. Insel@rmy.emory.edu
Role of Institution at Center (1 sentence)	Lead institution
Institution 2 Name	CLARK-ATLANTA UNIVERSITY
Address	223 James P. Brawley Dr., Atlanta, GA 30314
Phone Number	(404) 880-8131
Fax Number	(404) 880-6181

Email Address of Center Director	Isabella Finklestein, Ph.D. Ifinkels@cau.edu
Role of Institution at Center (1 sentence)	Provides faculty, undergraduate, and graduate students for research/education effort.
Institution 3 Name	GEORGIA STATE UNIVERSITY
Address	24 Peachtree Center Avenue, #402, Atlanta, GA 30303
Phone Number	(404) 651-2946
Fax Number	(404) 651-2509
Email Address of Center Director	Elliott Albers, Ph.D. Biohea@panther.gsu.edu
Role of Institution at Center (1 sentence)	Provides faculty, undergraduate, and graduate students for research/education effort, home of systems and behavioral cores.
Institution 4 Name	GEORGIA INSTITUTE OF TECHNOLOGY
Address	801 Atlantic Avenue, Atlanta, GA 30332-0363
Phone Number	(404) 894-4738
Fax Number	(404) 894-4243
Email Address of Center Director	Steve DeWeerth, Ph.D. Steve.deweerth@ee.gatech.edu
Role of Institution at Center (1 sentence)	Provides computational core and links to bioengineering.
Institution 5 Name	MOREHOUSE COLLEGE
Address	830 Westview Dr., SW, Atlanta, GA 30314
Phone Number	(404) 215-2610
Fax Number	(404) 507-8627
Email Address of Center Director	J.K. Haynes, Ph.d. Jhaynes@mh.edu
Role of Institution at Center (1 sentence)	Provides faculty and undergraduate students for research/education effort.
Institution 6 Name	MOREHOUSE SCHOOL OF MEDICINE
Address	720 Westview Dr. SW, Atlanta, GA 30310
Phone Number	(404) 756-5786
Fax Number	(404) 752-1041
Email Address of Center	Peter MacLeish, Ph.D.

Director	Macleip@msm.edu
Role of Institution at Center (1 sentence)	Provides faculty, graduate, and undergraduate students for research/education effort via Neuroscience Institute.
Institution 7 Name	MORRIS BROWN COLLEGE
Address	643 MLK, Jr. Drive, Atlanta, GA 30314
Phone Number	(404) 739-1101
Fax Number	(404) 688-5985
Email Address of Center Director	Jeanne Stahl, Ph.D. Jeane.stahl@morrisbrown.edu
Role of Institution at Center (1 sentence)	Provides faculty and undergraduate students for research/education effort.
Institution 8 Name	SPELMAN COLLEGE
Address	350 Spelman Lane, SW, Atlanta, GA 30314
Phone Number	(404) 223-7565
Fax Number	(404) 215-7863
Email Address of Center Director	Pamela Scott-Johnson, Ph.D. Pscott-j@spelman.edu
Role of Institution at Center (1 sentence)	Provides faculty and undergraduate students for research/education effort.

1b. Biographical Information (Appendix A - for biographies)

Newly recruited faculty:

Emory University – Kerry Ressler, Stephan Anagnostaros

Georgia State University – Matthew Grober, Deborah Baro

Georgia Institute of Technology – Steven Potter

Morehouse School of Medicine – Byron Ford

Morehouse College – Melissa Demetrokopoulos (science education)

Spelman College - Dolores Bradley

Current faculty joining the CBN:

Emory University- Marijn Brummer, Stephan Hamann, John Scott, Krish Sathian,
Phillipe Rochat

Morehouse School of Medicine – Gianluca Tossini

Clark Atlanta – Fernando Gonzalez

2. Executive Summary

The Center for Behavioral Neuroscience will be completing its second year of operation on October 31, 2001. If the first year was dedicated to launching the program, in this second year we are finally under sail with a number of innovative research and educational programs. Our major goals for the second year were (a) to recruit new faculty, students, and post-doctoral fellows, (b) to develop collaborative research teams across disciplines and institutions, and (c) to create new graduate and undergraduate courses and research opportunities. The Center's development has been charted on our Website (www.cbn-atl.org), our quarterly bulletin "Synapse", as well as LearnLink, a central electronic interface connecting all faculty at the participating institutions.

The strategic plan, completed 2/00, detailed the vision, goals, and performance indicators for the Center. In the first year, we recruited an administrative team, including deputy directors, administrative assistants at Emory and Georgia State, and a financial manager. One administrative assistant was replaced in this second year (Diane Moody replaced Lexi Hautau at GSU). Several additional faculty who were not part of the original proposal joined the Center. In addition to the three faculty members recruited from outside in Year 1 (Drs. Muly, Rainnie, and Parent), in Year 2 we added Drs. Ressler, Anagnostaros, Grober, Baro, Bradley, and Ford. Additional searches are underway for behavioral neuroscientists at Emory University, Georgia State University, and Morehouse College. In Year 2, we also lost several faculty (notably Dr. Melissa Harrington at Morehouse College and Dr. Donald Giddens at Georgia Tech). For the subcontracts, Principal Investigators were changed from Harrington to Haynes at Morehouse College and from Giddens to Deweerth at Georgia Tech.

In the second year, we note progress on each of the main components. In the research thrusts, we have active programs in affiliation, aggression, fear, and reproduction. These teams include investigators from all Center institutions and are supported by venture grants for innovative collaborations, post-doctoral fellows, and funds provided to each collaboratory. Currently, 4 post-doctoral fellows and 7 graduate students bridge CBN labs. A series of "amygdala meetings" in the fall, a February research retreat, a May symposium, and a day long July symposium on aggression were helpful for generating collaborative projects and moving the research forward. The first CBN publications have appeared in Nature Genetics, Journal of

Neuroscience, Behavioral Neuroscience, Hormones and Behavior, Nature Reviews Neuroscience, Current Opinions in Neurobiology. The CBN has sponsored several symposia at national meetings as well as hosting a monthly seminar series, a spring symposium (with the Atlanta Chapter of the Society for Neuroscience), and a technology workshop (planned for Oct, 2001).

An important aspect of Center research is the development of tools for behavioral neuroscience. In Year 1, cores were established for Molecular, Cellular, Systems, Computational, Imaging, and Behavioral studies. With the assistance of the Georgia Research Alliance, the Molecular Core developed a microarray production facility, managed by Dr. Scott Hemby, which has produced chips with 5000 mouse genes. The Cellular Core, with the assistance of Dr. Stuart Leff, has worked on adeno-associated and lenti-viral vectors for gene delivery. Under Dr. Ioannis Constantanidis, the Imaging Core rebuilt a 4.7T NMR to use for small animal fMRI. In addition, the Imaging Core is awaiting arrival of a MicroPET camera for small animal functional and receptor imaging. Finally, our Behavioral Core is establishing lab space at Morris Brown College for studying the development of social dominance in a rat visible burrow system.

The Educational component was able to build on several existing programs to demonstrate rapid progress in the first year. In this second year, the graduate program was inaugurated with 7 students (5 at GSU and 2 at Emory) and two core courses. At the undergraduate level, an exciting new evening seminar series was developed to interest first and second year students (mostly from AUC schools) in neuroscience. We developed new courses in behavioral neuroscience at Morehouse and Spelman and we hosted summer research opportunities for 23 students and 25 K-12 teachers. A number of programs were developed to bring behavioral neuroscience to a wider public.

The CBN's major challenge this year has been bridging the cultures of the various participant institutions. In fact, we foresaw the problems inherent in working with 8 schools and developed an Internal Advisory Board in 1999 as a forum for the provosts from each of the partners to discuss the needs of their schools and to understand the mission of the CBN. What we did not foresee was that nearly all of these provosts would depart by Year 2, so that the task of explaining our mission has become a continuous process. In Year 2, the AUC faculty continue to be under-represented in the collaboratories. With few notable exceptions, either there are insufficient faculty or the faculty at these predominantly undergraduate institutions do not have the release time to participate in a substantive way in the research program.

The goal of recruiting new behavioral neuroscience faculty at all of the schools has run up against a number of other needs at each institution. In June, 2001 we created a Task Force to address the problem of how each of the AUC institutions would participate in the CBN. A draft report from this Task Force should be available for the September, 2001 site visit. **We expect that this Task Force will alter our sub-contract budgets for Year 3. Although the total funds for subcontracts should not change, funds within these budgets may need to be reallocated for us to accomplish Center objectives. Rather than preempt the Task Force recommendations, we are submitting original budgets, including a large pool of unobligated funds from the subcontracts. As the task Force completes its plan, these budgets will almost certainly need to be modified before November 1.**

II. RESEARCH

1a. Research Objectives

There are two general objectives to the research program of the CBN: (a) to develop interdisciplinary, comparative teams for studying the neurobiology of social behavior and (b) to develop innovative tools for studying neural processes underlying social behavior. The teams are organized in four collaboratories or thrusts, each of which involves investigators from the various CBN institutions. The development of these collaboratories is, by itself, an experiment in a new model for interdisciplinary science. The first year was spent largely in developing this concept through meetings and venture projects.

Goals for our second year (from Strategic Plan - 2/00) were

- have collaboratories functioning as discovery teams
- matriculate first graduate students
- hold scientific retreat to assess progress
- continue monthly seminar series
- host national meeting on neurobiology of social behavior
- recruit 10 summer students/teachers in collaboratories

In our second year the collaboratories embarked on their first projects (see tables below for each thrust) with specific projects supported by the CBN venture grant program. Graduate students (n = 7) and post-doctoral fellows (n= 4) served as vectors across the various labs that make up each collaboratory. In our scientific retreat in February, with over 50 attendees from all of the participating institutions, we reviewed specific accomplishments and plans for each collaboratory. Our monthly seminar series was enlarged to involve the AUC schools as well as Emory (see list of speakers below). The CBN organized major symposia at four national meetings (Society for Neuroscience, Winter Conf on Brain Research, American Neuroendocrine Society, and Anxiety Disorders of America Research Satellite Meeting) and held a full day scientific symposia in Atlanta on Olfactory Coding, Plasticity, and Learning (May 4, 2001 - Fear Collaboratory) and the Neural Basis of Aggression (July 19, 2001 - Aggression Collaboratory). Summer students for the 2001 year are listed in the Education section of this Annual Report. Our seminar series is summarized below under professional development (III – 2c). Critical to our progress, the venture grant system has promoted innovative projects. Venture grants for this past year were awarded in February and July, following review by both the venture grant committee and the executive committee. (specific venture grants shown below)

The second major component is the core program, developing research tools that support the collaboratory efforts. These cores are focused in six areas: molecular, cellular, systems, imaging, computational, and behavioral. Each of them has a target technology (see table below). In addition, the cores are expected to support an annual workshop (planned for Imaging in 10/01), involve students in technology development, and promote technology transfer. The cores also provide a service function by assisting students and collaborators with standard techniques (in situ hybridization, immunocytochemistry, tract tracing , etc.). Commercial and industrial partnerships are being developed from these cores.

The performance and management indicators for our research plan are (a) the innovation, inter-disciplinarity, and quality of scientific projects as measured by publications, citations, and additional funding; (b) integration of collaboratories and cores as measured by joint projects; (c) integration of research and education as measured by involvement of students and post-doctoral fellows in projects and seminars; and (d) development of a functional center as measured by recruitment, participation, and national recognition.

1b. Problems

In general, our program works. A number of innovative projects are underway, many of our investigators have used CBN resources to move in new, exciting directions, and the first papers are appearing (over 40 this year). Collaboration is sometimes slower than a solo project, but we continue to believe that the results will justify the effort. Our major problems can be summarized in three areas.

Personnel. The CBN has a large faculty, but relatively few full-time investigators considering such an ambitious effort. In some areas, such as affiliation and fear, we could exploit very productive teams that were poised to use the additional resources that came with the Center. However, in aggression and reproduction, where we have fewer active scientists, research programs have been slower to develop. To address the personnel problem we have worked to educate the current faculty while working hard to recruit new faculty. In the fall, the fear collaboratory sponsored a weekly amygdala meeting to bring Center faculty, post-docs, and students together around a single topic. This series, attended by approx. 40 participants from institutions across the CBN, brought everyone up to date on the latest findings on the anatomy and physiology of the amygdala relevant to fear, aggression, affiliation, and reproduction. In July, the aggression collaboratory held a full day conference with national experts to seek advice on research directions. The addition of Fernando Gonzalez from

Morris Brown College and the recruitment of Deb Baro from Univ of Puerto Rico will provide important new talent for this collaboratory. The reproduction collaboratory has also been actively recruiting new faculty (offers to Matthew Grober, Emilie Rissman, Jill Becker). For the CBN to reach its potential, several active investigators need to be added, especially to support molecular and cellular studies in reproduction and aggression.

Cores. Our core programs are uneven. We have put considerable resources into the molecular core to produce microarrays for the CBN. A number of unexpected technical problems have delayed this core. The first mouse arrays are just available, 6 months behind schedule. The imaging core has acquired some powerful tools, including new 3T and 4.7T MR and, later this summer, a microPET camera. However, we do not yet have a full-time technician to assist investigators who want to use this equipment. This appointment has been delayed while Emory finalized its recruitment of a new leader in its imaging program. We expect that this recruitment will be complete by August 15, 2001. Finally, the computational core, always a distance from the heart and soul of the Center, still needs to be integrated with the collaboratories. The recruitment of Steve Potter from CalTech will help to bridge the computational core with the fear collaboratory as Potter will bring some extraordinary capabilities for *in vivo* imaging of the olfactory system.

Collaboration. The CBN was founded on the importance of collaboration for making breakthrough discoveries in an interdisciplinary area like behavioral neuroscience. In fact, creating collaboration is like herding cats. There were two major impediments. Some of our faculty were primarily teachers and had neither the time nor, in some cases, the training to contribute to an ambitious neuroscience effort. Conversely, many of our most productive investigators were already overly committed to their own funded research efforts and could not begin to stretch into new research collaborations. This situation, which looked dire last July, was partly alleviated by the arrival of post-doctoral fellows, graduate students, and new faculty. But the challenges to collaboration remain. We will need to be vigilant to ensure that the collaboratories create novel, interdisciplinary research opportunities rather than simply expanding the research of a lead investigator into a mega-lab. We are still a long way from having the cross-institutional teams of investigators we originally envisioned, as two of our collaboratories are largely composed of Emory faculty and students.

2. Description of Research Thrusts

Thrust Name	Affiliation collaboratory	
PI Name	Larry Young	
<u>Participants</u> (add rows as necessary)		
	Name	Status (Faculty, Student, Staff, Postdoc etc.)
1	Thomas Insel	Faculty - Emory
2	Timothy Bartness	Faculty - GSU
3	Dennis Liotta	Faculty - Emory
4	Darryl Neill	Faculty - Emory
5	Lorin Freedman	Faculty- Emory
6	Don Rainnie	Faculty- Emory
7	Steve Phelps	Post-doc- Emory
8	Hemu Nair	Post-doc- Emory
9	Darlene Francis	Post-doc- Emory
10	Jennifer Ferguson	Graduate student- Emory
11	Miranda Lim	Graduate student- Emory
12	Elizabeth Hammock	Graduate student- Emory
Funding (reporting year)		
	NSF	
	Collaboratory Funds	\$ 15,000
	Venture grants (Projects 1, 2, and beh core)	\$ 64,645
	Post-doctoral support (Phelps)	<u>\$ 27,500</u>
	TOTAL	\$107,145
	Other	Direct costs
	NIMH R29 and NAAR (Young)	\$155,165
	NIMH RO1 and NARSAD (Insel)	\$250,769
	NIH (Liotta)	\$199,207
	NIMH K08 (Freedman)	\$117,348
	Cure Autism Now (Francis)	\$ 40,000
	NIMH NRSA (Ferguson)	\$ 20,500
	Emory Grad stipends (Hammock, Lim)	<u>\$ 37,000</u>
	TOTAL	\$819,989
Funding (anticipated for next year)		
	NSF	Current
	Supplement for OTR-KO studies	+ \$38,522

Other	
NIMH KO2 (Young)	\$205,420
NIMH R21/R01 (Insel)	\$350,769
NIMH K08 - (Freedman)	\$118,161
NIH (Liotta)	\$186,877
Cure Autism Now (Francis)	\$ 40,000
NIMH NRSA (Ferguson)	\$ 10,500
NIMH NRSA (Lim)	<u>\$ 19,000</u>
TOTAL	\$930,727

Data from members of this collaboratory have demonstrated i) there is a relationship between neuropeptide receptor distribution in the brain and affiliative behavior, ii) there are specific brain regions involved in the neuropeptide regulation of affiliative behavior, and iii) early life experiences can alter both neuropeptide receptor expression and affiliative behavior in adults. The research projects of this collaboratory, briefly outlined below, expand on these observations.

Project 1. Neuroanatomical and cellular localization of oxytocin and vasopressin receptors and correlation with social behavior. With the aid of the **Cellular Core**, we are developing antibodies for localizing oxytocin (OT) and vasopressin (AVP) receptor containing neurons in rodent, non-human primate, and human brains. **(Post-doc project – Phelps)** We are also using receptor autoradiography to determine the distribution of these receptors in the brains of several primates with various social organizations. A major goal is to develop PET ligands, which will allow us to examine OT and AVP receptors in vivo. **(Venture grant 7/00 - Francis)** This project, developed with computational models from the Emory Dept. of Chemistry (Liotta), will ultimately require expertise from the **Imaging Core**.

The collaboratory is also using PCR to generate *in situ* hybridization probes that can be used to localize and quantify OT and AVP receptor homologues in several non-mammalian species. These will be used in collaborative projects involving several faculty outside of the CBN specializing in bird, fish and amphibian behavioral neuroscience. **(Collaboratory funds)**

Investigators: Young, Insel, Freedman, Liotta, Phelps, Francis, Lim

Project 2. Cellular mechanisms of social attachment and social recognition. Using viral vector gene transfer and antagonist studies, we have demonstrated that AVP and OT receptors in the ventral striatum play critical roles in pair-bond formation in prairie voles. (Pitkow et al., in press) Similar studies have shown that OT receptors in

the medial amygdala are necessary for social recognition in mice.(Ferguson et al., in press) Using double- and triple-labeled immunocytochemistry for the neuropeptide receptors, other neurotransmitters, and Fos in combination with tract tracing techniques (**Systems Core**), we are characterizing the neurotransmitter phenotypes and connectivity of the neuropeptide receptor containing neurons that are active during these behavioral processes. Electrophysiology experiments will also be used to characterize the effects of neuropeptides on the receptor containing neurons.(**Venture grant 2/01**)

Investigators: Young, Bartness, Ferguson, Rainnie, Hammock

Project 3. Genomic changes associated with changes in social behavior. cDNA microarray (**Molecular Core**) analysis is used to examine the profile of changes in gene expression associated with pair bond formation, social recognition, and maternal care in the brain regions or neurons involved in regulating these behaviors.(**Core and Collaboratory funds**)

Investigators: Young, Insel, Francis, Hemby

Project 4. The effects of early life experience on affiliative behavior and neurochemistry. Studies in rats, voles and monkeys have demonstrated that individual differences in early life experience alters adult social behavior. We are examining the effects of different levels of parental care on neuropeptide receptor expression using receptor autoradiography, as well as with cDNA microarrays (**Molecular Core and Post-doc project – Francis**).

Investigators: Hemby, Plotsky, Francis

Project 5. Reinforcement and pair bond formation. In monogamous species, OT and AVP receptors are found in reward pathways. To determine if these species respond to non-social cues for reward, ICSS, CPP, and other paradigms for studying reward will be evaluated in prairie voles and meadow voles.

Investigators : Neill, Young, Insel

Thrust Name	Aggression collaboratory	
PI Name	Donald Edwards	
<u>Participants</u> (add rows as necessary)		
	Name	Status (Faculty, Student, Staff, Postdoc etc.)
1	Donald H Edwards	Faculty - GSU
2	H. Elliott Albers	Faculty - GSU

3	Kim Huhman	Faculty - GSU
4	Tim Moore	Faculty- Clark Atlanta
5	Melissa Harrington	Faculty - Morehouse College
6	Paul Plotsky	Faculty - Emory
7	Marise Parent	Faculty - GSU
8	Fernando Gonzalez	Faculty - Morris Brown
9	Paul Katz	Faculty - GSU
10	Jeanne Stahl	Faculty - Morris Brown
11	Melissa Demetrikopoulos	Faculty - Morehouse
12	Charles Derby	Faculty - GSU
13	Lorin Freedman	Faculty - Emory
14	Deborah Baro	Faculty - GSU
15	Alicia Faruzzi	Student - GSU
16	Al Harmon	Student - GSU
17	Cha-Kyong Song	Student - GSU
18	Aaron Jasnow	Student - GSU
19	Heather Caldwell	Student - GSU
20	Albert Dean	Student - GSU
21	Katema Paul	Student - GSU
22	Fadi Issa	Student - GSU

Funding (reporting year) (FY 2000)

NSF:		
	Collaboratory funds	\$ 15,000
	Ventures	\$ 70,782
	IBN 0077474 (Derby)	\$121,000
	IBN 9726819 (Edwards)	\$ 52,013
	TOTAL	\$258,795
	NIH: R01MH058789 (PI: Albers)	\$134,603
	NIH: R01DC000312 (PI: Derby)	\$128,800
	NIH: R01NS041173 (PI: Parent)	\$140,829
	NIH: F31NS041857 (Stud Minority: Paul)	\$31,225
	NIH: R01 NS26457 (PI: Edwards)	\$115,233
	NIH: R01 NS26457 (Suppl)(Edwards)	\$ 50,000
	NIH: R01 MH62167 (PI: Edwards)	\$150,000
	NIH: R01MH050113 (PI: Plotsky)	\$243,230
	NIH: R01MH062641 (PI: Albers)	\$279,120
	TOTAL	\$1,273,040

Funding (anticipated for next year) (FY 2001)	
NSF:	Approx same as current year
Other:	
NIH: R01MH062641 (PI: Albers)	\$195,174
NSF IBN 9726819 (PI: Edwards)	\$ 53,050
NIH: R01 NS26457 (PI: Edwards)	\$175,000
NIH: R01 MH62167 (PI: Edwards)	\$150,000
NSF: IBN 0077474 (PI: Derby)	\$122,000
NIH: 5R01MH050113-07 (PI: Plotsky)	\$250,532
NIH: F31MH01290 (Student: Jasnow)	\$21,300
NIH: F31MH012713 (Student: Musolf)	\$24,658
NIH: R24DA007256 (PI: Stahl)	\$126,089
Total	\$1,117,803

Plan Development: During the past year, this collaboratory has focused on aggression and related behaviors that are released in agonistic encounters between pairs of naive animals during social hierarchy formation. A series of collaboratory meetings led to development of a strategic plan in which we proposed to follow changes in behavior, amine and peptide receptors, amine and peptide levels, stress hormones, and neurogenesis through the stages of dominance hierarchy formation. Both rodent and crustacean models will be used. Both social stress (isolation) and serotonin depletion have both been shown to reduce the rate of adult neurogenesis among olfactory interneurons in crayfish and lobsters, while social isolation has been shown to reduce serotonin immunoreactivity in the crayfish CNS. We are pursuing the relationships among social stress, CNS serotonin content, neurogenesis among adult olfactory neurons, and olfactory learning and discrimination in crayfish. Ongoing and proposed experiments include:

Project 1. The effect of changes in social rank on serotonergic systems Levels of serotonin, serotonin metabolites, and rates of serotonin synthesis, release, uptake and clearance will be measured in specific neurons and brain regions using quantitative ICC and microdialysis with HPLC. Thus far, we have shown that the modulatory effects of serotonin on an identified interneuron in crayfish depend on the pattern of exposure of the cell to the drug (Teshiba et al., 2001). Different effects occurred depending on the concentration, rate of application and duration of application. The

neuron is modulated by serotonin released through synaptic, paracrine and endocrine mechanisms that may provide corresponding different patterns of exposure.

Investigators: Edwards, Moore, Katz (Venture grant 2/01)(Collaboratory funds)

Project 2. Changes in serotonin and peptide receptors. Serotonin receptors in crayfish and arginine vasopressin receptors in hamsters have been shown to mediate social dominance behavior and aggression in crayfish and hamsters. This project will clone and sequence serotonin receptors in crayfish and AVP receptors in hamsters, and then use RT-PCR and immunocytochemical techniques to pursue changes in expression of the receptors with social experience. 5HT and CHH receptors in crustaceans and V1A receptors in rodents will be cloned and sequenced (**Molecular Core**). Quantitative methods will determine levels and patterns of expression of receptors in targeted neural tissues. As of 7/01, a crayfish 5-HT receptor homologous to the 5HTdro1 receptor has been cloned and sequenced. Immunoreactive labeling indicates that it is specific to olfactory interneurons in the brain, sets of identifiable neurons in other parts of the CNS, and blood vessels. Efforts to clone and sequence additional crustacean 5HT receptors and hamster AVP receptors are under way.

Investigators: Albers, Baro, Edward, Faruzzi, Caldwell

Project 3. Changes in neurogenesis. BrdU labeling will be used to identify and measure rates of neurogenesis in hamster and crayfish brain regions. (**Venture Grant 2/01**)

Investigators: Edwards, Song, Derby, Baro

Project 4. Changes in sensory discrimination and learning. Olfactory discrimination and learning tests will be used to identify the effect of status changes on olfactory processing and memory (**Behavior Core**). Recently, we identified behavioral and electrophysiological changes in the excitability of discrete neural circuits for escape in crayfish during dominance hierarchy formation (Herberholz et al., 2001). The changes in neuromodulation responsible for the changes in excitability are being sought. In related work Katz and colleagues are studying homologous serotonin neurons in *Tritonia*. (**Venture grant 2/01**)

Investigators: Derby, Edwards, Katz

Project 5. Consequences of defeat and changes in resource holding potential. The resource holding potential of individual dominant, subordinate and control animals will be measured in resource competition experiments with groups of naive animals (**Behavioral Core**).

Investigators: Gonzalez, Stahl, Huhman, Albers, Parent

Project 6. Neural correlates of prey tracking in a carnivorous snail. In an attempt to develop a novel model for the study of predatory behavior, we investigated neurons responsible for prey tracking in a carnivorous snail. **(Venture grant – 7/00)**

Investigators: Harrington, MacLeish

Project 7. Collaboratory Workshop: A Workshop on Aggression was held at the Indian Creek Lodge of Georgia State University on July 18, 2001, and featured talks and discussion by both visiting and resident investigators, and students, including Hans Hofmann, Harvard University; Manuela Martinez, Univ. Valencia; Klaus Miczek, Tufts University; Allan Siegel, New Jersey Medical School; Steve Suomi, NICHD; Lew Baxter, Univ. Alabama, Birmingham; and Donald Edwards, Georgia State University. **(Funded by GSU)**

Thrust Name	Fear Collaboratory	
PI Name	Michael Davis	
Participants (add rows as necessary)		
	Name	Status (Faculty, Student, Staff, Postdoc etc.)
1	Changjun Shi	Faculty - Emory
2	Larry Young	Faculty- Emory
3	Don Rainnie	Faculty- Emory
4	Jim Winslow	Faculty- Emory
5	Kerry Ressler	Faculty- Emory
6	David Walker	Faculty- Emory
7	Barbara Rothbaum	Faculty- Emory
8	Pam Scott-Johnson	Faculty- Spelman
9	Kim Huhman	Faculty- GSU
10	Scott Hemby	Faculty- Emory
11	Gayla Paschall	Post-Doc- Emory
12	Hemu Nair	Post-Doc- Emory
13	Kwok-Tung Lu	Post-Doc- Emory
14	Donna Toufexis	Post-Doc- Emory
15	Lisa Parr	Post-Doc- Emory
16	Aaron Jasnow	Pre-Doc- GSU
17	Matia Banks	Pre-Doc- GSU
18	Lisa Stanek	Pre-Doc- Emory
18	Karen Myers	Pre-Doc- Emory

20	Bethany Brooks	Pre-Doc- Emory
21	Ebony Glover	Pre-Doc - Spelman
22	Alisa Gutman	Pre-Doc- Emory
Funding (reporting year)		
	NSF	
	Collaboratory funds	\$ 15,000
	Venture grants	\$ 113,322
	Post-doctoral support	<u>\$ 82,500</u>
	TOTAL	\$ 210,822
	Other:	
	MH 47840, MH 57250, MH 58922, MH 59906, P50 MH52384, the Woodruff Foundation (Davis)	\$471,096
	Pfizer Award (Ressler)	\$ 65,000
	MH57016 R29, NARSAD, Whitehall Foundation, RW Johnson (Rainnie)	\$146,979
	MH R01 (Huhman)	\$117,684
	MH R01 (Rothbaum)	\$171,333
	MH R01 (Winslow)	\$166,281
	MH NRSA (Jasnow)	\$ 21,300
	Emory student stipend support (Stanek, Gutman, Brooks, Myers)	<u>\$ 70,500</u>
	TOTAL	\$1,230,173
Funding (anticipated for next year)		
	NSF	Approx. same as current year
	Other	Current year + application for approx. \$700,000 planned for 2/1/02
	All of the above + Davis, Rainnie, Ressler, Winslow applying for 3 interactive R01s	

The fear collaboratory grew out of our interest in potentiated startle as a behavioral model of fear in the rat and the amygdala as a likely site for fear responses to be organized. In the fall, we hosted a series of meetings on the amygdala with faculty and students from across the CBN. One of the purposes of these meetings was to generate collaborative projects to expand the scope beyond studies of the amygdala and potentiated startle by studying startle in primates, developing more ethologically-relevant models, and integrating the extraordinary tools from studies of olfactory plasticity and learning into research on the amygdala and fear conditioning.

Accordingly, the fear collaboratory initiated a number of new projects for the study of fear and anxiety in rodents and primates. These include:

Project 1. Development of a reliable way to measure acoustic startle amplitude, fear-potentiated startle and pre-pulse inhibition in rhesus monkeys. This has now been accomplished and is being prepared for publication. We also found that peer-reared monkeys had higher mean startle amplitudes than mother-reared rhesus monkeys but normal pre-pulse inhibition. This work is currently under editorial review. It will form the necessary pilot data for part of a new R01 application to NIH that will be submitted next year. In addition, we have just performed our first successful recording in the amygdala from brain slices in rhesus monkeys along with filling of recorded cells. This will form the basis for more pilot data, also for part of a second, related R01 application to NIH that will be submitted 2/02.

Investigators: Rainnie, Shi, Davis, Winslow, Parr (Venture Grant- 7/00 and Post-Doc project - Parr)

Project 2. Use of procedures derived from work on the fear-potentiated startle effect in rats to evaluate the degree to which social defeat in hamsters may result from fear conditioning during the defeat episode. These include local infusion of glutamate antagonists, GABA agonists and viral vector-mediated gene transfer in the amygdala during either the acquisition or expression of conditioned defeat.(Jasnow et al., in press) Thus far we have found that local infusion of NMDA or non-NMDA antagonists or muscimol into the amygdala block both the expression and acquisition of conditioned defeat. Early results also suggest that over-expression of the transcription factor CREB in the amygdala in hamsters facilitates the acquisition of conditioned defeat as it does the acquisition of fear-potentiated startle.

Investigators: Huhman, Davis, Shi, Jasnow (Venture grant 7/00 and 7/01)

Project 3. Development of fear-potentiated startle using odor cues. This work has shown robust, rapid fear conditioning using amyl acetate that is directly proportionate to the concentration of the odor, can occur with a single training trial, and lasts at least 40 days following 10 pairings. This paper is now in press in Behavioral Neuroscience.

Investigators: Paschall, Davis (Collaboratory funds)

Project 4. Two projects have screened for genes induced by fear conditioning. Using a small array with mRNA from the basolateral amygdala following fear conditioning, a total of 23 genes were investigated in trained vs. home cage controls. No differences were seen in these 23 genes. However, it was possible to obtain

enough RNA from dissected basolateral amygdala to carry out this initial project. Investigators: Shi, Hemby, Davis. (**Molecular core**) Using *in situ* hybridization to explore gene induction following fear conditioning as well as extinction in several rodent brain sections, a total of 40 genes have been analyzed. These were chosen on the basis of being implicated in other studies of plasticity such as long term potentiation in hippocampal slices. Several genes have been found to be activated in the amygdala and piriform cortex, habenula and other areas following fear conditioning. A few seem to be preferentially activated following fear extinction.

Investigators: Ressler, Myers, Stanek, Davis (Collaboratory funds)

Project 5. Anatomical tracing of the inter-connections between the amygdala and the bed nucleus of the stria terminalis (BNST). These have shown that the posterior basolateral amygdala projects heavily to not only the central nucleus of the amygdala but also the lateral division of the BNST. In addition, the lateral division of the central nucleus of the amygdala projects to the lateral BNST. In turn, the lateral BNST projects to the medial division of the central nucleus, which is the part of the central nucleus that projects to the brainstem involved in specific signs of fear and anxiety.

Investigators: Shi, Davis (Venture grant)

Project 6. Use of adenyly-associated virus to over-express CRF-1 receptors in the BNST to see if this would produce a persistent increase in acoustic startle amplitude. This work is just beginning.

Investigators: Young, Walker, Nair, Davis (Post-doctoral project - Nair)

Project 7. Investigation of fear potentiated startle and light-enhanced startle in female rats and the role of estrogen in these measures of fear and anxiety. This work is just beginning. *Investigators: Toufexis, Banks, Paschall, Davis. (Post-doctoral project - Toufexis)*

Project 8. Investigation of the role NMDA receptors in the medial nucleus of the amygdala, the basolateral amygdala and piriform cortex in fear-potentiated startle using olfactory and visual cues. Thus far we have found that local infusion of the NMDA antagonist AP5 significantly reduces the acquisition of fear potentiated startle using an olfactory cue, whereas local infusion into the medial nucleus of the amygdala or the piriform cortex does not. Lesions of the medial amygdala also fail to block fear potentiated startle to a visual stimulus.

Investigators: Walker, Paschall, Shi, Davis (Collaboratory funds)

Project 9. Development of a special slice preparation where it is possible to electrically stimulate the amygdala and record from cells in the BNST. This has now been seen in about 1 out of 5 slices indicating that the technique can be used but needs to be perfected. Once it is it will allow a detailed electrophysiological characterization of the connectivity between the amygdala and the BNST.

Investigators: Rainnie, Shi. (Rainnie start-up)

Project 10. Test of whether D-cycloserine will augment exposure therapy to fear of heights using a well-controlled virtual reality test protocol. This work is a direct result of preclinical data showing that the NMDA agonist D-cycloserine facilitates extinction of fear-potentiated startle, a paper now under editorial review.

Investigators: Lu, Ressler, Rothbaum, Walker, Davis (Venture grant 7/01)

Thrust Name	Reproduction collaboratory	
PI Name	Kim Wallen	
	Name	Status (Faculty, Student, Staff, Postdoc etc.)
1	Kim Wallen, Ph.D.	Faculty - Emory
2	David Edwards, Ph.D.	Faculty - Emory
3	Sean Kimbro, Ph.D.	Faculty - Clark Atlanta
4	Andrew Clancy, Ph.D.	Faculty - GSU
5	Lorin Freedman, Ph.D.	Faculty - Emory
6	Stephan Hamann, Ph.D.	Faculty - Emory
7	Mark Wilson, Ph.D.	Faculty - Emory
8	Bill Walthall, Ph.D.	Faculty - GSU
9	Larry Blumer, Ph.D.	Faculty - Morehouse College
10	Pat Whitten, Ph.D.	Faculty - Emory
11	Tim Bartness, Ph.D.	Faculty - GSU
12	Gianluca Tosini, Ph.D.	Faculty - Morehouse School of Medicine
13	Larry Young, Ph.D.	Faculty - Emory
14	Tom Insel, M.D.	Faculty - Emory
15	Rebecca Herman	Grad Student - Emory
16	Silke von Esenwein	Grad Student - Emory
17	Heather Patisaul	Grad Student - Emory
18	Matia Banks	Grad Student - GSU

19	Ketama Paul	Grad Student - GSU
Funding (reporting year)		
	NSF	
	Collaboratory funds	\$ 15,000
	Venture grants	\$166,327
	David Edwards (IBN 9974530)	\$ <u>35,519</u>
	TOTAL	\$216,846
	Other	
	MH (Wallen)	\$203,589
	NIH: R01HD37583 and R03 HD39153 (Wilson)	\$252,500
	NIH: R01 DK35354 (Bartness)	\$201,335
	Whitehall J96-24 (Clancy)	\$ <u>30,000</u>
	TOTAL	\$687,424
Funding (anticipated for next year)		
	NSF	Approx current year (- Edwards)
	Other	Current +
	Wilson R01HD38917	\$250,000
	Hamann's fMRI project, Clancy's ME amygdala project, and Edward's sexual differentiation project will apply for independent funding	new proposals (approx. \$200,000)

In the past year, this collaboratory has developed a long-term set of foci as well as a number of individual research projects that reflect new collaborations. The current projects are:

Project 1. Neural mechanisms of phytoestrogen action on reproductive behavior
Investigated whether acute dietary exposure to physiologically relevant levels of individual phytoestrogens affect ER and ER -dependent activities in the female rat brain.

Investigators: Whitten, Young, Patisaul (venture grant 7/00)

Project 2. Characterizing the role of a nuclear hormone receptor involved in male mating behavior of *Caenorhabditis elegans*. This project investigates *UNC-55*, a novel nuclear hormone receptor with properties relevant to mammalian steroid hormone receptors.

Investigators: Walthall, Gernert (venture grant 7/00)

Project 3. Activation of steroid neurons by mating in aERKO male mice. Ejaculation induced the expression of Fos-ir in estrogen receptor alpha immunoreactive neurons of the posterodorsal medial amygdala. Fos induction was significantly reduced in estrogen receptor knockout (ERKO) alpha males compared to wild-type males.

Investigators: Clancy, Kimbro(venture grant 7/00)

Project 4. Functional neuroanatomy of human sexual arousal: an fMRI study. Thus far, we have developed stimulus set for assessing neural activation to sexual stimuli in men and women. Data collection in progress with **Imaging Core**.

Investigators: Hamann, Wallen (venture grant 2/01)

Project 5. Effect of neuropeptides on mate size discrimination thresholds in female sailfin mollies. Based on previous behavioral studies of mate choice in mollies, we will investigate the role of neuropeptides, such as vasotocin.

Investigators: Blumer, Beck (venture grant 2/01)

Project 6. Long-term, reversible brain inactivation: a novel technique for behavioral neuroscience. This project has developed an MRI compatible external switch to direct neurally active compounds to indwelling brain cannulae or systemic circulation. This project will link with primate neuroimaging studies in the **Imaging Core**.

Investigators: Freedman, Wallen, Wilson (venture grant 7/00)

Project 7. Fasting/food restriction-induced maternal infanticide: changes in prolactin receptor gene expression and reversal by leptin. Species specific differences exist in maternal behavior/infanticide with Siberian hamsters showing less maternal and more non-nurturing behaviors than Syrian hamsters. This project investigates the role of leptin in this species difference.

Investigators: Bartness, Young (venture grant 7/00)

Project 8. Behavioral and molecular/genetic studies of the sexual differentiation of the rat brain, In the process of starting with **Molecular Core**, this project will use microarrays to assess gender differences in the cellular response to testosterone during development.

Investigators: Edwards, von Esenwein, Insel, Wallen. (venture grant 7/01)

Thrust Name	Research Cores
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PI Name	Insel	
Participants (add rows as necessary)		
	Name	Status (Faculty, Student, Staff, Postdoc etc.)
1	Scott Hemby	Faculty – Molecular Core - Emory
2	Grant MacGregor	Faculty – Molecular Core - Emory
3	Byron Ford	Faculty - Molecular Core - MSM
4	Kim Gernert	Faculty – Molecular Core - Emory
5	Yu Hua Li	Research technician – Molecular Core - Emory
6	Allan Levey	Faculty – Cellular Core - Emory
7	Stuart Leff	Faculty – Cellular Core - Emory
8	Michael Kuhar	Faculty – Cellular Core - Emory
9	Ioannis Constantanidis	Faculty – Imaging Core - Emory
10	Greg Berns	Faculty – Imaging Core - Emory
11	Vincent Rehder	Faculty – Imaging Core - GSU
12	Peter MacLeish	Faculty – Imaging Core - MSM
13	Michael Crutcher	Faculty – Systems Core - Emory
14	Timothy Bartness	Faculty – Systems Core - GSU
15	C. Kay Song	Post-doc –Systems Core - GSU
16	Steve DeWeerth	Faculty – Computational Core - GaTech
17	Don Edwards	Faculty – Computational Core - GSU
18	Ron Calabrese	Faculty – Computational Core - Emory
19	Kim Wallen	Faculty – Behavioral Core - Emory
20	John Gullede	Research Technician – Behavioral Core - GSU
Funding (reporting year)		
	NSF	\$30,000/core x 6 = \$180,000
	Other Georgia Research Alliance (Hemby)	\$354,000
Funding (anticipated for next year)		
	NSF	\$30,000/core x 6 = \$180,000

The core labs continue to focus on target technologies.

1. The molecular core has produced 200 mouse arrays spotted with 5000 cDNAs from Research Genetics. Human and rat neurochips are currently under construction. Informatics tools are available for analyzing microarray data. Current projects in the core involve collaborations on reproduction (Edwards), affiliation (Francis and Insel), and fear (Rainnie and Shi). Industry Partner: NuTech Biosciences for informatics tools.
2. The cellular core has produced antibodies for the affiliation collaboratory (Young and Insel) and is developing viral vectors for this group as well. Technician or post-doc needed to assist with viral vector construction. Industry partners: Chemicon and ABeone for antibody development and marketing.
3. The systems core has changed leadership this year in response to the demand from two groups for viral tract tracing (Affiliation and Fear). Timothy Bartness has become the new core leader, working with Dr. Lynn Enquist from Princeton to develop novel viral tract tracers for systems neuroscience. Dr. Song, a post-doc who bridges these two labs, promises to bring an important new technology into the CBN. Partner: Princeton lab of Dr. Enquist.
4. The imaging core has also changed leadership with Ioannis Constantanidis taking over from Ernest Garcia. Studies using the 3T fMRI are underway (reproduction collaboratory – Hamann and Wallen). Initial studies with 4.7T have been completed in rats (MacLeish). Technician or post-doc needed to assist with the development of small animal imaging. Industry partner: Insight Neuroimaging Systems, Ltd. Academic Partner: Laboratory of Cerebral Function and Behavior, UAB.
5. The computational core has recruited a new member – Steve Potter from Cal tech should arrive in Sept, 2001. Although this core remains separate from the collaboratory effort, there is great interest in their progress from several members of the CBN. Partner: Center for Neural Communication and Computation.
6. The behavioral core, with the assistance of John Gullledge, has assisted the aggression collaboratory in their development of a visible burrow system at Morris Brown, has set up equipment for behavioral testing at Morehouse College, and has assisted with training at GSU. Partner: Under development

III. EDUCATION

1a. Describe the Center's overall educational objectives. In the current reporting period, how have the Center's overall educational objectives and plans changed from the previous reporting period? Inform us of the performance and management indicators the Center has developed to assess progress in meeting its education objectives.

The mission of the education arm of the Center for Behavioral Neuroscience is to integrate research and education with the primary goals of: (1) creating pathways to careers in behavior and neuroscience for undergraduates and graduate students, with a special focus on minorities and women, (2) increasing the number of minority students attaining PhD's in behavior and neuroscience, (3) broadening career pathways to include science policy, journalism, biotechnology and pre-college teaching as well as academic and industry positions, (4) improving science, neuroscience and behavior education in Atlanta schools.

Internal Goals

Graduate Program Goals:

- To attract and retain high quality graduate students interested in behavioral neuroscience, particularly minorities (30%) and women (50%).
- To provide these students with an integrative, inter-disciplinary experience using the diverse facilities of the CBN
- To facilitate collaborative research by:
 - orienting students to the CBN and its resources
 - fostering inter-institutional laboratory rotations or internships
 - requiring inter-institutional participation on dissertation committees
- To facilitate interactions among students and faculty of the participating institutions who are interested in behavioral neuroscience.

The overall goals and plans of the graduate program component have not changed. We have delayed seeking external training grant funding until year 5 and delayed consideration of an interinstitutional graduate program to allow time for the current program to mature.

Internal assessment and advice from our external advisory board indicates the need to develop short courses on techniques and an integrative core course to supplement current coursework.

Indicators:

Short-term indicators include timely completion of the PhD, proportions of women and minorities, and qualitative assessments from students and faculty. Longer-term assessments include successful postdoctoral education and career successes (faculty appointments, publications, discoveries).

Undergraduate Program Goals:

- To attract students to careers in behavior and neuroscience
- To provide an understanding of behavioral neuroscience for students choosing other careers, such as science journalism, K-12 teaching and public policy
- To increase diversity by including participation of at least 30% minority and 50% women in undergraduate programs

Our overall goals have not changed. In keeping with the strategic plan goals for year 2, we have established two new programs to attract students to careers in behavioral neuroscience: Center for Behavioral Neuroscience Undergraduate Fellows (CBNuf) and Behavioral Research Advancements in Neuroscience (BRAIN) (originally called Introduction to Science Seminar or ISS). We have modified the timeline on some elements of our strategic plan (see section on changes in the strategic plan). We have added the goal of reorganizing funding and resources to assist current AUC faculty to become more involved in Center research.

Indicators:

Indicators for the undergraduate fellows program are an increase in students graduating with a minor or major in neuroscience with 30% minority and 50% women in our undergraduate programs. Number of students to be monitored by course enrollments. We are especially motivated to broaden the career choices of minority undergraduates in the sciences to consider options beyond medical school.

External Goals

Pre-College and Public Outreach Goals:

- To improve science education in regional public schools
- To coordinate existing programs
- To enhance public awareness and understanding of CBN research.

Our overall goals have not changed although we have modified the timeline on some elements (see section on changes in the strategic plan). We have added the goal of reorganizing funding and resources to develop curriculum units and media publicity around the work of particular Center faculty in collaboration with the Science and Society program.

Indicators:

Our indicators include number of events, attendance, teacher use of curriculum, BioBus (our mobile science lab) visits, among others as indicated in the strategic plan.

We are pleased that we have achieved most of our first and second year goals as outlined in the education section of the strategic plan (www.cbn-atl.org). Our graduate program has its first class of students at Emory and Georgia State (other schools are scheduled for later years). Our undergraduate programs have been innovative and well-attended, especially by students at the AUC schools. In terms of external goals, we have designed projects, workshops, and curriculum units with teacher input through the GIFT program. Teachers are conducting research in CBN labs and helping to translate this research into curriculum. Public awareness is being accomplished through activities of Brain Awareness month, radio programs and other media. These accomplishments were made possible through the hard work of committees representing each institution in our collaboration, CBN faculty and graduate students, and the NSF support that allowed the hiring of Dr. Danielle Gray as Assistant Director of the Integrating Research and Education component, for the CBN and Mr. Jordan Rose to support outreach to public education.

1b. Discuss any problems you may have encountered in making progress toward the Center's education goals during the reporting period as well as any problems anticipated in the next period. Include your plans for addressing these problems.

Faculty and post-doctoral fellowship recruitments at the AUC, GSU and in Emory College have not yet been completed, limiting progress on new courses for the minor and major. As noted above, we have initiated a task force to develop additional collaborative recruitment strategies and to develop strategies for supporting current faculty at the AUC schools to develop research aligned with CBN laboratories. Difficulties with registration across institutions challenged the CBNuf program. We are proposing a new restricted list of courses that each instructor and school has approved. We modified our plan for a summer institute for freshmen and sophomores into an academic year program and plan to add research rotations and a summer program with a REU grant to be submitted this September. GSU was unable to recruit undergraduates for its component of the summer research program due to faculty commitments.

We are considering reorganizing the undergraduate committee into three sub-committees to focus on curriculum development; infrastructure needs at the AUC and post-baccalaureate programs.

The primary challenge to outreach and public education was that the search for a neuroscience educator (tenure track) at GSU was unsuccessful. The position has been re-advertised. Graduate students and the K-12 committee are filling in to continue the workshops and the BioBus visits. A CBN graduate student (Heather Caldwell) will give the Brain Adaptations workshop this summer. The original budgets will be revisited this summer in light of unexpected costs for Outreach programs. Limited progress has been made on the public education video and curriculum led by Morehouse School of Medicine due to faculty over-commitments, but we expect to have phase 1 completed by November.

One limitation to the research and education mission has been the delay in recruiting a technology coordinator to assist with interactive web projects, videoconferencing and collaborative resource sharing. This position has been re-advertised and a number of excellent candidates have applied.

Transportation, travel time and parking are a constant source of irritation. The AUC schools have provided a van for their students. We are requesting assistance from the internal advisory board of provosts to assist with these issues. We have requested supplemental funds for both desktop and room based videoconferencing to serve collaborative research and education agendas.

2a. Describe the Center's internal educational activities in the reporting period. Include in the narrative a discussion of how the various internal education activities enable the Center to meet its goals.

Graduate Programs

Activity Name	The CBN Graduate Scholar Program
Led by	Dr. Paul Katz and faculty
Intended Audience	Graduate students from CAU, Emory, Georgia State Univ. and Morehouse School of Medicine interested in CBN research thrusts
Number of Attendees	7

The Graduate Scholar Program offers an integrative approach to behavioral neuroscience with access to the diverse facilities of the CBN. The CBN is not a degree-granting program, but enhances existing graduate programs in neuroscience, psychobiology, anthropology, and psychology.

In this, our first year of the CBN Graduate Scholar program, we had seven Ph.D. students enrolled:

1. Heather Caldwell (GSU Neurobiology and Behavior)
2. Alicia Faruzzi (GSU Neuropsychology and Behavioral Neuroscience)
3. Michelle Foster (GSU Neurobiology and Behavior)*
4. Elizabeth Hammock (Emory, Neuroscience Program)
5. Aaron Jasnow (GSU Neuropsychology and Behavioral Neuroscience)
6. Miranda Lim (Emory, MD/PhD, Neuroscience Program)
7. Matia Solomon (GSU Neuropsychology and Behavioral Neuroscience)*

Two of the students (*) are first year students and are also minority students. The others are resident students who applied during the Fall semester when the program was opened up for advanced students. In subsequent years, resident students will only be able to apply once a year with a July 15th deadline. There are already several applications from resident students for the July 15, 2001 pool.

We are in the final process of recruiting new students for the 2001-2002 school year. The presence of the CBN Graduate Scholars Program has been beneficial to the recruitment efforts at Georgia State University and Emory. The CBN is viewed as attractive to students applying to Georgia State University and has increased the acceptance rate. This year, the Neurobiology & Behavior program at GSU made 8 offers of admission of which 6 have accepted. In at least two of the cases, the CBN was a major factor in the student's choice. At Emory, three new CBN Graduate Scholars will be admitted. One student via the Psychobiology program and two from the Neuroscience program. Although no minority candidates were successfully recruited for next year, two of the Emory CBN students and three of the GSU students are female. Two minority students were offered admission at Emory, but declined to accept. Additional efforts will be made next year to recruit minorities by a more active participation in national conferences for minority science majors.

The graduate program includes two core courses:

The **Introduction to CBN Graduate Seminar** was taught in the Spring semester by Tom Insel and other CBN faculty. The first edition of this required course was attended by 9 students (5 GSU, 4 Emory) - 5 CBN scholars who were resident students, 2 CBN scholars who are in their first year, and 2 Emory students who plan to apply for the

program next year. The course was divided into two parts. The first section involved a tour of CBN core facilities, with emphasis on incorporating state-of-the-art techniques (microarrays, viral vectors, imaging) into the projects students are developing in the laboratories. This part of the course followed a hierarchical survey, starting with molecular techniques and ending with a visit to the Yerkes Field Station to discuss complex analysis of social behavior. The second part of the course was an in-depth exploration of the topic selected for the Atlanta Chapter of Society for Neuroscience Spring Symposium, "Olfactory Coding, Plasticity, and Learning". Each student focused on the research of one of the Symposium speakers. Specific papers, provided by the speakers, were reviewed in class. The students hosted the speakers' visit, introduced the speaker and asked questions generated by the class discussion. In the future, the preparation for the symposium will be separated into a special topics class. Post docs and new faculty will also be encouraged to attend.

Topics in Behavioral Neuroscience is an annual required course co-taught by faculty members in different disciplines or in different institutions. The first of these courses in the Fall will be *Reproduction in Context: Social and Environmental Influences*, co-taught by Dr. Timothy Bartness (Georgia State University) and Dr. Kim Wallen (Emory University). It will cover issues in the control of reproduction by the environment and social influences. Topics will include: Energy Balance and Reproduction, Integration of Environmental factors in Birds, Integration of Environmental Factors in Mammals and Social Context and Reproductive Behavior. The students will read the book on *Reproductive Behavior, Reproduction in Context* ed by Kim Wallen and Jill Schneider. There will be guest lectures by contributing authors from the book. These courses are not just valuable for the students, but should help bring the faculty members closer together as well since they will be co-taught.

Undergraduate Programs

In keeping with the goals for year 2, we have established two programs to attract undergraduate students to careers in behavioral neuroscience: Center for Behavioral Neuroscience Undergraduate Fellows (CBNuf) Program and Behavioral Research Advancements in Neuroscience (BRAIN) (originally called Introduction to Science Seminar or ISS). Detailed descriptions of both programs appear on the Center's website, www.cbn-atl.org. Although all programs are open to all Center students, a particular

focus is on the preparation and recruitment of underrepresented students. All participating schools have a high percentage of minority students interested in science. We have also:

- Developed an initial list of approved internships and lab experiences (see website)
- Recruited second cohort of Summer Undergraduate Research Experience students in Neuroscience and Behavior. Submitted an NSF REU in Neuroscience
- Designed lab courses at Atlanta University Center Schools
- Conducted new courses at CAU, Spelman, Morehouse, Emory and Morris Brown
- Developed outline for BS/MS
- Initiated a Science and Journalism course for 16 undergraduates
- Submitted an NIH proposal for a post baccalaureate research program

Activity Name	Behavioral Research Advancements in Neuroscience (BRAIN) - formerly ISS
Led by	Dr. Danielle Gray and many CBN Faculty
Intended Audience	Freshmen and sophomores in CBN Schools
Number of Attendees	40 first semester; 38 second semester

In Fall 2000, the CBN implemented an extracurricular seminar-based program to stimulate interest freshmen and sophomores in doctoral studies. The evening seminars were led by 14 faculty from 5 of the CBN member institutions and addressed ethical research conduct, career opportunities, and current findings in behavioral neuroscience. The ISS program received exceptional reviews from all of its participants with 66% stating that the program stimulated their interest in neuroscience and 76% stating that the program sparked their interests in doctoral studies. Intriguingly, 90% of participants touted the program as an effective springboard into the research enterprise of the Center.

In spring 2000, per recommendation of the External Advisory Board, the program was altered to include laboratory visits, demonstrations of techniques, broader neuroscience topics including neurooncology, neuroimmunology, and neuroendocrinology, and talks given by postdocs and undergraduate students.

The program attracted participants representing the Atlanta University Center (62% in Fall; 55% in Spring), Emory University (12.5% in Fall; 34% in Spring), Georgia State University (10% in Fall; 6% in Spring), Georgia Institute of Technology (15% in Fall; 3% in Spring). The predominant ethnicity was African American (>70%). Whites accounted for 13% -15% of participants, while Asians

accounted for 8%-10% and Hispanics, 2.5%-8%. Participating students were given a stipend of five hundred dollars (\$500) after the successful completion of the program. Successful completion of the program entailed full participation in all seminars, completion of a brief lab visit with a CBN faculty member and involvement in an exit interview.

For more information about the students and their projects, please visit <http://www.cbn-atl.org/about/annreport.html>

Activity Name	Center for Behavioral Neuroscience Undergraduate Fellows
Led by	CBN Undergraduate Committee and Researchers
Intended Audience	Undergraduate students interested in Behavior or Neuroscience
Number of Attendees (if appl.)	15

(CBNuf (www.cbn-atl.org/education/cbnuf/index.htm): The Center for Behavioral Neuroscience has offered its first neuroscience undergraduate fellows distinction to fifteen scholars who take at least one course in neuroscience and one course in behavior, as well as taking two elective classes, and participate at least 2 semesters in a CBN-sponsored seminar. At least one of the four required classes (neuroscience, behavior, elective or seminar) must be taken at an institution other than the student's home institution. They are also required to participate in an extra-curricular experience such as research in a CBN laboratory, CBN-sponsored summer program of at least 8 weeks or approved internship or externship.

The first cohort of CBNufs unanimously decided that CBNuf program operate as an organization. As an organization, the CBNuf students officially participated in the CBN-sponsored Brain Fair held at the SciTrek, a science and technology museum. The CBNuf students constructed an MRI simulator, displayed a poster on Alzheimer's and Parkinson's diseases, and hosted a game show on drugs of abuse.

This year 11 of the 15 who completed the program were from Emory, primarily because the NBB major already includes the CBN requirements. Next year we will focus on recruiting additional students from the AUC and other schools, since more courses are in place.

For more information about the students and their projects, please visit <http://www.cbn-atl.org/about/annreport.html>

Activity Name	Summer Undergraduate Research Experiences
Led by	Drs. Pat Marsteller, Cathy Quinones, and Danielle Gray and many faculty mentors
Intended Audience	Rising juniors and seniors
Number of Attendees	23

The summer undergraduate research experience (SURE) supported a total of 23 students in CBN labs. SURE provides a mentored research experience with a number of integrated activities to prepare students for careers in science. Program activities include:

- Orientation and Safety Training:
- Science Careers Component
- Graduate Student Panel
- Applying to Graduate Programs:
- Preparing Poster Workshop
- Grant Application Session.
- Alumni Panel: Careers in Science
- Poster Session and Best Poster Awards
- Ethics In Science
- Essay Competition

Our program's ethics component, sponsored by an NSFREU grant, benefited all participants of the SURE program. The ethics curriculum begins with a daylong simulation that introduces topics that are explored in detail during weekly meetings. The simulation combines role-playing and discussion segments.

At the suggestion of the external board we have broadened support to include all neuroscience and behavior. Participants in CBN faculty labs are supported directly by the Center grant. Other Neuroscience and Behavior participants are supported by the Emory HHMI grant and/or contributions from mentors or the Division of Biological Sciences. For more information about the students and their projects, please visit <http://www.cbn-atl.org/about/annreport.html>

As part of its cost sharing activity, the CBN summer research effort was aided by the HBCU-Up program in neuroscience, directed by Drs. Melissa Harrington and Sherry Williams. This program which originally targeted summer research experiences for AUC students in Neuroscience, shifted to include selecting students to work with faculty in the departments of biology, psychology, physics, and chemistry at Morehouse College as well as in the Morehouse School of Medicine, Spelman College, Morris Brown College, Emory and Georgia State. This year the HBCU UP program supported 9 students. All participants this year were African American males from Morehouse College.

Activity	Minor in Neuroscience at AUC
Led by	Many faculty

Intended Audience	AUC students and CBN undergraduate fellows
Approx Number of Attendees	2
<p>Narrative: At Morehouse, the Departments of Biology and Psychology introduced a minor in neuroscience to the College curriculum. The neuroscience minor will encourage students to approach biology and psychology from an interdisciplinary perspective and will distinguish students who have pursued an interest in the topic beyond the courses and electives required for their major. Students fulfilling the requirements for the neuroscience minor will be eligible to be Undergraduate Fellows at the Center for Behavioral Neuroscience (CBN-ufs) by participating in a summer program or internship offered by the center.</p> <p>The minor is open to students of any major and any academic division. To minor in neuroscience, students must complete 17 hours consisting of General Biology, Mind and Brain, Neurobiology, Psychobiology and one elective class. In addition, students must take an advanced laboratory class, either Neurobiology or Psychobiology Laboratory. Allowable electives are offered in the Biology, Psychology, and Computer Science Departments at Morehouse College, as well as on other campuses in Atlanta. In the first year that the minor was offered, two senior students were qualified to receive the minor, Cory Bradley a psychology major and William Humphries, a biology major. Because both students had pursued research projects in neuroscience laboratories and participated in inter-institutional activities, they also received recognition as undergraduate fellows of the Center for Behavioral Neuroscience.</p> <p>Spelman submitted a minor in neuroscience submitted to Associate Provosts and Chairs of Psychology and Curriculum Committee. They plan to have an institutional neuroscience minor beginning in 2002. Morris Brown plans to collaborate by offering some courses for the minor. Their students will complete minor requirements by cross-registering.</p>	

Activity	New and modified undergraduate courses
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Led by	Faculty
Intended Audience	Undergraduates interested in Behavioral Neuroscience
Approx Number of Attendees (if appl.)	See individual elements

Narrative:

Three new courses have been developed at Morehouse College: 1) a neurobiology lecture with an associated laboratory; 2) a laboratory in developmental biology to complement an existing lecture course; and 3) a freshman/sophomore level introduction to the neurosciences class. Two of these will be open to cross-registration for CBN UF. The Neurobiology lecture enrolled 30 students: 20 enrolled in lab. Mind and Brain enrolled 20 students in Fall and 20 in Spring. Psychobiology (Psy 460 AND LAB 461)modified enrolled 9 in lecture and 7 in lab.

Spelman offered two new courses this year. Psychology 320 Brain and Behavior; and Biology 110 / Psycholo110 Mind and Brain: Introduction to the Neurosciences. The laboratory for Brain and Behavior will be offered next year.

At Morris Brown College, a new course: sophomore level Introduction to Behavioral Neuroscience, PSY 201, is scheduled for fall 2001. Advanced Behavioral Neuroscience will be introduced spring or fall 2002. Morris Brown faculty began providing a stronger neuroscience emphasis to the following courses last year: CBN faculty member Fernando Gonzalez redesigned the Science of Psychology course into Introduction to Behavioral Neuroscience; he offered it twice this year to a total of 53 African American students. He also integrated more neuroscience content into Experimental Psychology & Lab for 41 students and Physiological Psychology & Lab for 37 students. Charlyn Harper Brown added content to Problems in Psychology (37 students). Jeanne Stahl modified the Classical and Instrumental Conditioning Course (24 Students). The Scientific Writing course also added a neuroscience focus for 20 students.

At Emory several CBN faculty developed and taught new CBN related courses. Dr. Danielle Gray co-developed and team-taught NBB 190: The Stressed Out Brain in the fall of 2000 with Dr. Susan Rouse for 15 freshmen. She also team taught NBB 190: The Forgotten Brain- Alzheimer's Disease with Dr. Keith Easterling. Dr. Pat Marsteller taught 16 freshman in a course called Mismeasure of Woman; Mismeasure of Man that emphasizes potential brain and behavior differences. She team-taught the NBB senior seminar with Dr. Paul Lennard and Dr. Sarah Gouzoules. This course emphasizes critique of original literature and emphasized the research of 7 CBN faculty.

CBN sponsored the development and first offering of a course entitled Science and Health Journalism. Taught by Nick Tate, science editor of the Atlanta Journal Constitution, the course had 16 students (and a waiting list of over 20, including graduates students and postdocs). The course introduced students to print and broadcast science journalism. Students also attended the annual

Activity	CBN Center for Teaching and Learning
Led by	Drs. Paul Lennard, Keith Easterling, Lori Marino & Melissa Harrington
Intended Audience	All Center NS and Behavior students
Approx Number of Attendees	
<p>Narrative:</p> <p>Dr. Lennard, along with Dr. Easterling, Dr. Marino, all of Emory and Dr. Melissa Harrington of Morehouse College have received a venture grant from the CBN to develop an interinstitutional Center for Teaching and Learning. They will be working on projects such as Brain Imaging Modules to test educational distance delivery. Software supporting 3D reconstruction and rendering typically demands significant computer resources and network bandwidth. The task is to develop an interface that is instructor/student friendly and that can be employed for classes at all CBN institutions without the necessity of new hardware, software or a significant increase in time allocation by computer support personnel. Testing and evaluation will be conducted by Dr. Marino in her NBB425, Brain Imaging class, which will be taught to approximately 20 students both in the Fall of 2001 and again in the Spring of 2002.</p> <p>A second project will provide online research datasets donated by faculty for the purpose of classroom teaching. At the CBN Retreat Dr. Donald Edwards suggested that the concept be expanded to include online tutorials, movie clips of lab procedures and various other materials furnished by the cores & collaboratories with the goal being the formation of a Behavioral Neuroscience Database to which instructors could go and selectively assemble a custom textbook for a single lecture or an entire course. The preliminary "Brainwork" Manual is on the web at nbb.emory.edu/Brainwork/Manual. Computers in a central lab at Emory have been modified to run Linux and thus be used with Brainwork Guided Web-Based Tutorial are being developed by Braden Fleischer. Dr. Lori Marino is developing the specific examples for use in classes. Initial classroom testing has been moved to Fall 2001. Dr. Keith Easterling is developing some of the databases.</p>	

2b. External Education Activities

Pre-College Programs

CBN Faculty and students were involved in many educational activities aimed at K-12 teachers and students and the general public. Some of these are highlighted below. Briefly we:

- Coordinated Brain Awareness Month with Atlanta Society for Neuroscience:
- BioBus visits to 9 middle and high schools (approx. 600 students) using comparative neuroanatomy module and specimens from Lending Library.
- Piloted Atlanta Brain Bee competition for high school students. 44 participants from 4 schools.
- Piloted Atlanta BrainStorm! Brain Awareness Fair at SciTrek: 400 participants
- Co-sponsored 4 public lectures with Atlanta Society for Neuroscience.
- Participation in Brain Awareness Month: 14 undergraduates, 33 graduate students, 16 faculty
- Developed approved list of educational outreach internships for CBN Undergraduate Fellows, with 3 students completing such internships
- Are consulting on the neuroscience component of SciTrek's BioTrek Internship Program for high school students (Summer/Fall 2001).
- Planned and conducted 2001 Summer Workshops including repeats of Brain Adaptations and Interactive Cases
- Cosponsored an HHMI lecture series on Biological Timing with the Emory and Spelman Hughes programs. Over 250 students and teachers participated in interactive sessions after the telecast led by Dr. Gianluca Tosini from Morehouse School of Medicine.

Activity Name	GIFT teacher research program
Led by	Stacey Hillock, Pat Marsteller & faculty
Intended Audience	High school and middle school teachers
Approx Number of	15; 7 in CBN labs

Attendees	
<p>The Georgia Industrial Fellowships for Teachers (GIFT) continues to offer Atlanta area high school teachers invaluable opportunities to gain hands-on experience in academic, business and industrial environments during the summer. GIFT teachers are offered stipends for the eight-week program and are required to translate their summer experience into the classroom. Through CBN and the Howard Hughes Medical Institute’s grant we sponsored 15 math and science teachers and placed them in various research positions. For eight weeks these teachers were immersed mainly in scientific research projects. They learned to use sophisticated laboratory equipment and were exposed to the latest scientific advancements. While the bulk to the summer is spent immersed in research, GIFT participants nonetheless have to start identifying ways to integrate their research with their classroom curriculum. As mentioned above, this is a key component of the program which allows teachers to act as conduits for scientific information between the tertiary educational institutes and high schools. It challenges teachers to find innovative ways of linking their summer research experience with the day-to-day world of their high school students. This has to be done in such a way that students’ interest in science is sparked and they begin to see the relevance of scientific research to every-day life.</p>	

Activity Name	Diversity and Adaptations in the Brain Workshop
Led by	Heather Caldwell, CBN Graduate Scholar, MS, Georgia State U.
Intended Audience	Middle School Teachers
Approx Number of Attendees (if appl.)	17

Narrative: A repeat of last year's workshop developed by Melissa Demetrikopoulos, PhD, Morehouse College, this year's program explores differences in groups of animals (i.e. mammals vs. fish) and show adaptations within the groups (i.e. large olfactory bulbs in rats). Both of these areas of study are contained within the Georgia Quality Core Curriculum. The 5-day workshop included a primer on basic brain anatomy and physiology, a review of vertebrate classifications, a discussion of species-specific adaptations in the brain, a sheep brain dissection, an introduction to CBN educational resources, and a review of useful web content for classroom use. Information available at <http://www.cbn-atl.org/education/brainwkshp.html>

Activity Name	Neuroscience Web Review for Teachers
Led by	David Parlier, Sutton Middle School, 2000 GIFT Fellow.
Intended Audience	K-12 School Teachers
Approx Number of Attendees (if appl.)	Unknown at this time
<p>Narrative: The Web Review was developed under the direction of Dr. Melissa Demetrikopoulos and in conjunction with the Neuroscience Workshop for Middle School Teachers (see above). The Review critiques a broad spectrum of internet resources available for use in the classroom. It is geared toward teachers who seek meaningful ways to utilize web technology in order to enhance their lesson plans and expose students to web resources, with a focus on neuroscience related links. This review was distributed to participants in the Diversity and Adaptations in the Brain Workshop, and is also available at http://www.cbn-atl.org/education/webreview.html</p>	

Activity Name	Lending Library of Neuroscience Educational Resources
Led by	Melissa Demetrikopoulos, PhD, Morehouse College
Intended Audience	K-12 Teachers
Approx	Unknown at this time

Number of Attendees (if appl.)	
<p>Narrative: Teachers can check out a variety of resources (books, models, specimens, learning modules, VHS, CD-ROM, MRI films, and CBN faculty) from our Library to use in their classrooms. Teachers participating in our workshops will be exposed to many of these materials and trained how to use them to effectively meet the Georgia Quality Core Curriculum requirements. Additionally, these resources are available on Georgia State University's BioBus which brings science educational opportunities to the schools in a mobile science laboratory (see below). A complete list of resources can be found at http://www.cbn-atl.org/education/lendinglib.html</p>	

Activity Name	Atlanta Brain Bee
Led by	Jordan Rose, CBN Outreach Coordinator
Intended Audience	High School Students
Approx Number of Attendees (if appl.)	44
<p>Narrative: The Brain Bee is a brain trivia competition for 9th-12th grade students. This year, the CBN piloted the first ever Brain Bee in Atlanta. Participating schools were provided with books and tutors (5 Emory undergraduates, 2 Emory staff, and 1 Fernbank Science Center educator) for their competitors. Prizes and certificates were awarded. The winner, a 9th grader from Stephenson High School, and her father received complimentary airfare to the International Brain Bee at the University of Maryland. This event was part of the CBN's Brain Awareness Month campaign.</p>	

Activity Name	Atlanta BrainStorm! Brain Awareness Fair
Led by	Jordan Rose, CBN Outreach Coordinator
Intended Audience	General Public
Approx Number of Attendees (if appl.)	Over 400

Narrative: The CBN also piloted Atlanta's first ever Brain Awareness Fair from 12-5pm on March 24, 2001 at SciTrek: Georgia's Technology Adventure. The BrainStorm! is a public education information fair consisting of informative and interactive booths for school children and adults, including Hold a Real Brain, Biofeedback, Your Brain on Drugs, Helmets & Brain Safety, Optical Illusions, as well as information on neurological disorders like Alzheimer's and Parkinson's. The event was free and open to all ages. Booths were created and staffed by 28 faculty, graduate, and undergraduate students from the CBN member institutions. This event was part of the CBN's Brain Awareness Month campaign. 14 undergraduates, 33 graduate students, 16 faculty participated in Brain awareness Month.
7 faculty, 3 graduate students, and 9 undergraduates participated in the fair.

Activity Name	School Visits
Led by	Laura Volpicelli, MS, Emory University and Jordan Rose, CBN Outreach Coordinator
Intended Audience	Middle and High Schools
Approx Number of Attendees (if appl.)	660

Narrative: The Atlanta Chapter of the Society for Neuroscience and CBN co-sponsored classroom visits by graduate and undergraduate volunteers in neuroscience programs at Georgia State and Emory Universities. Georgia State University's BioBus, a 30-foot travelling laboratory often accompanied the volunteers and displayed numerous brain models and specimens from the CBN Lending Library. In general, the school classes were split in two; half of the class participated in in-class presentations by the graduate students about their research, while the other half experienced the comparative neuroanatomy project on the BioBus. The groups switched places halfway through the class period. This event was part of the CBN's Brain Awareness Month campaign. GSU's BioBus project recently received a \$3 million NSF grant to expand the materials and number of visits.

Activity Name	Career Day
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Led by	Dr. Danielle Gray, Emory Univ. and Dr. Melissa Demetrikopoulos, Morehouse Col.
Intended Audience	Lithonia High School students
Approx Number of Attendees (if appl.)	300
Narrative: Drs. Gray and Demetrikopoulos visited Lithonia High School's Career Day on May 2 nd in order to inform the school's large minority population about the variety of career options in the sciences and neuroscience.	

Activity Name	Science and Journalists
Led by	Various
Intended Audience	General public
Approx Number of Attendees (if appl.)	over 200 for each of the events

CBN cosponsored two major events this year relevant to the public perception of science. We co-hosted a lecture by NY Times journalist Natalie Angier with over 200 attendees. We also cosponsored a program with Emory's Woodruff Health Sciences Center, along with the nonprofit organization Research! America a scientist-media roundtable in the WHSCAB auditorium on communicating research. The roundtable is one in a series of national programs that include local scientists, media and elected officials confronting barriers to coverage of science and how scientists and journalists can work to promote best practices in coverage. The Emory program was moderated by Emmy Award winning PBS commentator and former Today Show host Jim Hartz and Rick Chappell, director of the Office of Science & Research Communications & professor of physics at Vanderbilt University, authors of a report called "Worlds Apart -- How the Distance between Science and Journalism Threatens America's Future." Program panelists included Tom Insel, director of the Center for Behavioral Neuroscience; Otis Brawley, associate director of the Winship Cancer Institute; Paul Fernhoff, Emory associate professor of pediatrics and medical geneticist; Amelia Langston, Emory hematology-oncology clinician and researcher; Randy Martin, Emory cardiologist and television journalist; Nick Tate, science editor, Atlanta Journal and Constitution; Michael Giarrusso, news editor, Atlanta Bureau of Associated Press; and Rhonda Rowland, medical reporter, CNN.

Activity Name	Science In Your Life
Led by	Dr. Arri Eisen, Emory College Program in Science & Society
Intended Audience	General Public
Approx Number of Attendees	Unknown number of listeners to public radio
<p>Narrative: We are working with the Director of Emory's Science and Society program, Dr. Arri Eisen, on a radio show, Science In Your Life, that began Fall, 2000. The show airs in two two-minute-thirty-second slots on Saturday during the NPR news show Morning Edition, and then one of those two spots is repeated following All Things Considered on Sunday. The radio show features Atlanta-area experts and will often have integrated themes over several weeks. Several CBN faculty have been interviewed. For more informations, see http://www.emory.edu/college/scienceandsociety/scienceinyourlife/</p>	

Activity Name	BioTrek: Neuroscience Unit
Led by	Amy Thomson, BioTrek Director, SciTrek
Intended Audience	High school students
Approx Number of Attendees (if appl.)	18
<p>Narrative: In a continually expanding partnership with SciTrek: Georgia's Technology Adventure, the CBN will assist in the development of the Nervous System session of their BioTrek Internship Program for high school students in Fall 2001. BioTrek exposes high school students to careers in health, science and technology, while the program's hands-on, problem-based learning approach encourages independent investigations and ethical discussions. The CBN Outreach Committee Co-Chairs (Melissa Demetrikopoulos and Jordan Rose) will serve as curriculum advisors, while CBN-sponsored Atira Goodwin (undergraduate intern) and David Parlier (teacher consultant) will coordinate the program.</p>	

Activity Name	Public Lectures
Led by	Yoland Smith, PhD, Emory University, President, Atlanta Chapter of the Society for Neuroscience, and Jordan Rose, CBN Outreach Coordinator
Intended Audience	General Public
Approx Number of Attendees (if appl.)	110

Narrative: The Atlanta Chapter of the Society for Neuroscience and CBN co-sponsored the following four public lectures to inform the public about current research on the brain and behavior:

- "Novel Surgical Therapies for Parkinson's Disease & Related Movement Disorders" Dr. Mahlon DeLong, Chairman, Department of Neurology, Emory University School of Medicine
- "Social Dominance, Serotonin, and the Brain" Dr. Don Edwards, Professor, Department of Biology, Georgia State University
- "Little pitchers have big ears, but do babies hear the pitches of music?" Dr. Marsha Clarkson, Associate Professor, Department of Psychology, Georgia State University
- "The Ape and the Sushi Master: Do Other Animals Have Culture?" Dr. Frans de Waal, Director, Living Links; C.H. Candler Professor of Primate Behavior, Department of Psychology, Emory University

2c. Professional Development Activities (Faculty, Post-docs and Students)

Activity	CBN Seminar Series
Led by	Various CBN faculty
Intended Audience	CBN faculty, post-docs, pre-docs
Approx Number of Attendees	40 -50/lecture

November 3, 2000

"Imaging nervous system function in a simple animal: Phenotypic analysis and in vivo calcium imaging"

Bill Schafer, Ph.D.

University of California, San Diego

Room 218, Natural Science Center, Georgia State University.

November 17, 2000

"Sex and the Brain: Novel insights from functional neuroanatomical studies"

Lique M. Coolen, Ph.D.

Department of Cell Biology, Neurobiology and Anatomy

University of Cincinnati Medical Center, Vontz Center for Molecular Studies

November 30, 2000

"The Regulation of Vertebrate Sex Change: From Sociobiology to Cell Biology"

Matthew Grober, Ph.D.

Arizona State University West

10:00 a.m.

441 Natural Science Center, Georgia State University

January 10, 2001

"Genetics of Circadian Rhythmicity in Zebrafish".

Greg Cahill, Ph.D.

Associate Professor Department of Biology & Biochemistry,

University of Houston

108 MRC building (Neuroscience Institute), Morehouse School of Medicine

January 16, 2001

"High Spatial and Temporal Resolution FMRI"

Bharat B. Biswal, Ph.D.

National Biophysics Research Institute

Medical College of Wisconsin

Magnetic Resonance Education Center

Emory University Hospital

Co-sponsored by the Division of Radiological Sciences

January 19, 2001

"Molecular Analysis of Single Neurons and Dendrites: Transcriptome, Proteome and Disease"

Jim Eberwine, Ph.D.

Department of Pharmacology and Psychiatry

University of Pennsylvania, School of Medicine

1462 Clifton Rd, Emory University

Co-sponsored by Graduate Program in Neuroscience

February 9, 2001

"Fear Memory Consolidation and the Amygdala: From Phosphorylation to Freezing"

Glenn E. Schafe, Ph.D.

Center for Neural Science

New York University

White Hall #206, Emory University

Co-sponsored by the Department of Psychology

February 19, 2001

"Laugh acoustics: findings from production and perception studies"

Jo-Anne Bachorowski, Ph.D.

Department of Psychology

Vanderbilt University

Yerkes Primate Center, Emory University

Co-sponsored by Living Links Center

March 2, 2001

"Sex and Drugs: The Biological Basis for Gender Differences in Drug Abuse"

Jill Becker, Ph.D.

University of Michigan

White Hall, Emory University

Co-sponsored by the Department of Psychology

March 5, 2001

"Hormones, Genes and Behavior"

Emilie Rissman, Ph.D.

Department of Biology

University of Virginia

White Hall Room, Emory University

Co-sponsored by the Department of Psychology

March 8, 2001

"Differential Hemispheric Lateralization of Primary and Social Emotions"

Dr. Elliott Ross

University of Oklahoma

Yerkes Primate Center, Emory University

March 13, 2001

"From Song Learning to Senility: Genomic Mechanisms of Neuronal Adaptation and Change"

David Clayton, Ph.D.

Associate, Head Dept. of Cell and Structural Biology

The University of Illinois, Urbana

Yerkes Primate Center, Emory University

March 22, 2001

"Terra Cognita: On the Biology of Women"

Natalie Angier

Science Writer, the New York Times, Author

Keynote address for Women's History Month at Emory University.

Co-sponsored by Emory Women's Center, Institute for Womens Studies

Graduate School of Arts and Sciences, Hightower Lecture Fund, Emory College

Emory Arts and Sciences Alumni, Womens Council, President's Commission

for the Status of Women, Department of Psychology and Univ. Health Services

March 23, 2001

"Amygdala Lesion and Social Behavior in Monkeys"

David Amaral, Ph.D.

University of California, Davis

Center for Neuroscience

M.I.N.D. Institute

Yerkes Seminar Room

March 29, 2001

"Molecular Aspects of Sexual Differentiation of the Rodent Brain"

Anthony P. Auger, Ph.D.

University of Maryland

Room 441, Natural Science Center, Georgia State University

April 6, 2001

"Genes, the Brain and Cardiovascular Homeostasis"

David Murphy, Ph.D.

Professor of Experimental Medicine

Research Centre for Neuroendocrinology

University of Bristol, UK

Co-sponsored by the Atlanta Chapter of the Society for Neuroscience

May 5, 2001

Spring Symposium

Co-sponsored by the Atlanta Chapter of the Society for Neuroscience

"Olfactory Coding, Plasticity, and Memory"

8:30AM - 4:00PM.

Emory University, 1462 Clifton Rd. rm.#308

Peter Mombaerts, Ph.D.
Department of Molecular, Cell and Developmental Biology, Rockefeller University
"Targeting olfaction".

John Scott, Ph.D.
Department of Cell Biology, Emory University
"Physiological organization of the olfactory system"

Michael Leon, Ph.D.
Department of Neurobiology and Behavior, University of California, Irvine
"Cracking the Chemical Code"

Robert Anholt, Ph.D.
Department of Zoology, North Carolina State University
"The genetic architecture of odor-guided behavior in *Drosophila melanogaster*"

Charles Derby, Ph.D.
Department of Biology, Georgia State University
"Structural and functional plasticity in the postembryonic olfactory system"

Christiane Linster, Ph.D.
Department of Neurobiology and Behavior, Cornell University
"Central pathways for olfactory memory"

Keith Kendrick, Ph.D.
Head of Neurobiology, The Babraham Institute, Babraham, Cambridge, UK
"On the scent of memory"

May 24, 2001

"Ultraviolet Vision and Visual Signaling in Fishes"

Peter Nelson, Ph.D.

Post Doctoral Fellow

Hawaii Institute of Marine Biology

University of Hawaii at Manoa

Yerkes Seminar Room

Co-sponsored by the Living Links Center

Scheduled for September - October, 2001:

Donald Pfaff, Rockefeller University (Sept 25)

Steven Maier, Univ Colorado, Boulder (Oct. 5)

Activity

Amygdala Seminar Series

Led by	Fear Collaboratory (Michael Davis and others)
Intended Audience	CBN faculty, post-docs, pre-docs
Approx Number of Attendees	40
Narrative: Weekly meeting Fall, 2000 covered the anatomy, physiology, and behavioral aspects of the amygdala with brief presentations followed by discussion. Hand-outs were posted on website. Goal was to generate collaborative projects across institutions and to review latest findings on the amygdala relevant to social behavior.	

Activity	Spring Symposium
Led by	Drs. Insel (CBN) and Smith (Soc for Neuroscience –Atl Chapter)
Intended Audience	Neuroscience community
Approx Number of Attendees	60
Narrative: The CBN and Atlanta Chapter of the Society for Neuroscience co-hosted a day-long symposium entitled “Olfactory Coding, Plasticity, and Learning” with an international panel of experts. CBN graduate students introduced each of the lecturers and prepared questions based on prior review of relevant papers.	

Activity	Aggression Workshop
Led by	Aggression Collaboratory (Dr. Huhman)
Intended Audience	CBN faculty, post-docs, and students
Approx Number of Attendees	25

Narrative:

The Aggression Collaboratory sponsored a full-day symposium with 6 outside experts to discuss directions for research on aggression and social hierarchy formation. Participants covered studies with crayfish, crickets, mice, rats, monkeys, and people using a variety of approaches.

Activity	Faculty Development Seminar Teaching with Technology
Led by	Dr. Pat Marsteller
Intended Audience	CBN undergraduate faculty and others
Number of Attendees	18
Narrative: 6 CBN faculty were among the 18 faculty from CAU, Emory, Morehouse and Spelman who participated in a semester long workshop series led by Pat Marsteller. This course, sponsored by the Emory Center for Science Education, included weekend workshops on Interactive Case Based Learning and Bioinformatics. Faculty projects will be posted on the ScienceNet website.	

2d. Integration of Research and Education

CBN faculty and students are involved in external and internal education initiatives as already described. CBN faculty and staff who are primarily educators are involved in research seminars, collaboratory meetings and work closely with investigators to design curriculum materials based on collaboratory research.

While many other Centers focus on undergraduate, graduate and postdoctoral research as the education effort, we have taken a more innovative approach. When faculty apply for research venture funds, they are challenged to include education outcomes as a project outcome. For example, one faculty member is using virtual slice technology for neuroanatomical comparisons of monkey brains. Using the web, students in introductory brain and behavior classes will be able to participate in original research.

CBN graduate students were involved fully in research symposia and also brought their research to undergraduates through presentations to the BRAIN group and to pre-college students and the general public through their participation in Brain Awareness month and school visits on the BioBus.

Eleven CBN faculty participated in our evening series where freshmen and sophomores were introduced to Center research and to techniques for behavioral and neuroscience analysis. Teachers participated in research in the collaboratories and worked with CBN scientists and educators to develop modules based on fear, aggression, affiliation and reproduction for the classroom. We are accumulating behavior video of all center model systems (crayfish, monkeys, etc.) and plan to make web based interactive modules for the schools.

2e. Plans for Internal and External Education Activities

In July, 2001, we held an integrating research and education retreat. We revisited progress on the strategic plan and decided to develop a list of ideas for venture grants and proposals for additional funds for particular initiatives.

To increase our graduate recruitment efforts, particularly for minority students, CBN faculty will focus on recruiting undergraduate students (BRAIN, CBNuf and summer research students) to the Center. Center faculty will also assist with recruitment to the smaller programs at Morehouse Medical School and Clark Atlanta University. After CBN has a complete curriculum and a track record for training students, we plan to apply for a graduate training grant.

New collaborative topics courses are in the planning stages. CBN schools will cross-list some basic courses such as Computational Neuroscience at Emory, GSU, and Georgia Tech. To decrease the difficulty that students have in commuting to the different campuses, video conferencing will supplement course meetings. Mini-workshops on techniques through the CBN technology cores will be planned.

This year we will restructure the BRAIN seminar for freshmen and sophomores. The Fall version will introduce students to the science and scientists of the CBN. In the spring we plan to institute short lab rotations for the students. Successful students will select one of the rotations for summer research. CBN Undergraduate fellows will be offered additional internships in scientific communication and web development. Additional academic year and summer research positions may be supported if our REU application is successful and with unexpended funds at GSU. Faculty will be encouraged to support students through supplements to current grants.

The education arm with the support of research component of the Center will concentrate on developing interactive, instructional materials that will translate the excitement of research while motivating students to learn neuroscience. Our first series of modules will focus on the latest findings in the area of aggression. These modules will be defined in a manner to capture the attention of students by discussing aggressive behaviors in the context of human illnesses such as alcoholism, drug addiction and violence. Each module will be accompanied by a laboratory exercise or digital simulation that will highlight the universality of the scientific method. For example, students might learn to quantify aggressive behavior elicited in the intruder-resident mouse model and the learned helplessness model. Video clips of these behaviors will be made available on our website. Students will learn to properly score these behaviors and identify neurochemical motivators. Students will also be provided with actual raw data collected by Center scientist to analyze for each identified neurochemical. We plan to develop on-line behavioral experiments that permit students to collect data simultaneously with the PI.

Our outreach plans will more closely follow the research thrust areas and develop more undergraduate internships, teacher workshops, and K-12 curricula based on these areas. Some ideas include:

- creating internship opportunities to publish a newsletter on current brain research, focusing on CBN research, for public and K-12 consumption.
- developing a schedule of teacher workshops that rotates annually through each of the collaboratory topics, and a workshop on ethical issues in neuroscience.
- developing an interactive web-based behavioral neuroscience curriculum aimed at several levels from K-undergraduate, which would use undergraduate internships in science journalism and education to build content. Interns would video interview CBN faculty about their research, collect animal behavior videos for the audience to observe and score simulating real life lab techniques, and adapt research jargon into content for all ages. The curriculum would address several of the national and state science education standards at a variety of grade levels.
- strengthening existing BioBus curriculum modules and concentrate on classroom support for long term lesson plans with Lending Library materials, coordination of lab visits, faculty involvement, and other resources.

IV. KNOWLEDGE TRANSFER

1a. Knowledge Transfer Objectives

Our Knowledge Transfer goals were to (a) develop links to enhance the integration of research and education as well as increase public exposure to behavioral neuroscience and (b) to facilitate technology transfer of Center discoveries. The CBN knowledge transfer program, as outlined in our original proposal, focused primarily on public education about behavioral neuroscience (now classified as external education) and providing web access to Center activities. Partnerships with industry and government labs as well as patents and licensing agreements were foreseen as later consequences of technologies developed in the CBN cores.

1b. Problems

A major setback for the CBN was the loss of Gary Falcon who was developing our website, videoconferencing, and LearnLink network. We found an excellent replacement for Gary, but an administrative problem has delayed his joining the CBN by 6 months. At this point, we are re-opening the search for a new recruit to assist with both web support and video-conferencing. The absence of video-conferencing facilities should be remedied by a supplement from NSF.

A second problem that remains unresolved is the need for an intellectual property agreement. We designed a sample agreement and discussed this with our Internal Advisory Board, but have not been able to receive final approval from the Office of Technology Transfer at Emory. We will continue to press for approval so that a Center-wide intellectual property agreement can be used for technology transfer.

2a. List organizations with which knowledge transfer occurs.

Although the CBN maintains numerous partnerships, there are no current applications of Center research with industry or Federal laboratories. The CBN has supported the following forms of knowledge transfer:

Domestic Research Collaborations: see Partnerships below.

Leadership Exchanges: The Center's Ext Adv Board includes one member from the pharmaceutical industry (Aventis), two from Biotech (EmTech and Dov), and one from a Federal agency (NASA). Members of the CBN have consulted to Johnson and Johnson (Insel), NASA (Albers), the Georgia Research Alliance (Insel), and several serve on NIH study sections or special panels (Albers, Winslow, Hemby).

Industrial Development Activities: The CBN continues to maintain a close tie to EmTech Biosciences, a biotech incubator developed by Emory and Georgia Tech. Current

discussions have focused on opportunities for a start-up company for behavioral phenotyping of transgenic mice, using expertise from the CBN.

International Research Collaboration: The Affiliation Collaboratory (Young and Insel) has an ongoing collaboration with Dr. Katsuhiko Nishimori of Sendai University in Japan to develop transgenic mice. A collaborative NSF project has been submitted as a supplement to the STC grant as well as an independent proposal from Dr. Nishimori in Japan.

2b. Describe any other outcomes or impacts of knowledge transfer activities.

The Center has been funded for just over one year. Too early to evaluate.

2c. Plans for knowledge transfer in next reporting period.

We plan to develop a videoconference network to facilitate integration of research and education and to promote communication across participating institutions. The CBN is in discussions with Janssen Pharmaceuticals about hosting an annual Summer Institute in Behavioral Neuroscience. We hope to develop further international collaborations.

V. PARTNERSHIPS

1a. Partnership Objectives

In its second year, the CBN fostered two kinds of partnerships. Collaboratories began to work with investigators at other academic institutions to assist them with behavioral neuroscience projects. For instance, the Affiliation Collaboratory, with its focus on neuropeptides, cloned and sequenced the receptors for homologous neuropeptides in non-mammalian species relevant to affiliation. The collaboratory was able to provide riboprobes for in situ hybridization to Andrew Bass (Cornell), James Goodson (UCSD), Donna Maney (Hopkins), and Elaina Tuttle (Indiana), allowing these investigators to study the homologous receptors in their labs. A second form of partnership developed out of the cores to assist us in the development of key technologies. Our Molecular Core has partnered with NuTech Biosciences for the development of informatics tools to facilitate analysis of microarray data. Our Imaging Core has partnered with Insight Neuroimaging Systems to develop devices for imaging brain activity in awake, behaving animals. The objectives of these partnerships at this point are to facilitate the research

mission. As a longer term goal, we hope to offer internships for our students in non-academic scientific laboratories and to develop opportunities for technology transfer.

1b. Problems

The Center has been funded for just over one year. During this period, the development of internal collaborations has been a higher priority than the pursuit of external partnerships. Nevertheless, as it becomes clear that we will need both intellectual and physical resources not available in Atlanta, the need for partnerships will certainly grow out of our scientific program. Members of our External Advisory Board are assisting this effort.

2a. Activities

Partnership Activity		Various	
Led by		CBN Cores	
Participants (add rows as necessary)			
	Name of Organization	List Shared Resources (if any)	Use of Resources
1	Princeton Univ	Post-doc, reagents	Development of viral tract tracers for Systems Core
2	Insight Neuroimaging Systems	Scanner time, shared equipment	Development of techniques for scanning awake animals with fMRI with Imaging Core
3	NuTech Biosciences	Access to database, supercomputer	Development of informatics tools for microarray analysis with Molecular Core
	Insert rows as necessary		
Narrative:			

2b. Outcomes or Impacts

We are at the early phase of these partnerships; far too early to assess impacts.

2c. Plans

The CBN will continue to seek partnerships that can accelerate progress towards its research and educational goals. The advent of videoconferencing may provide an

opportunity to communicate with partners at a distance. We plan to develop an additional research partnership with Dr. Jill Becker from Univ of Michigan, including extensive collaborations and exchange of students. Dr. Becker will be joining the CBN for a sabbatical in the next year.

VI. DIVERSITY

1a. Describe the Center's overall objectives related to increasing diversity at the Center. If there have been any changes in the Center's overall objectives and plans related to increasing diversity since the last reporting period, discuss these changes and the reasons behind them. Inform us of the performance and management indicators the Center has developed to assess progress in meeting its diversity objectives.

The Center is dedicated to developing a new type of scientist, with interests that cross model systems, skills that span many levels of analysis, and ambition that is not discouraged by the difficult problems in behavioral neuroscience. The Center is also concerned about the low representation of minorities in neuroscience. In the latest demographic study of the Society for Neuroscience, 1% of its membership was African Americans, 4% was Hispanic, and 30% was female. Because of its location in Atlanta and the large minority student population of each of the participating institutions, the Center has a unique opportunity to increase the number of minority neuroscientists during this next decade. The participating institutions plan to recruit at least 15 new faculty for the Center over the next 5 years. In the early years, we will be recruiting for faculty through a national search, recognizing that the pool of minority applicants is limited. Ultimately, we hope to increase this pool through our Education Plan, allowing us to retain some of our local talent for the Center faculty. The goals of our recruitment and retention efforts are (1) increase and improve the behavioral neuroscience program across the participating institutions through faculty and post-doc recruitment and (2) increase the number of behavioral neuroscience faculty from under-represented minorities and women. CBN recruitment goals include 50% women and 30% minorities in undergraduate and graduate programs. Special efforts are being made to identify and recruit minorities and women for faculty positions.

	Total	Women	Minorities
Faculty	9	3	2
Postdocs	5	3	1
Grad Students	7	6	3
Undergrad*	88	50	45

1b. Discuss any problems you have encountered in making progress toward the Center's diversity goals during the reporting period as well as any problems anticipated in the next period. Include your plans for addressing these problems.

We plan to use post-baccalaureate research opportunities and a BS/MS program to attract minority students to the graduate programs. CBN faculty, particularly those at minority serving institutions are developing a list of potential faculty to contact. Additional recruiting efforts by CBN scientists at national and regional meetings, and participation in research seminars of MARC programs at minority serving institutions should help this effort. Undergraduate and teacher programs exceeded goals for minority and women participation. Keeping these students in the pipeline and following up on their progress, even if they attend other institutions should prove useful.

2a. Describe and discuss Center contributions to the development of United States human resources in science and engineering at the postdoctoral, graduate, undergraduate, and pre-college levels, with particular attention to accomplishments and activities that aim to attract, increase, and retain the participation of US citizens, women, and [underrepresented minorities](#).

As noted previously, CBN has taken a pipelines and pathways approach to increasing women and minority participation in careers in Behavioral Neuroscience and fields where advanced training in neuroscience and behavior is needed. To increase the pipeline, we are educating K-12 children about neuroscience and behavior and exposing them to careers. At the undergraduate level, where many minorities and women consider medical school primarily, we are exposing freshman and sophomore students to opportunities to learn about and conduct research in behavior and neuroscience. We hope to offer career development seminars for all graduate students and post-docs in the next year. Addressing why women and minorities leave science along the pathways to academic careers or preferentially locate in industry and liberal arts colleges is a national question that requires attention. In the pathways approach, we are developing internships in science journalism, web development, education and biotechnology that will broaden student ideas of what one can do with a science degree. Our outreach programs target schools in metro Atlanta where over 90% of the students are minorities.

2b. Describe your plans for programs or activities to enhance diversity for the next reporting period with attention to any major changes in direction or level of activity. Be sure to discuss how the planned activities will enable the Center to meet its goals.

CBN has established a Task Force to provide more opportunities for HBCU faculty to participate in Center research collaboratories, which in turn will enable more students to

be involved in research while undergraduates. This Task Force is also developing strategic plans for faculty and postdoctoral recruitment to increase the participation of minorities. Identifying prospective faculty and postdoctoral candidates with joint recruitment ads, special mailings, and capitalizing on the collaborative nature of the CBN is part of our plan. Members of our external board have suggested a workshop on recruitment and retention issues. Several of our faculty are involved in planning such material for the Graduate program Retreat at Emory this fall.

CBN includes 5 HBCU's in the 8 colleges and universities that comprise the Center. These schools send many minority students to graduate programs. Emory, GSU and GT also have significant minority and women undergraduate enrollments. Indeed GT has just been ranked number 1 in the number of black undergraduates and doctoral students completing engineering degrees. As we noted we are planning a BS/MS program for Center students and a post-baccalaureate research program to attract students to the graduate programs. NIH's IRTA programs and CAU's PRISM-D program provide ample evidence that additional research experience is the best predictor of success for minorities.

3. Discuss the impact of these programs or activities on enhancing diversity at the Center.

It is too early to evaluate impact.

VII. MANAGEMENT

1a. Organizational Strategy and Rationale (see Appendix B for Organizational Chart)

The CBN is a consortium of 8 institutions. Each institution has a representative on the CBN Executive Committee which oversees the three Center components: Research, Education, and Knowledge Transfer. The Executive Committee also includes the heads of the collaboratories and cores. The Executive Committee votes on Center membership, venture grants, and changes in Center policy. Due to the size of this group, a subgroup of 8 has formed a Steering Committee that meets weekly to address details of the Center's operations. The Steering Committee consists of the director, co-directors, their deputies, and Dr. Pam Scott-Johnson as a representative of the AUC. A second subgroup comprises the Venture Grant committee that reviews venture proposals and makes recommendations to the Executive Committee. The Venture Grant Committee includes the director, heads of the collaboratories, co-director for education, and Dr. Peter MacLeish as a representative of the AUC.

Two advisory committees have been formed (see below). An Internal Advisory Board consisting of the Provost (or Provost's designee) of each institution reviews issues of resource equity, cross-institutional policies, and opportunities for joint ventures. An External Advisory Board, consisting of 12 distinguished scientists and educators, advises the Center on a range of issues, from faculty recruitment to research development to educational programs and industrial partnerships.

1b. Problems

Two of our P.I.s have stepped down from the CBN: Dr. Melissa Harrington from Morehouse has moved to Delaware (9/01) and Dr. Don Giddens of Georgia Tech has taken on other responsibilities that preclude his commitment to the CBN. Dr. J.K. Haynes has replaced Dr. Harrington and Dr. Steve Deweerth has replaced Dr. Giddens.

The Internal Advisory Board has been hampered by changes in personnel. Of the 8 institutions, all but 2 have changed provosts this year. We will re-form this group in the coming year, but in the interim are using the Task Force to address the central issue: how will each institution assist the CBN in meeting its ambitious goals and how will the CBN assist each institution in meeting institutional objectives.

The External Advisory Board has met twice. In the most recent meeting, only half the Board could attend. A similar number has committed to our next meeting in October. We plan to enlarge this group to ensure that a sufficient number of Board members are present at meetings. This group represents an exceptional resource that will be used more intensively in the future.

2. Management & Communication systems

In the first two years of the CBN, we have encouraged face-to-face meetings rather than electronic communication. All of the original members of this Center work within 30 minutes of each other, yet most had never met. The frequent meetings and discussions, while challenged by traffic and parking problems, were critical for us to get to know each other as a working group. All CBN members were also networked by LearnLink.

At this point, we need to find more efficient ways to meet. A supplement proposal for portable videoconferencing equipment should assist us with communications for both research and educational missions.

3. Affiliations

Internal Advisory Board

	Name	Affiliation
1	Rebecca Chopp	Provost, Emory University
2	Ron Henry	Provost, Georgia State University
3	Jean-Lou Chameau	Provost, Georgia Institute of Technology
4	Peter MacLeish	Dir. Neurosci Inst., Morehouse School of Med.
5	J.K. Haynes	Dean, Sciences; Morehouse College
6	Sylvia Bozeman	Assoc. Provost, Spelman College
7	Grant Venerable	Interim Provost, Morris Brown College
8	Isabella Finklestein	Chair, Dept of Biology, Clark-Atlanta Univ.

External Advisory Board Members

	Name	Affiliation
1	Gene Block	Dept of Biology, University of Virginia
2	Dorothy Cheney	Dept of Biology, University of Pennsylvania
3	Errol E. de Souza	Aventis Pharmaceuticals, Inc., Bridgewater, NJ
4	Edward Kravitz	Dept of Neurobiology, Harvard Medical School
5	Shirley Malcom	Dir. Education and Human Resources, AAAS
6	Eve Marder	Volen Center, Brandeis Univeristy
7	Peter Marler	Ctr for Animal Behavior, UC Davis
8	Bruce McEwen	Dir. Neuroendocrinology, The Rockefeller Univ
9	Klaus Miczek	Neuroscience, Tufts Univeristy
10	Kathie Olsen	Chief Scientist, NASA Headquarters
11	Tony Shuker	Dir. Indus Rel & Tech Transfer, GA Tech
12	Phil Skolnick	Vice-Pres of Research,, Dov Pharmaceuticals
13	Sanya A. Springfield	The Comprehensive Minority Biomed, NIH

4. Changes to Strategic Plan

Our Strategic Plan is less than 18 months old. We have not changed the objectives or indicators, but some of the timelines were overly ambitious. In the research plan, the collaboratories are nearly on schedule but the cores are not yet ready for technology transfer. In the education/knowledge transfer plan, several of the plans for Years 1 and 2, such as the development of videos, on-line curricula, and virtual labs/virtual posters have

been delayed. The development of a cross-institutional major and a BS/MS program will be a focus for Year 3. The development of a videoconference links between participants is now planned for Year 3. The intellectual property agreement planned for Year 1 will be addressed in Year 3.

Most salient delays are in recruitment. We have exceeded our goal of recruiting 5 faculty in year 2, but we failed to land a senior recruit as proposed. An intensive faculty recruitment effort at Emory (Psychology) developed 4 offers, yielding only a single acceptance (two are pending, including one for an endowed professorship). Efforts for faculty recruitment at AUC need to be accelerated. Recruitments for cores (especially Imaging and Cellular) need to progress this year. And we have not met our goal of 10 post-doctoral fellows by Year 2. There are 5 fellows at Emory but none at the other institutions.

VIII. CENTER-WIDE OUTPUTS AND ISSUES

1a. Center Publications

1. Albers, H.E., Huhman, K.L. and Meisel, R.L. Hormonal basis of social conflict and communication. In: *Hormones, Brain and Behavior*, D. Pfaff (ed), Academic Press, in press
2. Cooper, T.T., Clancy, A. and Albers, H.E. Conversion of testosterone to estrogen is not necessary for the expression of mating behavior in male Syrian hamsters. *Hormones and Behavior*, 39:237-245, 2000.
3. Cushing, B.S., Martin, J.O., Young, L.J., and Carter, C.S. (2001) The effects of peptides on partner preference formation are predicted by habitat in prairie voles. *Hormones and Behavior*, 39:48-58
4. Cymbalyuk, G.S., Patel, G.N., Calabrese, R.L., DeWeerth, S.P., and Cohen, A.H. Modeling Alternation to Synchrony with Inhibitory Coupling: A Neuromorphic VLSI Approach. *Neural Computation*, 12: 2259-2278, 2000.
5. Davis, M. Neural circuits of anxiety and fear (1999). In: *Neurobiological foundation of mental illness*. D.Charney, E. Nestler and B. Bunney (Eds). Oxford University Press, 1999, 463-474

6. Davis, M. The role of the amygdala in conditioned and unconditioned fear and anxiety. In J. P. Aggleton (Ed.), *The Amygdala*, Volume 2, Oxford, United Kingdom: Oxford University Press, 2000, p. 213-288
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12. Gingrich, B., Liu, Y., Cascio, C., Wang, Z., Insel, T.R. Dopamine D2 receptors in the nucleus accumbens are important for social attachment in female prairie voles. *Behavioral Neuroscience* 114:173-183, 2000.
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15. Harrison, R.R., Bragg, J.A., Hasler, P., Minch, B.A. and DeWeerth, S.P. A CMOS Programmable Analog Memory-Cell Array Using Floating Gate Circuits. *IEEE Transactions on Circuits and Systems II*, 48:1 (4-11), January 2001.
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17. Insel, T.R., and Young, L.J. The neurobiology of attachment. *Nature Neuroscience Review* 2:129-136, 200
18. Jacob, D.A., Temple, J.L., Patisaul, H.B., Young, L.J. and Rissman, E. (2001). Coumestrol antagonizes neuroendocrine actions of estrogen via the estrogen receptor α . *Proceedings of the Society for Experimental Biology and Medicine*. 226:301-306.
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41. Young, L.J, Gingrich, B., and Insel, T.R. (2001). Cellular mechanisms of affiliation and monogamy. *Hormones and Behavior*. In Press

1b. Conference Presentations

1. Banks, M. C.; Jasnow, A. M.; Harmon, A. C.; Huhman, K. L. Behavioral and neuroendocrine response to social defeat in female Syrian hamsters. *Neuroscience Abstracts*, 26, 1272, 2000.
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6. Faruzzi, A. N.; Huhman, K. L. Effect of social defeat on defensive withdrawal behavior in Syrian hamsters. *Neuroscience Abstracts*, 26, 1271, 2000.
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10. Jasnow, A. M.; Huhman, K. L. Infusion of muscimol into the amygdala blocks acquisition and expression of conditioned defeat in Syrian hamsters. Neuroscience Abstracts, 26, 1534, 2000.
11. Johnson, K., Clifford, K., Martin, K. and M.A. Harrington In the carnivorous snail *Euglandina rosea* prey trail recognition and following are learned behaviors dependent on nitric oxide (2001) Society for Neuroscience Abstracts
12. L.J. Young, E. Frank, J.M. Aldag, A. Wigger, and R. Langraf Expression of the vole V1a vasopressin receptor in the rat brain using an adeno-associated virus vector: Improved social recognition. 2001 World Congress of Neurohypophysial Hormones. Bordeaux, France.
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15. Moore, Karom, Smith Huhman and Albers Differential expression of aggressive behavior in a familiar and unfamiliar environment. Society for Neuroscience, 2000.
16. Paschall, G.Y. and Davis, M. Olfactory-mediated fear potentiated startle, Society for Neuroscience Abstracts, Vol. 26, 2199, 2000.
17. Shi, C.J., Mathews, E. and Davis, M. Muscimol administration into dorsal hippocampus blocks the expression of trace fear conditioning, but not context fear, measured with fear-potentiated startle. Society for Neuroscience Abstracts, Vol. 26, 483, 2000
18. Simoni, M. F., M.Sorensen, G. Cymbalyuk, R.L. Calabrese, S.P. DeWeerth, Building Hybrid Systems Using a VLSI Model of the Leech Heart Interneuron. Society for Neuroscience Abstracts, November 2000.
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20. Stanek, L., Walker, D.L. and Davis, M. Amygdala infusion of LY354740, A group II metabotropic glutamate receptor agonist, blocks fear-potentiated startle in rats Society for Neuroscience Abstracts, Vol. 26, 2020, 2000.

21. Walker, D.L. and Davis, M. Quantifying fear-potentiated startle: A comparison of absolute versus percent increase scoring methods. Society for Neuroscience Abstracts, Vol. 26, 482, 2000.
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23. Whitten, Jasnow, Albers, Martin-Schild, Zadina and Huhman The effects of endomorphin-1 on social behavior in Syrian hamsters. Society for Neuroscience, 2000.
24. Whitten, R. D.; Jasnow, A. M.; Albers, H. E.; Martin-Schild, S.; Zadina, J. E.; Huhman, K. L. The effects of endomorphin-1 on social behavior in Syrian hamsters. Neuroscience Abstracts, 26, 1771, 2000.

1c. Dissemination Activities

See Knowledge Transfer.

2. Awards and Honors

	Recipient	Reason for Award	Award Name and Contributor	Date
1	Pat Marsteller	A+ Award	Atlanta Public Schools	5/01
2	Jeanne Stahl	Robert S. Daniel Award	Am. Psycholog. Assn.	8/01
3	Peter MacLeish	George and Barbara Bush Chair of Neurobiology	Bush Family	2/01
4	Thomas Insel	Distinguished Investigator Perry Gilbert lecture	NARSAD Cornell Neurobiology	5/01 3/01
5	Sarah Pallas	Outstanding Faculty Achievement Award - nom	Georgia State Univ	Spring , 2001

3. M.S. and Ph.D. Students

	Student Name	Degree(s)	Years to Degree	Placement
1	No Graduates			
2				
	Add rows as necessary			

4. General Outputs

Patent Name	Number	Application Date	Receipt Date (leave empty if pending)
No Patents			
License Name	Number	Licensed By	Date
No license agreements			
Name of Start-Up Company	Year	Main Product	
No companies			
Narrative: Describe any other outputs of knowledge transfer activities not listed above.			

5. Participants - Faculty and Post-doctoral fellows

	Participant Name	Category	Gender	Disability Status	Ethnicity	Race	Citizenship
1	Albers, Elliott	FAC	M	None	Not Hispanic or Latino	White	U.S.
2	Bartness, Timothy J.	FAC	M	None	Not Hispanic or Latino	White	U.S.
3	Beck, Christopher	FAC	M	None	Not Hispanic or Latino	White	U.S.
4	Clancy, Andrew	FAC	M	None	Not Hispanic or Latino	White	U.S.
5	Constantinidis, Ioannis	FAC	M	None	Not Hispanic or Latino	White	U.S.
6	Crutcher, Michael	FAC	M	None	Not Hispanic or Latino	White	U.S.
7	Davis, Michael	FAC	M	None	Not Hispanic or Latino	White	U.S.
8	Demetrikopoulos, Melissa	FAC	F	None	Not Hispanic or Latino	White	U.S.
9	Derby, Charles	FAC	M	None	Not Hispanic or Latino	White	U.S.
10	DeWeerth, Steve	FAC	M	None	Not Hispanic or Latino	White	U.S.
11	Edwards, David	FAC	M	None	Not Hispanic or Latino	White	U.S.
12	Francis, Darlene	P-Doc	F	None	Not Hispanic or Latino	African-Canadian	Can.
13	Freedman, Lorin	FAC	M	None	Not Hispanic or Latino	White	U.S.
14	Gernert, Kim M.	FAC	F	None	Not Hispanic or Latino	White	U.S.
15	Gonzalez, Fernando	FAC	M	None	Hispanic or Latino	White	U.S.
16	Gray, Danielle N.	FAC	F	None	Not Hispanic or Latino	African-American	U.S.
17	Harrington, Melissa A.	FAC	F	None	Not Hispanic or Latino	Asian	U.S.
18	Hemby, Scott	FAC	M	None	Not Hispanic or Latino	White	U.S.
19	Huhman, Kim L.	FAC	F	None	Not Hispanic or Latino	White	U.S.
20	Insel, Thomas R.	FAC	M	None	Not Hispanic or Latino	White	U.S.
21	Katz, Paul	FAC	M	None	Not Hispanic or Latino	White	U.S.
22	Kimbrow, Sean	FAC	M	None	Not Hispanic or Latino	African-American	U.S.
23	Kuhar, Michael J.	FAC	M	None	Not Hispanic or Latino	White	U.S.
24	Lennard, Paul	FAC	M	None	Not Hispanic or Latino	White	U.S.
25	Liotta, Dennis	FAC	M	None	Not Hispanic or Latino	White	U.S.

					Latino		
26	MacGregor, Grant	FAC	M	None	Not Hispanic or Latino	White	Perm Res
27	MacLeish, Peter	FAC	M	None	Not Hispanic or Latino	African-Amer.	U.S.
28	Marsteller, Pat	FAC	F	None	Not Hispanic or Latino	White	U.S.
29	McGinnis, Michael	FAC	M	None	Not Hispanic or Latino	White	U.S.
30	Moore, Tim	FAC	M	None	Not Hispanic or Latino	African-Amer	U.S.
31	Muly, Christopher	FAC	M	None	Not Hispanic or Latino	White	U.S.
32	Mustari, Micael J.	FAC	M	None	Not Hispanic or Latino	White	U.S.
33	Nair, Hemanth	P-DOC	M	None	Not Hispanic or Latino	Asian	U.S.
34	Neill, Darryl	FAC	M	None	Not Hispanic or Latino	White	U.S.
35	Pallas, Sarah L.	FAC	F	None	Not Hispanic or Latino	White	U.S.
36	Parent, Marise	FAC	F	None	Not Hispanic or Latino	White	U.S.
37	Parr, Lisa	P-DOC	F	None	Not Hispanic or Latino	White	U.S.
38	Phelps, Steve	P-DOC	M	None	Not Hispanic or Latino	White	U.S.
39	Plotsky, Paul	FAC	M	None	Not Hispanic or Latino	White	U.S.
40	Rainnie, Donald	FAC	M	None	Not Hispanic or Latino	White	U.S.
41	Rothbaum, Barbara O.	FAC	F	None	Not Hispanic or Latino	White	U.S.
42	Scott, John	FAC	M	None	Not Hispanic or Latino	White	U.S.
43	Scott-Johnson, Pamela	FAC	F	None	Not Hispanic or Latino	Afr- Am	U.S.
44	Shi, Changjun	FAC	M	None	Not Hispanic or Latino	Asian	Perm Res
45	Stahl, Jeanne	FAC	F	None	Not Hispanic or Latino	White	U.S.
46	Toufexis, Donna	P-DOC	F	None	Not Hispanic or Latino	White	U.S.
47	Wallen, Kim	FAC	M	None	Not Hispanic or Latino	White	U.S.
48	Walthall, Walter W.	FAC	M	None	Not Hispanic or Latino	White	U.S.
49	Wilson, Mark	FAC	M	None	Not Hispanic or Latino	White	U.S.
50	Winslow, James	FAC	M	None	Not Hispanic or Latino	White	U.S.
51	Young, Larry	FAC	M	None	Not Hispanic or Latino	White	U.S.

					Latino		
Add rows as necessary							

Student Participants (n = 63)

Last Name	First	Category	Gender	Dis-ability	Race	Ethni city	Citizenship
Banks Solomon	Matia	G	Female	UNK	African American		US
Caldwell	Heather	G	Female	UNK	WhiteNonHispanic		US
Faruzzi	Alicia	G	Female	UNK	WhiteNonHispanic		US
Foster	Michelle	G	Female	UNK	African American		US
Hammock	Elizabeth	G	Female	UNK	WhiteNonHispanic		US
Jasnow	Aaron	G	Male	UNK	WhiteNonHispanic		US
Lim	Miranda	G	Female	UNK	WhiteNonHispanic		US
Atkinson	David	UG	Male	None	White		US
Artman	Allison	UG	Female	None	African American Native American		US
Banton	Sophia	UG	Female	None	African American		US
Bellamy	Michael	UG	Male	None	African American		US
Berenguer	Christie	UG	Female	None	White		US
Billings	Jonathan	UG	Male	None	African American		US
Blake	Judd	UG	Male	None	African American		US
Bolden	Travis	UG	Male	None	African American		US
Bowler	Kate	UG	Female	None	White		US
Bradley	Corey	UG	Male	None	African American		US
Campbell	Patrick	UG	Male	None	African American		PR
Castain	Angela	UG	Female	None	African American		US
Chandler	Kevin	UG	Male	None	African American		US
Chapman	Shelley	UG	Female	None	African American		US
Cunningham	Timothy	UG	Male	None	African American		US
Cureton	Carlos	UG	Male	None	African American		US
Fusaro	Angela	UG	Female	None	White		US
Furlong	Ellen	UG	Female	UNK	White		US
Garuba	Fatima	UG	Female	UNK	African American		
Gunawan	Charles	UG	Male	UNK	Asian		US
Hassett	Janice	UG	Female	UNK	WhiteNonHispanic		US
Humphries	William	UG	Male	UNK	African American		US
Johnson	Lloyd	UG	Male	UNK	African American Non-Hispanic		US
Katz	Elyse	UG	Female	UNK	WhiteNonHispanic		US

McKenna	Jaclyn	UG	Female	UNK	WhiteNonHispanic		US
Merchant	Chris	UG	Male	UNK	African American		
Misra	Monica	UG	Female	UNK	AsianPacificIsland		
Oskounei	Armin	UG	Male	UNK	UNK		US
Pacquin	Jason	UG	Male	UNK	White		US
Poku	Helena	UG	Female	UNK	African American		US
Raghaven	Amit	UG	Male	UNK	Asian		US
Saben	Rebecca	UG	Female	UNK	WhiteNonHispanic		US
Shea	Stephanie	UG	Female	UNK	WhiteNonHispanic		US
Siebert	Erin	UG	Female	UNK	WhiteNonHispanic		US
Wagner	April	UG	Female	UNK	WhiteNonHispanic		US
Cochran	Kristin	UG	Female	UNK	WhiteNonHispanic		US
Gaudry	Qeuntin	UG	Male	UNK	WhiteNonHispanic		US
Gurvich	Svetlana	UG	Female	UNK	WhiteNonHispanic		US
Lee	Laura	UG	Female	UNK	WhiteNonHispanic		US
Lundy	Tamelca	UG	Female	UNK	AfricanAmerican Non-Hispanic		US
Na	Hye	UG	Female	UNK	AsianPacificIsland		US
Poku	Helena	UG	Female	UNK	African American		PR
Shkolnik	Alexander	UG	Male	UNK	WhiteNonHispanic		US
Solomon	Wesley	G	Male	UNK	African American		PR
Tennant	Phillip	UG	Male	UNK	WhiteNonHispanic		US
Valentine	Nduku	UG	Female	UNK	African American Non-Hispanic		US
Virmani	Sharad	UG	Male	UNK	AsianPacificIsland		US
Vu	Christi	UG	Female	UNK	AsianPacificIsland		US
White	Justin	UG	Male	UNK	WhiteNonHispanic		US
York	Stacy	UG	Female	UNK	African American		US
Brannon	Nancy	T	Female	UNK	African American Non-Hispanic		US
Carter	Charles	T	Male	UNK	African American Non-Hispanic		US
Hicks	Sherrilyn	T	Female	UNK	African American Non-Hispanic		US
Kamara	Angel	T	Female	UNK	African American Non-Hispanic		US
Spivey	Alicia	T	Female	UNK	African American Non-Hispanic		US

Thomas	Marjorie	T	Female	UNK	African American		US
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6. Internal Reporting Purposes

1	the number of participating institutions (all academic institutions that participate in activities at the Center)	8
2	the number of institutional partners (total number of non-academic participants, including industry, states, and other federal agencies, at the Center)	5
3	the total leveraged support (sum of funding for the Center from all sources <i>other</i> than NSF)	<p style="text-align: right;">Cost share = \$1,218,543</p> <p style="text-align: right;">Other research support = <u>\$4,010,626</u> (from 4 collabs)</p> <p style="text-align: right;">TOTAL = \$5,229,169</p>
4	the number of participants (total number of people who utilize center facilities; not just persons directly supported by NSF)	<p>51 faculty/post-docs</p> <p><u>63 students</u></p> <p>114 total</p>

7. Media Publicity

"Science Explains Why Men are Like That" - Gene Tied to Social Memory - Jim Winslow - New Yorker- Aug. 7, 2000

"Elder Bushes Lend Names to Chair at Morehouse Medical School" - Dr. MacLeish - Atlanta Journal Constitution - Feb. 6, 2001

"EDUCATION NOTES: Neuroscience research pays visit" - News brief on BioBus visits as part of Brain Awareness Month - AJC Dekalb Extra - pg. JA4 - March 15, 2001

Lori Marino - NPR coverage of mirror self recognition in dolphins - May 1, 2001; CNN News Site, live with Joey Chen - May 2, 2001; NY Times, May 2, 2001

AAAS Radio report - "Science Update"- Insel and others - May 22

"Brainpower: How to keep it. Aging takes a toll, but mental workouts can help avert decline" - Danielle Gray - AJC - Sunday, May 20, 2001 -

http://www.accessatlanta.com/partners/ajc/epaper/editions/sunday/perspective_b37025c501519192004a.html

"Proving that your brain has magnetic appeal" - Stephan Hamann - AJC - Sunday, May 20, 2001 -

http://www.accessatlanta.com/partners/ajc/epaper/editions/sunday/perspective_b37025f1015140ee0087.html

Atlanta Public Radio- feature piece on Tom Insel's research on oxytocin and monogamy in voles - July 17, 2001.

French State Television series on love - Tom Insel and Frans Dewaal - Fall 2000 - projected air date Fall 2001.

Attachments

Appendix A: Biographical Information of New Faculty (Recruited Year 2)

Stephan Anagnostaras, Ph.D. is a new Assistant Professor in the Department of Psychology at Emory University. Dr. Anagnostaras received his B.S. (Psychology) from Univ. of Michigan, his Ph.D. from UCLA (advisor - Dr. Michael Fanselow), and his postdoctoral training at UCLA with Dr. Alcino Silva. In his graduate work, he demonstrated the effects of hippocampal lesions on retrograde amnesia. As a post-doctoral fellow, supported by an NRSA, he focused on learning and anxiety, with the use of several transgenic mouse models. In the CBN, Dr. Anagnostaras will be involved with the Fear Collaboratory.

Deborah Baro, Ph.D. is a new Assistant Professor in the Department of Biology at Georgia State University. Dr. Baro received her B.S. and Ph.D. from Univ of Illinois (Advisor: Michael Cummings). She completed a post-doctoral fellowship with Ron Harris-Warrick at Cornell's Department of Neurobiology and Behavior in 1991 and remained in this same lab as a research associate until 1998. For the past 3 years, Dr. Baro has been an Associate Investigator in the Institute of Neurobiology, University of Puerto Rico. Her research focuses on ion channels, with molecular comparisons of

channel sequences in various invertebrates. She will be working with the Aggression Collaboratory to develop molecular tools for the study of serotonin receptors and transporters in identified neurons of the crayfish. Her research is supported by NSF (IBN9904017) and NIH (R01NS38770).

Dolores Bradley, Ph.D. is a new Assistant Professor at Spelman College. Dr. Bradley received her B.A. from Tennessee State University, Ph.D. from Brown University (Experimental Psychology), and a post-doctoral fellow with Ron Booth at Emory. Since 1992 she has served as a research Associate at Yerkes Research Center where she studied the impact of early experience on development of the visual system in non-human primates. Dr. Bradley's enthusiasm for working in the lab with undergraduates will be an important asset for the CBN. In addition to her teaching at Spelman, she will maintain a lab at Yerkes where AUC students can get a unique experience of behavioral neuroscience research with infant monkeys. Dr. Bradley's research is supported by a Minority Scientist Long-Term Supplement to the Yerkes P51 grant NIH/NCRR and a subcontract to an R01 award from NIH/NEI.

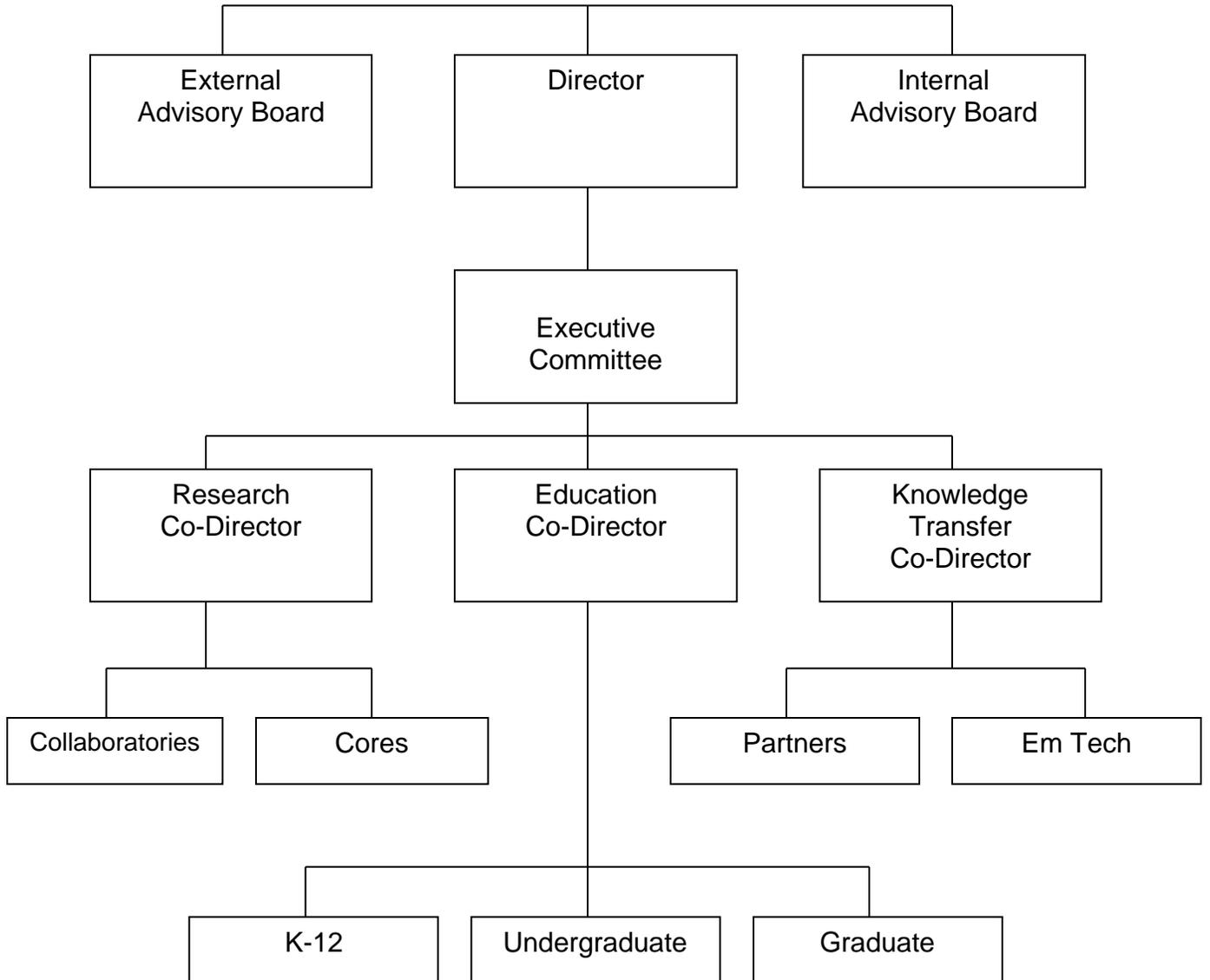
Byron Ford, Ph.D. is a new Assistant Professor in the Neuroscience Institute at Morehouse School of Medicine. Dr. Ford received his undergraduate degree in biology at Grambling State University, his Ph.D. in neuroscience at Meharry Medical College, and his postdoctoral training at Harvard Medical School in the lab of Dr. Gerald Fischbach where he was an NSF fellow. In 1998, Dr. Ford moved with Dr. Fischbach to NIH where he served as manager of the Section on Developmental Neurobiology. Dr. Ford's research has focused on the role of neuregulin in myogenesis. Neuregulin is one of several factors that may also have a role in neural plasticity. Dr. Ford's role in the CBN will be initially with the Molecular Core where he will develop microarrays for the study of neural plasticity in mice.

Matthew Grober Ph.D. is a new Associate Professor in the Department of Biology at Georgia State University. Dr. Grober received his undergraduate degree from California State Univ. Long Beach (marine biology) and his PhD from UCLA (biology). He did a post-doctoral fellowship with Andrew Bass at Cornell where he became experienced in neuroscience. His major research interest has been neural correlates of gender change in coral reef fish. For instance, he was the first to demonstrate changes in arginine vasotocin mRNA with sex change. For the past 5 years, Dr. Grober has been in the Department of Life Sciences at Arizona State University West. In the CBN, Dr. Grober will participate in both the aggression and reproduction collaboratories. He brings extensive field experience to the CBN, providing novel opportunities for our students to

participate in behavioral experiments in more naturalistic settings. Dr. Grober is supported by an NSF grant via the program in neuroendocrinology.

Kerry Ressler, MD, Ph.D. is a new Assistant Professor in the Department of Psychiatry at Emory University School of Medicine. Dr. Ressler received his undergraduate degree from MIT (Biology), his PhD degree from Harvard (Neuroscience), and his MD degree from Harvard Medical School (1997). His graduate work with Dr. Linda Buck was in the area of odorant receptor organization of the mammalian olfactory system. He was one of the first investigators to use molecular techniques to map the olfactory receptive field, demonstrating an extraordinary convergence from epithelium to olfactory glomeruli. This work published in two papers in *Cell* and a third in *Neuron* has become the foundation for a broad investigation into the organization of the mammalian olfactory system. Following medical school, Dr. Ressler trained in psychiatry at Emory University. He joined the CBN upon completing his residency in July, 2001. His specific interest is the use of molecular techniques to track functional pathways from the olfactory bulb through the amygdala. With Dr. Michael Davis in the Fear Collaboratory of the CBN, Dr. Ressler will investigate genes specifically activated by olfactory fear conditioning. He is supported by a Pfizer Postdoctoral Fellowship Award, a Culpepper Medical Scholarship (Rockefeller Brothers Fund), and has applied for a NARSAD award.

Appendix B: CBN Organizational Chart



Appendix C: Minutes of Advisory Committee Meetings

CBN External Advisory Board Meeting

9/7/00-9/8/00

The External Advisory Board (EAB) of the Center for Behavioral Neuroscience (CBN) held its first meeting on September 7th and 8th, 2000. The goals for the first meeting were to: 1) provide an overview of research, educational and outreach components of the center; 2) review and discuss the progress in meeting first year objectives; 3) discuss the upcoming site visit; 3) review and discuss proposed second year activities; and 4) tour laboratory and outreach facilities. As a first order of business, a charter for the Board was adopted.

The EAB was greatly impressed with progress during the first year. This was especially impressive inasmuch as NSF funding for the Center began only about four months ago. The scientific effort has begun as a set of "informed scientific conversations" among groups of center investigator interested in different aspects of the neurobiology of social interactions. These conversations have led to new and, in some cases, very novel multi disciplinary collaborations. These collaborations of which ten formal ones have been established are seed-funded with Venture Grants provided by the Center.

With respect to the research program, the Center is clearly just initiating its activities and is still in a discovery stage where new relationships are being explored and plans developed for new research efforts.

The strategy that the Center has adopted, the creation of "collaboratories" in which groups of investigators interact and collaborate in new and hopefully productive ways, is a work in progress. Center investigators appear very flexible in testing and modifying this model as they gain experience in working together within a multi-university consortium.

With regard to education and outreach, the Center has clearly hit stride in a very short time. Rapid progress has been aided by having been able to enlist the participation of a very successful educational outreach program that has been in operation for several years. The outreach effort is active at several levels from K-12 to undergraduate and graduate students. The Center has developed an integrated and expansive set of activities including some novel science educational outreach to primary and secondary schools

(e.g., a mobile biology laboratory) to attempts to integrate and expand neuroscience education at the participating institutions.

The External Advisory Board was impressed with the breadth of educational and outreach activities being initiated. It does have a few recommendations. We believe that the research opportunities for undergraduates, sponsored by the Center, should go beyond the Center's research theme to the neuroscience field, broadly defined. That is, we see great benefits to Center support of undergraduates performing research in many areas of neuroscience, including neuroscience research in laboratories of non-center investigators. To provide some connectivity between the undergraduate research experience and the CBN, a regular "research lunch" could be held where center investigators get a chance to meet with student performing neuroscience research. An end of the summer day of student research seminars could also provide important contact between center faculty and students engaged in directed neuroscience research.

A second recommendation of the EAB is that the CBN should exercise caution in expanding too aggressively the number of outreach and educational programs sponsored by the center. It is the collective experience of EAB advisors that quality outreach programs are time-intensive and very difficult to sustain at a high level of quality. The CBN should strive for quality rather than quantity in defining its outreach and educational mission. A few effective programs will have greater impact than a large number of less well supported programs. We believe that the Center has initiated some very innovative programs which should be allowed to develop into mature programs without significant expansion of these activities.

The Center for Behavioral Neuroscience faces many complex but interesting challenges as it charts its course during its first few years of operation. One important issue is the underlying tension between two competing strategies. On one hand, for the Center to make highly visible scientific progress (i.e., many prominent scientific publications within a short time), the Center may have to adopt a very focused scientific research program that may end up somewhat exclusive in terms of the number of investigators contributing to the core research mission. NSF centers are expected to produce highly innovative research that take advantage of the scale and duration of center funding in order to extend research beyond the capabilities of research supported on an individual investigator basis. In this context the "collaboratory approach" that the center has initiated carries some risk. On the other hand, an important and special opportunity this center enjoys is the possibility of engaging scientists at several primarily minority institutions in research in new and interesting ways. This special opportunity argues for a very inclusive approach to the scientific program to avoid a situation where some of the

institutions end up performing all of the research while other institutions participate exclusively in educational and outreach activities. We believe that this outcome should be avoided. In this context the collaboratory concept seems to have merit in providing a mechanism for bringing scientists together to plan and engage in the scientific mission.

Given the special circumstances and opportunities that this center enjoys, the External Advisory Board urges that the Center should be given time to explore innovative strategies to develop inclusive research groups. It may not be possible for CBN to rapidly post many high profile research publications. However, the Center leadership are well aware of these issues and we are confident that the center director will make the appropriate choices and adaptations to insure the success of the center.

Another shorter-term challenge that the center faces in the next year or so is maintaining an appropriate balance among the center's missions of research, education and outreach. This represents a special challenge to this center insomuch as the educational and outreach missions came on-line rapidly as a result of previous activities in this area. Research collaborations, on the other hand, are developing more slowly. Until some form of equilibrium is reached in terms of the maturity of programs there is a danger that the center can become unbalanced, where outreach and educational programs begin to fill in all of "center space", in the sense that the center comes to view itself primarily with respect to its non research mission. Outreach and education play important roles in any NSF center and certainly CBN should be among the leaders in this area. Nonetheless, the center research program is central to the success of the CBN's mission and the research agenda must be central to the CBN's vision and identity. We are confident that the CBN leadership can establish the appropriate balance among these important activities.

In summary, the review committee is greatly impressed by the progress that the CBN has achieved during its first year of operation. The Director and Co-Directors form a highly effective team that brings together substantial administrative experience, research expertise and expertise in outreach and educational programs. Although the mission facing any new NSF Science and Technology Center is daunting, the Center for Behavioral Neurobiology has an excellent chance of becoming distinguished.

CBN External Advisory Board Meeting

May 4, 2001

Attending: Gene Block (chair), Errol DeSouza, Ed Kravitz, Peter Marler, Kathie Olsen, Phil Skolnick

Guests: Robert Anholt (N.C. State), Keith Kendrick (Babraham Institute)

Absent: Klaus Miczek, Shirley Malcom, Eve Marder, Bruce McEwen, Tony Shukar, Sanya Springfield

Synopsis of CBN presentations:

This was the second meeting of the CBN EAB. The Center is mid-way through its second year with its next site visit planned for late September. After reviewing the previous Board report and Site Visit report, Dr. Insel described progress and problems. The Center has established a working administrative infrastructure with support staff and committees. A monthly seminar series brings outstanding scientists to the CBN. The CBN has plans for new buildings at Emory and Georgia State. In the past 6 months, new faculty have been recruited at Emory (Kerry Ressler, Stephan Anagnostaros), Georgia State (Matthew Grober, Deb Baro), and Morehouse School of Medicine (Byron Ford). Emory has offers out to Emilie Rissman, Jill Becker, and Donna Maney with responses expected in the next few weeks. The Board discussed the importance of bringing faculty into collaborations with an identity in the Center as well as their home departments.

Dr. Albers described recent progress in the scientific component of the CBN. After a series of meetings on the amygdala and a scientific retreat in the winter, collaboratories were reorganized to be more focused and coherent. Each collaboratory (affiliation, aggression, fear, reproduction) has been challenged to develop a detailed strategic plan which will bring their area of research to the next level. These plans now form the basis for venture grants and for technical developments in the cores. Each of the collaboratory heads then presented an overview of ongoing projects.

Larry Young described research on affiliation. Much of this focuses on the neuropeptides oxytocin and vasopressin. Studies in diverse species (fish, birds, monkeys, and humans) are cloning and mapping receptors for these neuropeptides or their non-mammalian ancestral forms. The collaboratory is interested in the interaction of genes and experience on the development of these systems and related behaviors, including parental care, pair bond formation, and infant social interaction. This group published a recent paper in

Nature Reviews Neuroscience to describe the opportunities in this area of research. The Board suggested additional opportunities for collaboration by including species (crustacea, for instance) that are used elsewhere in the CBN.(Kravitz) They also recommended that an external partner be found for developing proteomics.(DeSouza)

Don Edwards described research on aggression. This collaboratory has focused on social dominance in crayfish and hamsters, specifically the change in behavior that accompanies either acquiring or losing dominance. The major thrust is to identify neural changes that accompany this dramatic shift in behavioral state. Projects will focus on serotonergic neurotransmission, peptides associated with stress, alterations in neurogenesis in defined pathways, and changes in learning and sensory discrimination. The Board raised questions about the role of olfactory cues in the behavioral paradigms and the importance of individual recognition for the maintenance of dominance.(Marler) They also emphasized the difficulty in studies of social stress differentiating effects on learning from effects on attention. (Kendrick)

Michael Davis described ongoing studies in the fear collaboratory, This group has built on a productive tradition of research in startle and fear conditioning. One project, closely allied with the aggression collaboratory, investigates the relevance of fear conditioning to the ethological problem of conditioned defeat in hamsters. Another project has developed fear potentiated startle in rhesus monkeys. A third project has begun to map the rat amygdala by recording from slices after cells have been filled with retrograde or anterograde tracers, so that physiology can be assessed in cells of known connectivity. The largest effort has gone into developing a model of olfactory fear conditioning – a new direction for this research program. Kerry Ressler, a new faculty member, described recent discoveries about the molecular and cellular organization of the olfactory system in the rat that may permit an analysis of the fear circuitry from olfactory stimuli that has not been possible with auditory or visual stimuli. The Board asked about studies in development (Marler) and whether the changes will be in dendritic proteins in the bulb or synaptic plasticity in the piriform cortex (where LTP has been demonstrated) or the amygdala as expected.(Kendrick)

Finally, Kim Wallen described the plans for the reproduction collaboratory. This group plans to focus on gender differences, specifically the development of neuroanatomic differences and their relevance to reproductive behavior. Venture grants have been funded to study mate choice in fish, sex behavior in knockout mice, and steroid receptors in *C. elegans*. The group recognized a need for more cellular studies. The Board suggested the need for study of steroid hormones as enhancer elements and that this might be a worthy area for recruiting new collaborators.(Kravitz)

The collaborative presentations were followed by presentations from four trainees. Lisa Parr, a post-doc in the fear collaborative working with Winslow and Davis provided preliminary results from visual scanning studies of face processing in rhesus monkeys. Steve Phelps, a post-doc in the affiliation collaborative working with Young and Insel described variation in the neuroanatomic distribution and molecular structure of vasopressin receptors in wild caught prairie voles. Heather Caldwell, a graduate student working with Elliott Albers, described a novel approach to studying vasopressin effects on flank marking in hamsters by using viral vectors to over-express the V1a receptor in the anterior hypothalamus. Finally, Aaron Jasnow, a graduate student working with Kim Huhman, presented his results of the role of CREB on social defeat in hamsters, again by overexpressing CREB with a viral vector injected into the amygdala.

The Board then recessed for lunch and an opportunity to visit with 8 CBN undergraduate fellows who presented posters based on their research.

The afternoon sessions were devoted to the education and outreach programs. Pat Masteller provided a quick overview of progress.

Paul Katz who directs the graduate program described the beginnings of this initiative (the graduate program was scheduled to begin in year 2). This non-degree granting program, grafted on to existing programs, accepts both incoming first year students (n = 2) as well as advanced students (n = 5) as “CBN scholars.” The goal has been to provide opportunities for students to cross institutions and disciplines without placing additional restrictions beyond the current programs. Core courses include Intro to CBN (taught this past semester) and an annual topics course (planned for fall semester). Recruitment has improved at GSU (4 new students expected for fall) but has not done as well at Emory (2 of 8 accepted students expected in fall). The Board suggested changes in core courses and in recruitment. A core course should cover the basics of behavioral neuroscience, so that all graduates of the program will share a specific core of knowledge. This course could be developed into a textbook and might help to define the field. The Board recommended a Cold Spring Harbor approach with an intensive three week program in the summer including both technical and academic classes. In addition, the Board felt that the CBN needs to become more visible to enhance recruitment. Packaging the Center as a unique opportunity for integrative training might help. The Center should draw from the pool of students in similar interdisciplinary undergraduate programs (mind-brain program at Harvard, new neuroscience program at Smith, human biology at Stanford). Overall the graduate program should worry less about being too restrictive and more about providing rigorous training.

Danielle Gray described the first year's experience with her undergraduate seminar series for freshman and sophomore AUC students. She has been coordinating a biweekly (ie. every other week) evening seminar and dinner to interest students in science careers. The seminars are from post-docs and graduate students. Although attendance and enthusiasm have been high, she noted problems with transportation and coordination across schools. The Board suggested the possibility of meeting on Saturdays and noted the importance of having assistance at each institution.

Melissa Demetrokopolus briefly described outreach programs this year, including a Brain Fair at the local science museum, SciTrek and programs for middle school teachers. She will present results of these and other programs at the Society for Neuroscience meeting in October. The Board recommended Joan Reed and Ed Furshpan at Harvard who are funded for similar efforts.

The final presentation was entitled Inter-Institute Challenges. Pam Scott-Johnson from Spelman who is a member of the CBN Steering Committee chaired a discussion that included J. K. Haynes (Dean and Chair, Biology) and Melissa Harrington (Biology) from Morehouse College and Winfred Harris (Provost) and Isabella Finkelstein (Chair, Biology) from Clark-Atlanta University. Dr. Scott-Johnson noted that the AUC schools each have a unique culture. A number of specific requests were made by Dean Haynes (representation of Morehouse on CBN steering committee and venture grant committee, CBN seminars at Morehouse, including HBCU faculty member on External Advisory Board) but the primary issue articulated by Dr. Scott-Johnson was the role of predominantly teaching institutions in the CBN. Specifically, tenure decisions are based mostly on teaching and service and under the best of circumstances no more than 25% time is available for research. Dr. Block noted that this is not a problem unique to HBUCs but endemic to four year teaching colleges which have a different mission from research intensive universities. Recruitment to the AUC is difficult as few qualified candidates respond to advertisements. It was agreed that a task force, already planned to address these issues, will be critical for sorting out the contribution that each of the institutions make to the CBN.

Advisory Board Recommendations:

The Board meeting ended with an Executive Session to review the day's presentations and craft specific recommendations. The following points were made:

The Science plan has made great strides since the previous meeting with a number of exciting projects underway. The areas of focus and the model systems are excellent. There are a number of opportunities for partnering with biotech for specific technical needs. Drs. DeSouza and Skolnick will provide details to Dr. Insel.

The inter-institute challenges are complex, given the number and cultural clashes between the various partner institutions. The CBN must deploy its task force immediately, documenting the problems and the earnest attempts to resolve the inter-institute conflicts. The task force will need to focus on the goals of the original grant, the needs of the Center for innovative research, and the missions of the predominantly educational institutions. The task force needs to define how each of the partners will contribute to the goals of the CBN, addressing issues of recruitment, committee representation, and expectations for research and education. A draft report should be prepared before the late September site visit and shared with the Board.

The Board asked for more frequent and more intensive involvement in the CBN. One day each year is not sufficient to cover the issues in any depth. Conference calls and e-mails re specific issues should prove useful. Meeting every 6 months might be required leading up to the 4 year site visit. In the near term, the Board will provide names of “tough” reviewers for the upcoming site visit.

The overall impression is that the Center has made impressive progress during this “building phase” of its operation. Scientific programs are now defined and underway. Educational programs are focused and continue to be strong. The challenge facing the Center will be the crafting of appropriate roles for all of the contributing institutions. The Board stands ready to help the Center be successful in this effort.

Minutes of Internal Advisory Board Meeting

July 31, 2000

Yerkes Board Room – 12:00-1:30PM

Present: Sylvia Bozeman, Rebecca Chopp, Isabella Finkelstein, J.K. Haynes, Peter MacLeish, Jeanne Stahl, Michael Thomas

CBN: Elliott Albers, Tom Insel, Dennis Liotta, Pat Marsteller

Absent: Ron Henry (GSU)

Guest: Gary Falcon

Tom Insel described recent Center progress, including signing of Cooperative Agreement, submission of Annual Report (8/1/00), and preparation for Site Visit (10/4/00). Annual Report posted on the CBN website (www.cbn-atl.org). Subcontracts still need to be signed by 5 CBN institutions before money can be released at these schools. An External Advisory Board meeting is scheduled on September 7-8. Peter MacLeish suggested that NSF representative could be invited to this meeting.

Progress in scientific component was reviewed briefly. Collaboratories have met but still need to develop. Collaborative research will be facilitated with venture grants and post-doctoral fellows. Ten venture grants have been funded, with each institution represented. These are described on the website. Two post-docs have been recruited and three more are under consideration. Core labs are up and running. New faculty have been recruited at Emory University (Psychiatry) and GSU (Psychology), with current searches or recruitment efforts underway at Emory (Psychology), GSU (Biology), Morehouse (Biology), and Morehouse Med (Neuroscience Institute).

Pat Marsteller reviewed recent progress in the education component. The CBN helped to sponsor several programs this summer for both Atlanta Public School teachers, including three workshops and a research experience through the G.I.F.T. program. CBN also sponsored 10 undergraduate students for research in behavioral neuroscience labs. A committee of CBN faculty from each of the undergraduate schools has been meeting to plan out new courses as well as an undergraduate fellow program. The goal is to capture first and second year students for a science career before they decide on medicine or business. Jeanne Stahl noted that stipends for undergraduates will be essential at Morris Brown. As another strategy for increasing minorities in science, Pat Marsteller described plans for a B.S./M.S. program through CBN. Funds for this will need to come from another grant mechanism and the program might stretch across CBN institutions. Mike Thomas stressed the importance of involving registrars early on any program that involves joint degrees. A graduate program proposal is nearing approval by the Executive Committee.

Dennis Liotta described the importance of completing an intellectual property agreement. A draft is currently in the hands of the Office of Technology Transfer at Emory University. The goal is to develop an agreement that will include the CBN as a beneficiary for intellectual property revenue.

Gary Falcon reviewed progress on linking the labs and faculty of the CBN across institutions. The website (www.cbn-atl.org) is now operative. All CBN faculty have received LearnLink accounts and instruction in how to use this application to facilitate

communication. The next major task is videoconferencing for teaching, meetings, and lab work. Gary reviewed some of the options, including the current availability of ISDN lines and the potential of internet-2. He has visited most, but not all schools to address needs and compatibility. Dennis Liotta pointed out that videoconferencing will be essential for teaching across institutions. There was discussion about costs, both for installing and maintaining internet-2. Several new initiatives are emerging for funding networking at minority-serving institutions. Gary will be exploring these.

The meeting ended with Peter MacLeish's observation that we need another center grant. With these 8 institutions working together it should be possible to develop an additional neuroscience center with a different focus.

The next meeting will be scheduled in November, 2000, following the Site Visit.

Minutes of Internal Advisory Board Meeting

3/15/01

Yerkes Research Center

Present: Sylvia Bozeman (Spelman), M. Demetrokopolis (Morehouse), Isabella Finkelstein (CAU), Charles Louis (GSU)

From CBN: Elliott Albers, Dennis Liotta, Pat Marsteller, Tom Insel

Dr. Insel reported on recent progress in the CBN. New faculty have been recruited at Emory, GSU, and Morehouse School of Medicine. The CBN has submitted new grant proposals for a post-baccalaureate program and for construction. There are expanding graduate (9 current students) and undergraduate (16 current students) programs as well as several outreach programs.

Dr. Albers described a recent scientific retreat. The strategic plans for the scientific components are due this week and, after some delay, the four laboratories are moving forward.

Dr. Marsteller then described problems met in developing a cross-institutional undergraduate program. CBN undergraduate fellows are required to take a course outside of their home institution, but several difficulties with cross-registration have prevented students from completing this requirement. A meeting with Michael Gerber at ARCHE did not provide a solution. In the course of the discussion, it became clear that the solution to this problem resides with the registrars and that registrars at the AUC have already developed the mechanisms to facilitate cross-registration. Emory University has less experience in this regard. Pat Marsteller will address these issues at Emory. Even

with the registration problem solved, there remain challenges for transportation and parking.

There was further discussion about dissatisfaction at Morehouse College. The CBN advisory board has recommended that all new CBN faculty receive a full year of release time for establishing their research programs. Morehouse feels that this is not compatible with their mission as a teaching college. Furthermore, they feel that they have not received their share of support from the venture grant program. Dr. Insel noted that the NSF expects the CBN to develop the research programs of each of the participating institutions. New faculty recruitment, support of existing faculty, post-doctoral fellows, and venture grants are all targeted for this purpose, but these may require an increased commitment to research as well as increasing integration of new research and educational programs.