

**Report from the
Emory College Neuroscience Strategic Planning Committee
to Dean Robin Forman**

December 5th, 2013.

Report collated by Dieter Jaeger, Committee Chair

Committee Members:

Larry Barsalou, Psychology
Greg Berns, Economics
Ron Calabrese, Biology
Joe Manns, Psychology
Lynne Nygaard, CMBC and Psychology
James Rilling, Anthropology
Carol Worthman, Anthropology

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Executive summary

After soliciting input from numerous faculty members, the Emory College Neuroscience Strategic Planning Committee makes the following recommendations to Dean Robin Forman for building on strengths and addressing weaknesses regarding research related to the field of neuroscience in the Emory College of Art and Sciences:

- Build on strengths in five intersecting and interdisciplinary research areas (see Figure 1): Computational social and cultural neuroscience; Contemplative neuroscience; Learning and memory; Social neuroendocrinology; and Theoretical neuroscience.
- Target hiring of new tenure-track faculty in and across these areas.
- Create postdoctoral and graduate student fellowship programs to support research in and across these areas.
- Sponsor workshops, provide course releases, and fund competitive seed grants for initiating new multidisciplinary research programs in order to attract external funds.
- Improve research information technology support, including allocation of additional resources for data processing, storage, and sharing as well as for professional website development for laboratories and research initiatives.
- Appoint a new associate director for neuroscience research activities in the Center for Mind, Brain, and Culture.
- Establish an ongoing Emory College neuroscience advisory committee.

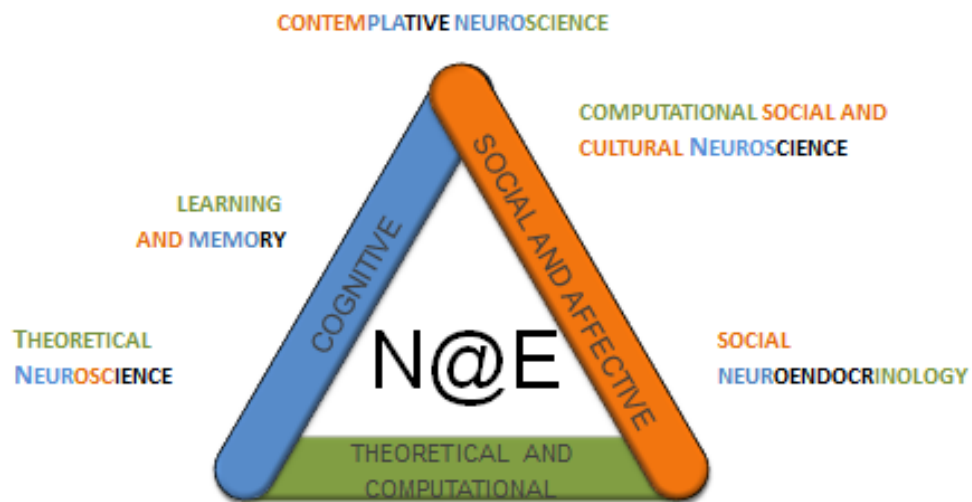


Figure 1. Depiction of core Strengths of interdisciplinary excellence in Neuroscience Research at Emory College and proposed 5 Focus Areas of targeted development drawing from these strengths in varying combinations.

Introduction

Within the Emory College of Arts and Sciences, neuroscience is a well-established and successful domain of research in a number of departments. These strengths includes departments traditionally involved in neuroscience research such as Psychology, Biology, and Anthropology, but increasingly involves other departments, notably Physics, Chemistry, and Economics, each of which now features faculty that are directly engaged in neuroscience research. Further, even departments in the humanities not usually involved in neuroscience, for example the Department of Religion, are now becoming engaged in scientific explorations of the mind through fMRI scanning.

As requested by Dean Robin Forman, an Emory College strategic planning committee in neuroscience was formed in the spring of 2013 in order to explore how the existing considerable strengths in neuroscience research could be leveraged to create nationally and internationally highly visible research foci in the College. From the outset, the committee was strongly encouraged to pursue interdisciplinary approaches between departments, as enabling such multi-pronged approaches would provide a clear opportunity to highlight the strength of research in a College framework beyond the direct biomedical aspects of neuroscience research interest, which are often found to provide the sole focus in medical schools. From the outset, it was also recognized that Emory University is no different in this regard, and that the Emory School of Medicine (SOM) with over 100 research active neuroscience faculty could not be emulated or surpassed by research taking place in Emory College. Instead, the objective is to build up highly visible research areas that have their center of gravity in the College, while also allowing for synergistic interactions with research taking place in the SOM.

The realization of these objectives as envisioned by our committee is described in the following report. In the process of forming this report, input from all neuroscience researchers in the College was sought through open houses with the committee. Nevertheless, it is important to note that this report should not be taken as an immutable gold standard for future development in neuroscience at the College, as constant development of new research methods, interests, and funding mechanisms in neuroscience require that such planning be adjusted to reflect changing realities. Therefore, we also recommend establishing a permanent Emory College neuroscience strategic planning committee that will be advisory to the Dean. Details regarding this committee are described in a later subsection of the report.

The Committee hopes that this report will lead to the stimulation of growth in neuroscience research at Emory College such that the highest potential in innovation and visibility can be achieved and strong extramural funding can be attracted by each developing research focus

area in turn. We are fully convinced that the potential in our present faculty and research specializations is enormous, and we are ready for takeoff to achieve eminence in several multi-disciplinary areas of investigation.

Overall strategy and expected benefits

When analyzing the current environment of neuroscience research at Emory College several considerable strengths can be noted, but clear weaknesses also exist. These strengths and weaknesses should be taken into consideration in planning future support for targeted development of excellence in neuroscience research.

Strengths:

- 1) We have a research-active extramurally-funded multi-disciplinary faculty with strong research programs in neuroscience already in place. Few colleges in the world can claim a more promising starting position than Emory College in this regard. When examining the research areas currently being pursued successfully by our diverse faculty, several foci of potential synergism and future interdisciplinary collaborations are readily identifiable. It is clear that the right strategy is to build on these existing strengths by targeted faculty hiring to complement such interdisciplinary approaches in these areas. These areas and potential targeted hiring opportunities are described in detail below. The faculty named in each of the five research areas below agreed with being listed on the respective proposals, and the current committee was eager—and remains eager—to garner even more faculty participation.
- 2) We have a strong undergraduate neuroscience major (Neuroscience and Behavioral Biology; NBB) in place, which recruits highly talented students to neuroscience research labs in the College. The relation between research and undergraduate education is highly synergistic, because better students will chose Emory because of excellent research opportunities, and high quality research will be conducted in turn. The visibility of releasing an Emory pool of well-trained and enthusiastic students into the national research and graduate training environment should also not be underestimated.
- 3) Emory College has recently supported the acquisition of an fMRI scanning facility, which allows for innovative collaborations in non-medically oriented fMRI research, and unique access to scanner resources for such projects. This facility will likely help attract highly talented young or senior investigators to Emory College as new faculty hires or collaborators.
- 4) Neuroscience research at Emory College takes a visible and successful part in the wider research arena at Emory provided by the SOM, and many College researchers collaborate with SOM faculty. In addition, College faculty have performed many

leadership roles in the GDBBS Neuroscience Graduate Program and are also highly visible in the Emory / Georgia Tech Biomedical Engineering Program, both of which are programs affiliated with the Emory SOM. For example, Ron Calabrese, Professor in the Department of Biology, was director and DGS of the Neuroscience Graduate Program for many years. This existing network will allow for specific areas of research to find their center of gravity at Emory College, while also benefitting from thriving collaborations with SOM faculty.

- 5) College faculty have already attracted two successful federal graduate training programs to Emory College, namely in computational neuroscience and learning and memory. These training grants can form nuclei in future enhanced graduate training programs.

Weaknesses:

- 1) While we have considerable strength in several focus areas in neuroscience research, in several cases there are not enough faculty to amount to a “critical mass” to push a given area to national and international eminence. This is clearly the case for theoretical neuroscience and contemplative neuroscience, but also affects other focus areas. Therefore, adding junior and senior faculty in these focus areas will be a most important measure in order to make continued success in these emerging areas of eminence possible.
- 2) There is very little in terms of graduate or postdoctoral fellowship support at Emory College. Such support is common at our most eminent peer institutions. It needs to be recognized that strong research programs depend entirely on young researchers (graduate students and postdoctoral fellows) of the highest caliber. A fantastic P.I. can go no further than the resident talent in the lab. Developing an infrastructure and reputation that recruits the highest caliber young talent is of utmost importance.
- 3) Modern approaches in neuroscience research are highly computationally demanding, and therefore demand a high level of computational resources that enable work at the frontier. Emory College has currently little support for research computing (a problem also plaguing Emory SOM researchers). For example, there are no shared research databases, there is no research data curation, and there is little research software installation and maintenance support. If we aspire to make computational approaches a hallmark of our neuroscience research program, as would be timely, support for such activities needs to be envisioned.
- 4) Public visibility in the modern era is largely determined by a meaningful presence on the internet, including laboratory web pages complete with social media integration. Yet relatively few resources are provided to faculty for establishing such a presence. Emory College—and Emory as a whole—could do more to enable researchers to become more

visible on the web, such as support for elegant and recently updated websites and social media accounts. This is a missed PR opportunity at a large scale.

The College neuroscience strategic planning committee, in considering these strengths and weaknesses, finds that a clear set of research program initiatives and infrastructure improvement plans can be recommended that will allow us to build on our strengths while ameliorating the weaknesses. We will consider these two strands of recommendations in two separate sections below. Given the nuclei of highly visible interdisciplinary research collaborations already in place, the dominant recommendation for research program initiatives will consider targeted faculty hires both at junior and senior levels in order to further enable the formation of eminent research areas. Our research infrastructure improvements will recommend fixing the most harmful weaknesses at this time that put us behind the leading institutions in the country. We see no reason that we could not match or even surpass the quality and visibility of neuroscience research efforts at prestigious institutions such as Caltech, Princeton, or Yale! However, a significant investment is necessary to reach the research support environment of these premier institutions. Because it is not feasible to pay for such measures out of the limited College operating budget, the strategy necessarily has to include support from the Provost and Board of Trustees levels and ultimately needs to identify targets that can lead to endowment funds for specific funding goals. While a complete interdisciplinary Neuroscience Institute with its own building and graduate program seems unrealistic for the near future, smaller packets of such strategic endowment plans can be identified and are recommended below. Overall, we hope to foster a lively conversation that reaches outside of Emory College as well, and will generate institutional support for neuroscience as one of Emory's most strategically placed areas of excellence, in which the College will play a vital role. Of utmost importance in this plan is a high degree of College neuroscience faculty enthusiasm, who will bear significant additional workloads. Buy-in of the department chairs is also required. Both these factors require that significant new resources are dedicated to this initiative, and that hires and resources do not result in reducing future hires in the existing core disciplines of the participating departments. Given the new and additional resources outlined in this plan, we are convinced that in the five focus areas of interdisciplinary neuroscience research proposed below Emory College is poised to take a leading role in the nationally and indeed internationally.

Recommendations for developing targeted focus areas

The committee has extensively sought faculty input across departments contributing to neuroscience research and discussed the identity of existing nuclei of interdisciplinary

areas of excellence. The committee is convinced that targeted support of these areas optimizes the expected rewards in terms of national and international visibility and attraction of major extramural funding. A guiding principle in identifying targeted research areas was that they would span across multiple departments and essentially be multidisciplinary. Integrative approaches are clearly needed to address important questions in modern neuroscience and Emory College specifically is ideally suited to support such multidisciplinary efforts due to the wide-ranging expertise in different departments. In fact, the committee had no problem determining a list of very exciting integrative topics that have already a notable footprint at Emory College (Figure 1). Nevertheless, it is important to note that such a list is a working hypothesis and that additional or different research areas may present themselves as equally exciting and promising even in the future. Therefore a continued process of advisement and updates through a permanent College neuroscience strategic planning committee is also proposed in this report. Our current working list of most exciting interdisciplinary research focus areas recommended for growth is explained in detail below. Because we do not intend to prioritize this list any further as these topics are often incomparable in their approaches and merits, the sequence given below is purely determined through the use of a random number generator (random.org). While resources may not suffice to support all of the listed areas equally, the recommendation is to consider support for each area based on specific proposals brought forward by the participating departments, core faculty groups, and lead organizers as listed with each research area. The committee recognizes that promoting each research focus will require a core group of faculty committed to helping growth in this area as well as buy-in from at least two departments. However, we should note that the particular faculty listed under each focus and indeed, the foci themselves should be seen as initial proposals. Other faculty within and across departments are likely and encouraged to be affiliated with each focus area.

1) **Social Neuroendocrinology**

Participating Departments: Anthropology, Psychology, Biology

Lead Organizer: James Rilling

Contributing core faculty: Donna Maney, Robert Liu, Kim Wallen, Sherryl Goodman, James Rilling, Carol Worthman, Elaine Walker, Patricia Brennan, and David Edwards

Existing Strengths: A major interest and funding priority for federal agencies is to advance understanding of complex social behavior and its underlying biological mechanisms. A large number of faculty across Emory College have well-established research programs exploring the regulation of social behavior by the endocrine system. Despite the strengths of these independent research programs, there is currently no mechanism to leverage our considerable strengths through innovative collaborations and cutting-edge interdisciplinary research. The proposed focus area in Social Neuroendocrinology would help to accomplish this. As outlined below, a decided strength of this group is that collectively, we approach social neuroendocrinology from a

comparative, evolutionary perspective, working with non-human primates, rodents, songbirds and humans.

Department of Psychology, Neuroscience and Animal Behavior (NAB) program

- **Kim Wallen**: effects of estrogen on memory and sexual behavior
- **Donna Maney**: role of hormones in the development of social reward; interactions between hormones and the genome in the control of social behavior
- **David Edwards**: hormonal correlates of athletic competition and performance

Department of Psychology, Clinical program

- **Sherryl Goodman**: effect of mothers' depression and parenting behavior on children's stress hormone levels
- **Patricia Brennan**: hormonal predictors of responsiveness to multi-systematic therapy; hormonal abnormalities in children with externalizing problems
- **Elaine Walker**: role of gonadal and adrenal hormones on the early developmental course of schizophrenia.

Department of Anthropology

- **James Rilling**: effects of oxytocin and vasopressin on cooperative behavior and associated brain activity using fMRI; effects of these hormones on paternal behavior and associated brain activity
- **Carol Worthman**: using neuroendocrine, autonomic, and epigenetic measures to assess effects of deprivation or trauma on the development of stress regulation in naturalistic settings

Department of Biology

- **Robert Liu**: role of hormones and social experience in the neural plasticity of sensory systems as behaviorally salient stimuli are learned

Proposal for enhanced interdisciplinary research: The following plan will 1) facilitate interactions among core faculty, 2) increase productivity and future grant funding and 3) increase the international visibility of this broad but untapped strength at Emory College.

These goals will be realized through 1) a monthly seminar involving presentations by core faculty about their current and future research activities, 2) the seed grant funding program, as described in the common infrastructure section, that would provide small amounts of funding for collaborative pilot research that would seed new extramural proposals, and 3) the postdoctoral program, as also described in the common infrastructure section. Priority would be given to fellowship applicants who propose to work at the interface of at least two of our laboratories so as to facilitate collaboration

across labs. This initiative would be centered in Emory College while also encouraging interaction with other faculty conducting research in this area, including faculty in Emory Medical School, at Georgia State University, and within the Emory University Center for Translational Neuroscience.

Initial targeted hiring: Given our breadth of strong faculty in this area, we do not see an immediate need to recruit additional faculty. However, we see a strong need for the common postdoctoral program described below, which would facilitate interactions across laboratories, provide the primary scientific labor, increase visibility of the College in this area of study through publications and presentations, and teach courses that are highly sought after by students in Emory College. In addition, while the current core faculty is internationally recognized as experts in their areas, some are quite senior and we need to plan replacement hires to keep the group dynamic and funding-competitive as we experience retirements in the coming years.

Involvement with training programs: The NAB, Anthropology, and Neuroscience graduate programs provide the main source of graduate students for the neuroendocrinology research currently being conducted. Students accepted into these programs routinely express interest in neuroendocrinology and/or behavioral neuroscience, but can end up selecting other institutions. Our proposed focus area would raise the visibility of this research area by highlighting our critical mass and diversity, attracting greater talent to Emory College.

Extramural funding opportunities: The common seed grant funding program will facilitate new collaborative research proposals that we expect will lead to future larger federal grants. We have an excellent model of the impact of seed grant funding in our 10 year experience with the inter-institutional Center for Behavioral Neuroscience, which managed a \$300,000/yr venture grant program. Evaluation of this program shows that every \$1K invested in seed grant funding brought in \$10K in extramural funding. We anticipate significantly increased funding in the form of NIH R01 and NSF grants to individual or small groups of PIs. In addition, once the foundations for the focus area have been laid, we will be in an excellent position to apply for NSF and NIH Center grants.

2) Theoretical Neuroscience

Participating Departments: Physics, Biology, Math/Computer Science, Psychology

Lead Organizer: Ilya Nemenman

Contributing core faculty: Sadly, few theorists with expertise in Neuroscience are currently resident at Emory College. Dr. Nemenman represents the core competence, and some of the research of additional faculty, such as Dr. Prinz, falls into the

theoretical domain. There is an overwhelming demand for theoretical collaborations from existing experimental labs at Emory College in multiple disciplines, which cannot be satisfied by the current core faculty.

Definition of interdisciplinary approach: Neuroscience has traditionally been a field in which modeling, computation, and theory have contributed fundamentally to progress in concert with more traditional experimental studies. From the classical work of Hodgkin and Huxley, to development of neural networks, to models of reinforcement learning in animal behavior, and to more recent advances in imaging, computation and theory have been major players. By having broad training across disciplines, and without the need to develop a costly experimental setup that necessarily targets just one model system, computational and theoretical neuroscientists have been especially important in synergizing activities of experimental researchers and carrying ideas across boundaries. For example, the field of machine learning grew this way as an off-shoot of attempts to model pattern recognition in higher neural systems.

Existing Strengths: Emory College is at a point now where there are multiple "clusters of excellence" in different branches of experimental neuroscience (see the descriptions of other research foci for more details), areas that are poised to benefit from additional investment in theoretical neuroscience.

Proposal for enhanced interdisciplinary research: International eminence can be achieved by developing synergies within and among these groups, with one of the easiest ways of doing this being hiring an exceptional and *broad* theorist interested in multiple facets of neuroscience.

Initial targeted hiring: As a part of the neuroscience strategic plan for the College, we propose to hire an Assistant Professor in theoretical/computational neuroscience. Such a faculty could have a primary appointment in many of the College departments: Biology, Psychology, Physics, Math/CS, Economics, depending on the primary interest of the faculty, which could range from neurophysiology to behavioral and cognitive neuroscience. An interesting possibility to consider is a joint appointment with QTM for candidates with the interests at the appropriate scales. We emphasize our desire to search for a theorist whose research is firmly based in empirical data. As an example, Danielle Bassett, whom Physics Department attempted to hire last year, is a good illustration of a candidate we consider hireable under this initiative: she would have bridged research in physics, biology, and psychology, focusing on neuroeconomics and capitalizing on a substantial investment in the fMRI machine made by the College. Similarly excellent theory/computation candidates exist in all other subfields of neuroscience, and potential for securing funding is great (see below). We believe that the hire of a junior faculty better suits the College at this time. A major argument for this is that an important goal for such hire is to provide theoretical collaborators for experimentalists on campus, and junior faculty are naturally more receptive to new

collaborations compared to their more senior colleagues, who often already have all the collaborations they need, outside of Emory.

Infrastructure improvements: To strengthen the interdisciplinary collaborations within the thrust, several important infrastructure improvements are also necessary. These will benefit existing faculty and will help recruiting and supporting the new hire. First, to establish theory-experiment collaborations, a seed grant program as requested under this strategic plan (see below) is necessary: few funding agencies would support a collaboration without tangible proof that the PIs have already been collaborating successfully. Second, co-advised postdocs and graduate students are especially important to facilitate experiment-theory collaborations, hence the need for the fellows program outlined below. Finally, computational infrastructure must be improved to support the new computational hire.

Involvement with training programs:

Dr. Nemenman is currently a member of the Neuroscience Graduate Program, NBB, as well as the participant on the Computational Neuroscience and Learning and Memory training grants. It is expected that the theory hire under this theme will contribute to the training programs in a similar manner. Additionally, it is expected that existence of dedicated computational neuroscience training programs at both the graduate and the undergraduate levels will be a strong attractive point for recruitment of a faculty member within this theme. Furthermore, modern externally funded training opportunities emphasize theory as a facet of the training experience, and thus a stronger theory core at Emory will be essential in growing the training programs.

Extramural funding opportunities: Due to the emphasis on computation and theory in the modern quantitative neuroscience era, funding opportunities are plentiful. Theorists are traditionally supported through the Collaborative Research in Computational Neuroscience Program joint program between NSF and NIH (which was just expanded this year), with which Emory College faculty (Jaeger, Prinz, Calabrese, Nemenman) have had tremendous successes. Other programs, such as the Physics of Living Systems program at NSF (one of the only two NSF Physics programs experiencing growth) and various statistics and computational sciences programs also fund computational neuroscientists. Funding is also available through NIH, focusing particularly on the BRAIN initiative-related funding, where theory and computation have been strong contributors. Crucially, theorists open possibilities for attracting DOD funding, such as from the ARO Decision Making program, DARPA Synapse, and their successors. Finally, private foundations, such as McKnight foundation and the McDonnell foundation, have historically been very receptive to funding top young theorists, like the ones we would like to recruit.

3) Contemplative Neuroscience (CN)

Participating Departments: Anthropology, Religion, Psychology

Lead Organizer: Carol Worthman

Contributing core faculty: Anthropology: Jim Rilling, Jenny Mascaro, Carol Worthman; Psychology: Larry Barsalou, Sherryl Goodman; Religion: John Dunne, Lobsang Tenzin Negi

Definition of interdisciplinary approach: Contemplative neuroscience builds on the neurosciences' inherent multidisciplinary to galvanize research that engages multiple constituencies within the College and across Emory, and leads to real advances in basic and applied sciences that pertain directly to urgent questions about the human condition and promotion of flourishing. More specifically, our nationally and internationally recognized capacities in social and behavioral sciences, neuroimaging and biomarkers, and scholarship on the contemplative practices themselves offer tremendous potential for path-breaking contributions and unique educational opportunities.

A distinctive feature of our CN focus is that it involves neuroscience writ large, involving three domains: 1. brain structure and function, 2. cognition, affect, and behavior, and 3. the cultural contexts in which practices and their effects unfold. The work of contributing core CN faculty demonstrates our expertise in working across these domains, as follows:

Larry Barsalou (Psychology) is interested in the cognitive and neural mechanisms that underlie contemplative practices, especially mechanisms associated with conceptual processing and representation. Specific projects include the neural networks that underlie mindfulness meditation, and the effects of mindfulness on affective and appetitive processes.

Sherryl Goodman (Psychology) has centered her work in this area on Mindfulness-Based Cognitive Therapy (MBCT), which has a strong base of evidence for the effectiveness of preventing depression recurrence, by modifying it and testing its feasibility and effectiveness for the prevention of depression during the perinatal time period. Measures of effectiveness have included clinical diagnostic, affective, cognitive, behavioral, and contextual.

Jenny Mascaro (Anthropology) uses neuroimaging, psychophysiology, and behavioral and cognitive assessment to investigate the effects of contemplative practices on neurobiology, immune function, cognition, behavior, social connectivity and well-being, and to understand how individual variation and culture impact contemplative practice and its outcomes.

Jim Rilling (Anthropology) uses neuroimaging to investigate the effects of contemplative practices on social cognitive processes and their underlying neurobiology. Potential studies may characterize effects of CBCT on prosocial behavior in the Prisoner's Dilemma Game or evaluate a CBCT intervention to enhance fathers' coping with inconsolable infant crying.

Carol Worthman (Anthropology) studies the neuroendocrine, immune, epigenetic, and health effects of cultural practices and conditions, including the range of existing practices within the Tibetan monastic community in relation to mental health indicators. Planned collaboration with CN faculty includes a full trial of CBCT with undergraduates using a summer retreat design.

John Dunne (Religion) focuses on Buddhist philosophy and contemplative practice, including analyses of Buddhist cognitive phenomenology that support his fruitful dialog with cognitive science to probe the effects of meditation on the brain and the use of meditation practices for the neuroscience of consciousness.

Lobsang Tenzin Negi (Religion) developed cognitive-based compassion training (CBCT) and conducts collaborative basic and intervention research on both its psychobehavioral and health effects, and the proximal mediators (neurobiological, immune) of those effects. The Emory-Tibet Partnership and CBCT programs that he directs are major resources for contemplative neuroscience at Emory.

Existing Strengths: Emory University established early prominence in the now-burgeoning field of contemplative sciences, based on research by faculty leaders in the field, its strong programs in neuroscience, psychology, anthropology, religion, and psychiatry, its supportive culture of collaborative research, and the presence of His Holiness the Dalai Lama on the faculty. Recent research faculty losses (Chuck Raison, Susan Bauer-Wu, Tadd Pace) and flagging investment in this area have eroded our lead just as the scientific, health, and education communities have recognized the importance and potential of contemplative sciences and other institutions (most prominently Stanford, University of Virginia, Wisconsin) have energetically built their programs. Substantial strengths nevertheless remain as Emory faculty have migrated to or intensified their work in this arena. In addition to such faculty resources and existing research programs, we now have the MRI scanner in PAIS as an accessible resource.

Proposal for enhanced interdisciplinary research: There is surging widespread interest in understanding the functional effects of contemplative practices and the proximal pathways by which they operate. Additionally, such practices provide the cognitive and basic neurosciences with naturalistic probes to study such diverse processes as neuroplasticity and memory, pathways in emotion regulation, neuroendocrine bases of social cognition, and brain-body interactions. Relatedly, the capacity of this field to identify evidence-based interventions and materially enrich educational practices is increasingly recognized as a valuable resource for fueling significant research and application.

Relatively small inputs of resources, along with the resources managed according to the current proposal and CMBC structural supports, would integrate our existing strengths

and unleash our potential in this area. The modest yet sufficient human resources needed for the CN focus would comprise the following:

1. One faculty hire, open level (a major priority; associate might be ideal)
2. One course off for faculty organizer (subject to review)

The targeted faculty hire would signal Emory College's commitment to excellence in contemplative neuroscience research. The possible opportunity to recruit Chuck Raison that galvanized faculty conversations and action this fall vividly has underscored the need and importance of such a hire. It also has revealed that a strong structural framework for contemplative neuroscience in particular and contemplative sciences in general readily can be created here with minimal additional resources. From our systematic survey of existing people, labs, and programs, we find that the integration of the current proposal within the CMBC would be an ideal home for the CN focus.

Activities of the CN focus will include the following, and are designed to mobilize and enhance our existing research strengths while maximizing impact from the new faculty hire:

1. Meditation research seminar (ongoing weekly, run by Jenny Mascaro) would be greatly enriched by bringing in outside speakers, who could be supported by competitive applications for Initiative speaker funds.
2. Proposals for seed funding from the current proposal for collaborative pilot studies (imaging facilities, psychophysiology measures or participant costs) to ground formal proposals for extramural funding. Under the competitive federal funding conditions, such pilot data are mandatory, but they also can spark interest among the many private and foundation sources for funding in contemplative sciences.
3. Research workshops (2/year) involving core and other relevant faculty (and possibly their students) for developing study designs and protocols. Proposed workshops are those that feature an invited expert consultant pursuing novel approaches or methods that can inform, possibly transform, the work. Others will involve core and other interested faculty to develop innovative protocols and/or design collaborative research. Workshops will enrich our research and enhance the prospects for extramural funding.
4. Graduate seminars organized under the existing CMBC rubric. One under preparation for submission this year is "Human minds: the varieties of mental experience" (Mascaro, Dunne, and Worthman).

Initial targeted hiring and support: One faculty hire and an annual course off or a CN faculty coordinator (continuation subject to review after 2 years). Emory's particular strengths are a key reason that we leapt at the possibility to re-hire Chuck Raison. The window of opportunity for that possibility may have closed, but Raison represents one of a small and growing set of exciting, innovative, and prominent investigators among whom we would recruit. A hire from among these young and fast rising leaders would

aim to bring swiftly expanding research programs, excellent teaching/communication skills, charismatic and energetic presence, and global networks that not only would catalyze research, funding, and program growth but also signal Emory's commitment to continued leadership in this important area. Such a move would provide a catalyzing ingredient to further basic and intervention research in Emory College. As evidence for a shared felt need for such a hire, we point out that the faculty who vigorously have endorsed the Raison re-hire include leading members of Psychiatry (Rappaport, Miller), Psychology (Barsalou, Goodman), ILA (Paul) and Religion (Dunne, McClintock, Negi), and the entire Anthropology Department. The initial course relief for the CN coordinator would be necessary to get everything going to achieve a hire, solicit and coordinate proposals for research workshops, pilot studies, and seminars, and shepherd the first wave of grant proposals.

Involvement with training programs: Excellent young talent is being drawn into the field. Such work draws support from NIH but especially from well-endowed private and foundation sources. Five examples illustrate our existing capacity to mount and support training in this area, although we need the proposed structure and access to resources to advance program activities to the next level.

- The Center for Mind, Brain, and Culture runs a successful **certificate program** in Mind, Brain, and Culture to which CN members contribute and that we see as a potential model for this interdisciplinary group. Indeed, the incorporation of the current proposal as a research-oriented component of the CMBC is the ideal arrangement to foster a certificate in contemplative neuroscience.
- The ongoing NIH-supported work on cognitively based compassion training (CBCT) not only exemplifies research potential in this arena, but also hosts a **training program for CBCT educators** that are in high demand throughout the country. This is not "training" in the usual degree-granting sense, but is the kind of distributive education that the academy must pursue in future.
- The Templeton Foundation is working with Emory to craft a funding plan for the **Emory-Tibet Science Initiative (ETSI)** in the coming roll-out in monasteries in India. This plan will include involvements of graduate students and postdocs along with faculty in neuroscience (as well as biology and physics) education, distance learning, and evaluation.
- Four Emory faculty (Barsalou, Dunne, McClintock, Worthman), three in CN, are on the scientific advisory board of the Mind and Life Institute (MLI), whose activities include fostering young scholars in the field through research grants and workshops. Each of us also attends and contributes to the **MLI Summer Research Institute**.
- The **Neuroscience Education Postdoctoral Fellow** is a one-year position (search now underway) in the ETSI, Neuroscience section, under the auspices of the Emory Center for Digital Scholarship. The fellow will play leading roles in ETSI

neuroscience education programs and gain valuable experience in science outreach and distance science education.

Extramural funding opportunities:

As the funding records at Emory and of places such as Wisconsin and Stanford attest, federal, foundation, and private funding in CN is strong. At present, CN faculty draw funding from various sections of NIH, Templeton Foundation, Hope Foundation, and NARSAD. The Contemplative Neuroscience program will put us in a yet stronger position to design and execute path-breaking, rigorous research that competes successfully for funding and sets the pace for progress in this dynamic and important arena.

4) Computational social and cultural neuroscience.

Participating Departments: Economics, Psychology, Anthropology

Lead Organizer: Greg Berns

Contributing core faculty: Jim Rilling, Phillip Wolff, Dietrich Stout, Eugene Agichtein (Math/CS)

Existing Strengths: fMRI remains the predominant experimental tool for cognitive neuroscience and the creation of FERN positions the College well to leverage the tool to new faculty and disciplines. The core faculty are already strong in fMRI acquisition and analysis.

Definition of interdisciplinary approach: Neuroscience is already highly computational in nature. By using computational methods as a bridge between neuroscience and cultural studies, we can use big-data methods across disciplines. Indeed, many of the new methods for fMRI analysis use graph-theory, connectivity, and network analysis. “Blobology” is quickly become passé, and we need more faculty and students versed in network analyses.

Proposal for enhanced collaborative approaches: A faculty member who can bridge computational and social neuroscience approaches. As big-data analytics have matured to the study of large-scale human behavior, we need an individual who can link the large of social networks to the small scale of neural networks both experimentally and computationally. Such a person would necessarily be interdisciplinary and may not fit well in an individual department.

Initial targeted hiring: Read Montague (C.V. available from Dr. Berns). Dr. Montague is a highly prominent senior investigator, who has already expressed specific interest to join Emory College. Montague has pioneered the use of dopamine recordings in humans that intersect well with both neurosurgery (e.g. deep-brain stimulation) and the work of both Berns and Rilling. Montague is beginning to connect the different levels of description through the use of computational models. In addition to the computational

efforts, Montague is also developing new, non-invasive methods of making real-time measurements of neurotransmitters in humans.

Involvement with training programs: Students would likely come from neuroscience (GDBBS), psychology, anthropology, and Math/CS. An integrated concentration should be developed with core competencies in neuroscience, computational methods, neuroimaging, and network analytics.

Extramural funding opportunities: Sociocultural neuroscience continues to be an area of funding interest from DOD, NSF, and NIH. The BRAIN Initiative, of course, will be focused on technology development, but computation goes along with the types of data that are being proposed.

5) **Physiological, cognitive, and computational mechanisms of learning and memory**

Participating Departments: Biology, Psychology, Physics, Economics

Lead Organizer: Dieter Jaeger

Contributing core faculty: Dieter Jaeger, Robert Liu, Sam Sober, Ron Calabrese, Astrid Prinz, Joe Manns, Rob Hampton, Patricia Bauer, Donna Maney, Harold Gouzoules, Stephan Hamann, Larry Barsalou, Ilya Nemenman, Greg Berns.

Definition of interdisciplinary approach: Interdisciplinarity in this context refers to the use of highly quantitative and/or technically demanding experimental methods as well as modeling and theoretical approaches to address basic questions in the biology and psychology of learning and memory. For example, this could be accomplished by bringing together individuals with expertise within each domain (e.g., a theoretical physicist and an experimental psychologist). Indeed, this is one of the approaches that will be pursued, and leads to a clear link with the Theoretical Neuroscience focus area spearheaded by Ilya Nemenman. Increasingly though, researchers are also individually trained in a variety of quantitative approaches that they apply towards their own specific questions. They contribute to interdisciplinary research by being able to interact with experts in different domains (e.g. mathematicians and biologists) while making contributions to multiple fields (e.g. developing a general computational method while also addressing a specific psychological question). Multidisciplinary collaborations can be significantly strengthened by the recruitment of scientists who are trained with both experimental and modeling or theoretical approaches. We will pursue such interdisciplinary approaches at multiple levels of description in the field of Learning and Memory, namely ranging from physiological mechanisms of synaptic plasticity and their theoretical implications to innovative approaches in fMRI analysis of cognitive aspects of learning and memory in humans. Through regular interdisciplinary workshops, we hope to gain interactions between these levels and ultimately generate research approaches that can cross between levels, for example relating cognitive aspects of learning to distinct brain circuits and mechanisms of synaptic plasticity.

Existing Strengths: The specific model systems and questions currently pursued in the area of learning and memory by different PIs at Emory College already encompass multiple levels, ranging from songbirds to rodents all the way to mankind. Further, several PIs not currently directly involved with research in Learning and Memory are well poised to broaden their research into this field. This is for example true for Dr. Dieter Jaeger, whose work on basal ganglia and cerebellar systems physiology may soon include questions of synaptic plasticity. The methodological approaches taken by our faculty in different departments are complementary in ways that will help establish the collective group's strengths in electrophysiology, computational modeling of neural mechanisms, quantitative methods in neural data analysis, the study of natural behaviors, and human cognition. As evidence for this, there are already multiple venues through which subsets of PIs and their labs have interacted with each other—the Biology Computational Neuroscience Group Meeting (to which several Psychology faculty members have given presentations and attended), the Systems-Electrophysiology Journal Club (to which Psychology and Medical School faculty members and students attend), Biology Seminars, Psychology Seminars (both Cognitive/Developmental and Neuroscience and Animal Behavior), and activities associated with the NIH-funded training grants in computational neuroscience and in learning and memory.

Proposal for enhanced collaborative approaches: Despite this common interest, more can be done to spur actual interdisciplinary collaborations that utilize expertise across labs. In particular, hiring two new PIs with experimental and/or computational expertise currently lacking among the larger group but who address overlapping scientific questions would help increase visibility in several ways. First, it would expand our critical mass in quantitative methodologies and therefore strengthen the appeal of our existing training programs in computational neuroscience and learning and memory. Second, if the research questions or model systems used by the new hires overlaps with existing areas of depth, such as in sensorimotor integration and communication, it would establish the critical mass needed for focused program project and center grant proposals. One of these hires (currently aimed as initial hire) would be targeted at complementing our strength in studying biological approaches to learning and memory at a mechanistic level, and would be aimed to build a new bridge in this area between Biology and Psychology Departments. This would greatly enhance emerging links between faculty in the Biology and Psychology Departments (see above). Already, these faculty have become increasingly familiar with each other's research projects, and have started collaborative projects between departments. This new faculty would also greatly aid in an enhanced interaction of the teaching activities between Biology and Psychology in the NBB undergraduate curriculum. A second hire would most likely be targeted at human studies of learning and memory, and could also be associated with the College fMRI imaging facility. This hire also aims to build a bridge with the strategic focus area '**Computational social and cultural neuroscience**' proposed in this report,

and could be a joint hire between anthropology or economics and psychology for example.

Initial targeted hiring: A tenure-track position in the area of ‘Physiological and Computational Mechanisms of Learning and Memory’. Research combining experimental and computational approaches in a suitable model organism with a well-defined learning paradigm is preferred. Applications from those using innovative approaches in cellular imaging, multiunit recording, intracellular recording, and optogenetics are particularly encouraged. The successful candidate will have a PhD in Neuroscience or other relevant field; evidence of quantitative and/or computational training; a demonstrated potential to develop a strong independent research program.

Involvement with training programs: The new faculty would exhibit the ability to contribute to the interdisciplinary undergraduate neuroscience training mission of Emory College and our NIH-supported interdepartmental graduate training program in ‘Mechanisms of learning across development and species’. Participation in our NIH Blueprint-funded undergraduate and graduate computational neuroscience training grant, “From cells to systems and applications,” will also be important.

Extramural funding opportunities: We see several areas in research of ‘learning and memory’ at the cusp of being candidates for program project funding from the NIH, or an NSF center grant. However, the new hires proposed above would likely provide key links in our existing research strengths in order to make such applications truly outstanding in a very competitive funding environment.

To significantly strengthen the interdisciplinary research approaches in Learning and Memory in the College, several important infrastructure improvements are also necessary. These will help existing faculty as well as new hires to be enabled in successfully establishing ambitious new collaborative approaches. First, a seed grant program as requested under this strategic plan (see below) is necessary in order to give a helping hand in forming new research approaches, and preliminary data for grant proposals. Second, co-advised postdocs and graduate students will be essential in forming the ‘glue’ between labs in new collaborations, and because grant funding is not initially available when such collaborations are started, the proposed postdoctoral and predoctoral fellowship programs for collaborative projects will be truly enabling. And third, interdisciplinary workshops, seminars, lunches, retreats, and journal clubs that will be organized by the CMBC with a new associate director for our strategic research initiative will bring together faculty on a path of discovery for new collaborations and exciting interdisciplinary prospects in research.

In closing this exciting section of high potential for ‘eminent’ interdisciplinary neuroscience research at Emory College, the committee would like to add a note of caution, a set of

concerns echoed to a large extent by the Report of the Special Committee on Jointly Appointed Faculty (http://college.emory.edu/home/administration/policy/faculty_reports.html). Emory College has to date not streamlined the procedure for joint hires between two or even three departments very well, and past experience, for example in the Computational and Life Sciences Initiative (CLS), has revealed that such lack of clarity regarding procedures can lead to failed searches and a feeling of discomfort among applicants. As the recommended strategy for fostering interdisciplinary neuroscience research in the College envisions an increasing number of such interdisciplinary hires, the joint hiring procedure should be carefully examined and appropriately structured for each case. One obvious recommendation is that prior to starting a particular faculty recruitment process, the commitment in and role of each department in this process needs to be clearly established. This will require a minimum a discussion in the respective faculties and agreement between Chairs. True dual appointments in the College can often be seen as creating double jeopardy in the tenure process as well as potentially exaggerated expectation of contribution to teaching in multiple departments. Hence, both the tenure process and teaching obligations should be carefully pre-planned, and during recruitment visits, this plan uniformly presented to the candidates by all involved. We will only attract faculty of the highest caliber if we can make the added attraction of interdisciplinary opportunities and collaborations clear while having a complete handle on the potential pitfalls of interdepartmental hiring. To alleviate some of the potential breaking points, the potential for a leading department in each hire could also be examined.

Recommendations for enhancing neuroscience research infrastructure

As briefly outlined in the introduction, interdisciplinary neuroscience research of top quality requires a highly competent, enthusiastic, and well trained workforce especially at the postdoctoral and graduate student levels. It also requires high-quality research facilities and instrumentation, which in some cases is best put in place through shared core facilities. A shining example to date of this nature is the new Emory College fMRI facility. Another important example is the Emory High-Performance Computer Center (EHPCC), which provides access to Linux clusters and system administrators on a university level. However, especially when it comes to research computing, much could be done to improve on the existing conditions. A third area of infrastructure recommendations concerns the availability of seed funding mechanisms dedicated to interdisciplinary neuroscience. Clearly, new collaborative approaches that are seeking for extramural funding require an initial dose of seed funding to establish the collaboration and obtain preliminary data.

Our specific proposals for infrastructure addressing these three major areas are:*1.1 A postdoctoral training program with fellowship support*

To establish collaborative research projects and innovative approaches across departments it is vital to have a highly-trained world-class group of young researchers available, who after all carry out the core progress of such research. It would be an illusion to believe that a group of professors can advance a world-class neuroscience research program on their own. The most highly-trained and productive young researchers are generally postdoctoral fellows. However, only a select few in this group are truly outstanding. We believe that our research foci described above have the vision and the forward-looking research goals that would attract such extraordinary talent, on which the ultimate success critically depends. Nevertheless, each collaborative research project has a startup phase where external funding is not always available in sufficient amounts, and fellowship support for ‘pioneer’ postdocs in the project is vital. Other premier research institutions have recognized the need for such fellowships in distinguished research areas. For example, the California Institute of Technology has Prize postdoctoral fellowships in Theoretical Physics, complete with “competitive annual stipend and/or salary combination, and offer an annual research expense fund (<http://www.pma.caltech.edu/GSR/fellowtheory.html>)”. Caltech also offers similar fellowship support in the field of sustainability focused scientific research (<https://applications.caltech.edu/job/rpd>), as well as in ‘Nanoscience’. That is, Caltech is one of the Institutions that has endowed strong research foci with postdoctoral fellowship support. Emory College could achieve a quantum jump in research ability with the institution of similar prestigious postdoctoral fellowships. The committee therefore recommends that endowing such a program becomes an active goal of the College. Because such fellowships can be named after donors, or can be associated with foundations, they could be a promising target for fundraising.

1.2 An Emory College collaborative neuroscience graduate student fellowship program.

Similar to postdoctoral fellows, graduate students of the highest caliber are also vital to a vibrant and innovative research initiative. In particular, the new collaborative research foci that form the core of this strategic plan require a matching set of high-quality graduate students in order to carry forward the day to day research activities going along with the planned projects. Such graduate students need to be able to support the building of bridges between departments and typically will be co-advised by two mentors in different departments. Graduate students are often creative, available for trying out new ideas, and eager to learn new approaches. In this capacity they will be vital in order to produce preliminary data for joint grant proposals. This is not a one-way street benefitting the P.I.s, however. In turn the graduate students will assemble a stronger portfolio, be trained in interdisciplinary approaches, and be able to form a community of similarly minded peers, who together will take part in interdisciplinary training opportunities provided through this

strategic initiative (see 1.3 below). Together with teaching opportunities resulting from these fellowships and exposure to non-academic careers the collaborative neuroscience fellows will define a new level of graduate training at Emory College.

The specific proposal is as follows. Each year, 3 graduate fellowships will be provided for a 3 year fellowship. This will result in 9 graduate fellowships phased in over 3 years. Each fellow will be accepted into one of the existing graduate programs associated with faculty that are part of the collaborative College Neuroscience plan. Hence, this could be a wide range of programs, including physics, anthropology, cognitive psychology and neuroscience and behavior, but also biomedical engineering and the GDBBS neuroscience program. Recruitment would be done jointly by the existing admissions committees of each program and a specific fellow selection committee coming out of this initiative. Each fellow will need to be associated with a collaborative project between two advisors, one of who (but not necessarily the primary one) needs to be program faculty in the program that the student is a member of. Further, each fellow will have a one semester teaching duty in years 2 and 3 of their support. Following year 3, the fellow will be supported by funds from the P.I.s in the labs that their thesis work is performed in or other available funds such as training grants. In order to attract the best students towards this program it is important that compensation is commensurate with the highest paying participating program. Therefore, it is recommended to support these students at the GDBBS neuroscience program levels or slightly above. Once this program is established and can provide a record of success, we expect that a training grant in support of these fellows can be obtained. This could for example be an NSF IGERT grant.

As a note we should acknowledge that this program takes inspirations from the M2M program already in existence, as well as the previous SPINR program from the University Strategic Initiative. However, in contrast to SPINR, the new program would have its intellectual focus in the College and be closely associated with the CMBC. Further, the primary mentor would always be faculty with an appointment in the College.

1.3 A stimulating intellectual environment with specific initiatives for postdoctoral and doctoral engagement

Emory College is fortunate to already have the 'Center for Mind, Brain, and Culture' (CMBC) in place, which over the past few years through many workshops, seminars, lunches, and short courses has fostered truly interdisciplinary thinking and gatherings that have brought many faculty, postdocs, and graduate students at Emory College in contact with each other who otherwise would not have realized some of the common intellectual interests. The committee proposes not only to maintain the CMBC's activities, but to further strengthen them. Essentially, the CMBC is ideally placed to become the intellectual focus for interdisciplinary neuroscience research at Emory College. However, it should be noted that this would expand the current focus of the CMBC, and a new associate director for

interdisciplinary neuroscience research and education should be added to the CMBC. This new branch of the CMBC would specifically organize an additional interdisciplinary neuroscience seminar series that gives visitors and participants in our proposed focus areas additional visibility and opportunity for interactions. New opportunities for interdisciplinary training (such as short courses and workshops) of the postdoctoral fellows and graduate students active in the research foci would also be developed. Finally, an annual College neuroscience retreat would be planned.

It is important to recognize that for the overall cohesiveness and success of the College neuroscience research initiative, the creation of a vibrant intellectual program and exchange of ideas among trainees and faculty is essential. Additionally, interdisciplinary training options as for example fMRI imaging technique courses for anthropologists, or cognitive psychology workshops for biologists could lead to specific training certificates for postdoctoral fellows and graduate students having completed certain courses in interdisciplinary training.

2.1 Improved research computing support

A majority of the proposed research areas heavily depend on strong quantitative skills among the trainees, as well as sophisticated data analysis and computer modeling approaches. In this respect, certainly a strong collaboration with the newly established Emory College Institute for Quantitative Theory and Methods (QTM) is desirable, and the presence of the QTM effort presents a strength. However, while QTM will likely be highly instrumental in establishing interdisciplinary training and research opportunities for quantitative approaches, it does little in the narrower domain of research computing support. Also, the existing College 'local support' structure for computers is limited to teaching and administrative computing needs. In contrast, the considerable needs for support in research computing, namely the system administration of research computers, the installation and maintenance of research software, the management of research data backup, etc., presents a completely unmet need among the Emory neuroscience research community. From all appearances, the current condition consists of individual faculty having to organize their own research computing system management, which frequently means that they spend their own time to organize system setups, data backup etc. It is clear that such use of a significant chunk of faculty time leads to a reduction of availability for important interdisciplinary activities, writing of grants, etc. In the view of the committee therefore it is essential that Emory College institutes an infrastructure of neuroscience research computing support through the hire of a highly capable system administrator in this area.

2.2 *Implementation of data storage and shared databases*

Beyond the basics of keeping computers running and data backed up, a more advanced computer research infrastructure would significantly enhance collaborative research approaches. One important component of such an infrastructure would be the development and hosting of shared research databases, in which researchers could organize and share their data for collaborative approaches. It should be noted that the development of such shared databases is also a stated goal of the NIH and NSF, and specific funding opportunities exist in this area.

2.3 *Research lab website development support*

A clearly missed opportunity is given by the absence of support for developing state-of-the-art websites with attractive content for research labs and programs at Emory College, and for that matter at Emory University. Clearly, in this day and age the outside visibility of one's achievements and vision is primarily given by the web presence they create. And again, spending faculty effort to build minimal websites for their own labs and a hodgepodge of interfaces across the College is definitely not in the best interest of the Institution. The committee recommends hiring web developers and to install a uniform web interface and web hosting mechanism for research lab websites. The positive effect of a highly developed web presence cannot be underestimated, and among many other benefits promises to attract a higher quality of students and potentially donors.

3.1 *A dedicated seed funding program*

As noted above for postdoctoral and doctoral support, the initial stages of new collaborations often require a set of startup resources and research fellows that are hard if not impossible to fund from extramural grants. Therefore, to bring new collaborative approaches to fruition, the committee recommends the implementation of a seed funding program dedicated to interdisciplinary neuroscience at Emory College. These funds could be associated with postdoctoral and/or doctoral fellowships, and cover the additional resources needed, such as transgenic mouse lines or fMRI scanner time. As part of this seed program, faculty engaged in clearly promising new research initiatives should also be able to buy out part of their teaching obligations to enable a temporary refocusing on developing their research program. A neuroscience review committee would be established to review seed fund proposals, and on the order of 2-3 awards of \$30,000 - \$45,000 per year would be needed to create a meaningful program.

3.2 *A support structure for faculty commitment to pushing interdisciplinary research focus areas forward*

None of the proposed research development can take place without the full enthusiasm and significant additional effort of faculty, who are already working with overflowing commitments to research, administration, teaching, and service. It needs to be recognized that important goals of this plan such as obtaining new interdisciplinary center and training grants, or spearheading the collaborative effort of a focus area will require faculty time commitments to such a degree that some other effort needs to be reduced. A well-established method for such effort reduction would be a reduction in teaching load. To compensate departments for such loss in teaching effort, additional hiring of lecture track lines may be required. More creatively, as part of the proposed postdoctoral research fellowship program, teams of 2 postdocs could teach a full class. Each postdoc would do this for one semester. Alternatives such as faculty compensation for summer effort in grant writing could also be envisioned. Without an apparent carrot, it is clear from our interactions with College faculty that they are unable to commit significant additional effort to this important initiative. Of course, implementing the recommended infrastructure improvements would also in itself substantially help faculty in reducing time commitment for example spent on computer and website administration, and could be tied to active participation in the College neuroscience research strategic initiative.

Recommendation of setting up a continued college neuroscience advisory committee

As is amply apparent from the extensive recommendations and goals put forward in this report, the establishment of eminent interdisciplinary research areas in neuroscience at Emory College will be an ongoing process for some time to come. It is also to be expected that goals set forth in this report are incomplete or will need to be modified in a changing environment. Additionally, new opportunities might arise that cannot be anticipated at the present time. For all these reasons we recommend convening a new permanent advisory committee for neuroscience research to the Dean of Emory College. This committee would initially consist of the strategic planning committee submitting this report, but in terms of service would be limited to 2 years. New committee members would be appointed by the Dean in consultation with the committee. Re-appointments would be possible if so desired. The committee would meet once each semester with the Dean, and would convene additional meetings as needed. Importantly the committee would seek input from all constituencies in neuroscience research at Emory College, and its goal would be to foster a consensus view on important research initiative decisions.

Concluding remarks

Most importantly, in this report we have outlined the clear opportunity to bring already strong research foci in neuroscience research at Emory College to a new level of truly international distinction through targeted hires. Each of the recommended areas of growth is interdisciplinary, involves multiple departments at Emory College, and uses innovative combinations of approaches and tools. The proposed research foci in particular play to the strength of the Emory College as they integrate areas of investigation such as anthropology, economics, and psychology with neuroscience research that cannot be provided by Medical School research. Therefore, these foci are well-suited to generate nuclei of distinction with a center of gravity in the College while remaining embedded in a university with a very successful and productive overall neuroscience research environment. In fact, each of these foci do benefit in several ways from our existing collaborations with medical school research labs and strong support for them in the College will also lead to a further strengthening of these ties and result in an overall benefit to Emory University.

While we are proposing the support of several distinct research foci, it is important to emphasize that these research programs share important methodological and intellectual aspects. Clearly, the use of fMRI imaging as a central research tool is common to several of the proposed foci. And even more widely shared are computational approaches through sophisticated data analysis and modeling along with a clear need for theoretical components of the respective research focus. These shared interests and approaches allow for great optimism that the neuroscience research enterprise with proper nurturing will grow as a whole and generate a single community of enthusiastic researchers as opposed to falling into distinct and separate groupings. Further, the proposed additional intellectual elements of joint seminar and interdisciplinary training programs through the CMBC will bring the community together on a weekly basis. While a dedicated building for all neuroscience research foci in a combined Neuroscience Institute would clearly form an even stronger community and remains a future aspiration, we are optimistic that the ties we are proposing to be put into place will already allow us to foster new collaborative research projects in an ongoing fashion.

Secondly, the committee strongly recommends that Emory College improves the infrastructure in neuroscience research to allow the identified research foci to fully blossom in a supportive environment. We notice that some current structural challenges make the research environment difficult for the pursuit of new and innovative approaches. We indicate in some places opportunities to offload costs to the College by favoring the pursuit of endowed positions at all levels from graduate student, postdoc, and faculty. We would be very keen to participate in discussions at the Provost and potentially Board of Trustees

level in order to support strong arguments on full institutional support for the plan outlined in this document.

This Emory College of Arts and Sciences neuroscience research strategic plan has found unanimous support from all planning committee members and the proposed CMBC involvement has been cleared with the CMBC directors.

Signed,

Dieter Jaeger, Biology
Ron Calabrese, Biology
Larry Barsalou, Psychology
Joe Manns, Psychology
Greg Berns, Economics
Carol Worthman, Anthropology
James Rilling, Anthropology
Lynne Nygaard, CMBC and Psychology