Table VIII. Core Labs at Emory and Georgia Tech

The Biomolecular Computing Resource (BimCore)

The Biomolecular Computing Resource (BimCore) at Emory University School of Medicine is a subscription-based computing support service for Emory researchers. BimCore provides computational resources, training, and on-call support for various Bioinformatics software (sequence analysis, genomics, microarray analysis) and Biomolecular Modeling software (display, modeling, mutagenesis, docking). BimCore actively evaluates current software packages to create an offering which addresses the needs of faculty, is complete, and supplies state-of-the-art solutions to Bioinformatics questions.

The BimCore Sequence Analysis Facility was established in 1992, and the BimCore Molecular Modeling Center was established in 1996. The Sequence Analysis Facility (SAF) supports various genetic data analysis software packages along with access to the Celera human genome database and SNPs database. The Molecular Modelling Center (MMC) supports molecular modelling and graphics software packages. Microarray analysis software is also available. A Microarray Analysis Facility will be established in 2002.

BimCore receives ongoing financial support from Emory School of Medicine, Woodruff Funds, Graduate School, College and Information Technology Division (ITD).

DNA Core Facility

The DNA Core Facility is a core resource of Emory University School of Medicine and the Atlanta VA Medical Center (VAMC). The Facility is committed to providing quality service by fulfilling the needs of the research community in a consistently rapid, dependable, and economical fashion. Our support is open to all Emory University, VAMC, and outside investigators. However, priority is given to Emory/VAMC affiliated personnel. Services include automated DNA sequencing using state-of-the-art instrumentation and the latest protocols to ensure high quality results at reasonable prices. The Facility also houses Affymetrix GeneChip technology and cDNA microarray slides for analysis of high throughput gene expression.

The Facility was established in 1997 using funds provided by the Atlanta VAMC and Emory School of Medicine, from which it receives ongoing support. It was also recently highlighted in the Spring 2001 issue of Momentum in an article titled "On the front lines of health care." The article details the successful collaborative and historical relationship between the Atlanta VAMC and Emory University. Also, a brief review of the Facility was noted in the March 2000 issue of "The Dean's Letter," a monthly communication to the School of Medicine.

Transgenic Mouse & Gene Knockout Core Facility

The Transgenic Mouse and Gene Targeting Core Facility is a shared core resource of the Emory University School of Medicine and the Winship Cancer Institute. The core offers a full range of services for the generation of both Transgenic and Gene-Targeted mice. In addition, facility personnel are available to provide expert consultation in the design and initiation of transgenic and gene targeting experiments.

The Facility was established in 1998 using funds provided by the School of Medicine, the Winship Cancer Institute and the Department of Pathology and Laboratory Medicine, and receives ongoing support from these entities.

Nuclear Magnetic Resonance Research Center

The Nuclear Magnetic Resonance Research (NMR) Center, located in the Emory Department of

Chemistry, uses a technology that is complementary to X-ray crystallography, focusing on the structure of a specific part of a molecular. The Emory NMR Research Center houses six high resolution superconducting NMR spectrometers and four workstations for fast data processing and plotting.

Cherry L. Emerson Center for Scientific Computation

The Emerson Center provides high-end computational facilities and expertise in support of computationally oriented scientific research at Emory and encourages collaboration in computational sciences with other institutions.

Microchemical Core Laboratory

The Microchemical Facility is a shared core resource of the Emory University School of Medicine and the Winship Cancer Institute that provides peptide synthesis, oligonucleotide synthesis, peptide purification, and oligonucleotide purification. The Facility also provides peptide and protein sequence analysis, mass spectrometry (MALDI and ESI), and amino acid analysis in support of proteomics research. The Facility was established in 1986 using funds provided by an N.I.H. Shared Instrumentation Grant, and receives ongoing support from Emory University, the Emory University School of Medicine, and the National Institutes of Health. The Facility provides investigators with access to state-of-the-art instrumentation, the highest quality products, and provides expert consultation regarding methods and product applications.

PET Center

The PET Center Facility (J. Douglas Bremner, MD, Director) is a shared core resource of the Department of Radiology and the School of Medicine. The core offers Positron Emission Tomography services for clinical studies, clinical research andbasic research. The establishment of this PET Center as a university wide resource administered by a multi-departmental team has succeeded in fostering strong collaborative research while strengthening the clinical service. Our mission is to provide financially responsible services and resources to the Emory University System of Health Care and the state of Georgia for leading-edge research, clinical service, and teaching associated with Positron Emission Tomography. These resources are used to pursue new techniques, improving the diagnosis and assessment of disease. The ultimate focus of these activities is to provide the highest standards of health care delivery. The core lab offers radiochemistry for radiopharmaceutical production for research, on on-site cyclotron, a brain-dedicated High Resolution Research Tomograph (HRRT) (CTI) PET camera, a GE Discovery LS PET-CT camera, a Concord MicroPET, and an ECAT 921 (CTI) camera, all at the Emory Hospital location, for research scanning.

The Facility was established in 1993 using funds provided by Emory University, Emory University Hospital, and the Georgia Cancer Research Alliance

Biomedical Engineering Core

The biomedical engineering core is a joint venture of Emory and Georgia Tech directed by the recently recruited GRA Eminent Scholar in Imaging Sciences, Xiaoping Hu, Ph.D. The core has available for research a 3 T GE MR scanner and a 4.7 T animal scanner. Two additional cameras are in the process of being purchased, 3 T and 9.4 T animal scanners.

MRI Center

The Frederik Philips Magnetic Resonance Research Center (Rod Pettigrew, MD PhD, Director) is an MRI research facility located in the Department of Radiology at Emory University in Atlanta, Georgia. The Center began in 1988 as a joint project between the Emory University School of Medicine and Philips Medical

Systems. There are two 1.5 T Philips MR scanners for research in humans.

CENTER FOR BEHAVIORAL NEUROSCIENCE CORES

The following core laboratories are available to trainees who are collaborating with investigators in the Center for Behavioral Neuroscience (T. Insel, Director)

Molecular Neuroscience Core It is likely that only a small fraction of the genes that are important for behavior have been identified. Although great insight has been gained by studying the individual genes and proteins, this single gene-single protein approach for neurobiology will not suffice for behavior, which results from the orchestrated interplay of hundreds of regionally selective genes and neuroproteins. Novel molecular biological techniques which permit the simultaneous screening of more than 40,000 genes on microarray chips have provided the first opportunity for rapid screening of known and previously unidentified neural correlates of behavior. Not only is it possible to quantify coordinate changes in the expression of multiple genes associated with behavior, but ultimately these techniques will provide a molecular fingerprint of how and where experience influences gene expression in the brain. Alternatively, the same methodologies could be used to ask which cDNAs are distinctively modulated in similar brain regions from different species, allowing for comparative neurogene discovery. This core aims to develop these approaches to bring gene discovery to all of the collaboratories of the Center.

Cellular Neuroscience Core The cellular core serves as a key interface between the molecular core and the systems core. One of the greatest challenges of the next decade will be to translate the discovery of new genes, including those uniquely linked to behavior, to an understanding of how the encoded proteins actually influence behavior. At present there is a tremendous lag between the discovery of a gene and the difficult task of understanding the functions of the protein encoded by the gene. Thus, an overall goal of this core is to develop techniques to study the cellular functions of novel behavior-related proteins and to make them accessible to researchers in the collaboratories and other institutions. Several members of this core who are already proficient in modern chemical neuroanatomic techniques (immunocytochemistry, receptor autoradiography, in situ hybridization, microdialysis, and classical tract tracing) will be a resource for the Center faculty and students.

Systems Neuroscience Core The goal of systems neuroscience is to understand how cellular activity in the brain collectively produces the emergent property we call behavior. For this purpose, we need new techniques that bridge anatomy, physiology and behavior. In the next decade, neuroscience will need to progress beyond single cells to multi-synaptic circuits or ensembles of neurons and behavioral neuroscience will need physiological techniques for use in an ethological context.

Neuroimaging Core Perhaps no technical development has changed clinical neuroscience as much as neuroimaging. The ability to visualize regional brain activation with PET or fMRI during a cognitive or behavioral task is redefining the functional anatomy of the primate brain. In the next decade, the challenges will be to develop imaging techniques for neurotransmitter-defined pathways, to optimize spatial resolution, to integrate simultaneously functional signals from distinct imaging modalities, and to create instruments for experimental use in a broad range of species. With the bioengineering and signal detection expertise at Georgia Institute of Technology, the considerable neuroimaging capabilities at Emory, and the radiochemical facility of the Emory PET Center, this core is positioned to address these challenges.

Computational Core The standard procedure in circuit and systems neuroscience is to take the neural circuits or systems apart to understand the individual components, and then to imagine how they might work together as an integrated whole. However, because of the complexities of these systems (e.g., many nonlinear operations, history and state-dependence, and the sheer number of neurons and connections), unaided human imagination is unequal to the task of understanding their function. This understanding can be obtained using computer and electronic models of neural circuits; these models can be tested at near real-time speeds with full access to all the components and parameters. Members of the Computational Core are expert in the development of neural simulations techniques, both with digital computers and with neuromorphic VLSI (very large-scale integration) technology. We have used these techniques to build and test models of thalamo-cortical circuits in rat, escape circuits in crayfish, and neural pattern generator circuits in the leech. They will

continue to develop this technology, focusing on the conversion of digital computer models into VLSI electronic circuits on silicon chips. Refined models of circuit function can be integrated into systems models, and ultimately into models of behavior.

Behavioral Technology Core The study of social behavior has been impeded by limited technology designed to facilitate fast, accurate recording of complex behavioral sequences in ethological settings. Most behavioral neuroscience describes the behavior of single organisms performing operant responses in automated testing chambers. Similarly, our understanding of the neurobiology of social behavior has been mostly limited to pairs of subjects in simple environments. However, social behavior is radically different when studied in environments more closely reflecting the organism's evolutionary history. The principle difficulty in collection social behavior data in ecologically-relevant environments is the sheer mass of information available and the extended time needed to train observers. These limitations have resulted in using simple behavioral measures to study complex systems. This core will develop and integrate technologies that facilitate the study of behavior in social contexts.

Core Facilities at the Georgia Institute of Technology

Facilities and equipment at Georgia Tech are shared by investigators involved in neuroengineering and optical imaging research. at Georgia Tech, in the Laboratory for Neuroengineering, 3rd floor of Whitaker BME building, Georgia Tech campus, there is a 640 sq. ft. Optical Neuroimaging light-shielded room with low-noise DC lighting, with Zeiss Axioskop 2FS fluorescence microscope, with quadnocular head, motorized x-y stage, full set of high-NA dipping objective lenses, monochromator xenon illuminator, CoolSnap CCD camera and RedShirt NeuroCCD camera (2000 frames/sec, for optical recording); SlideBook acquisition and image processing software (Intelligent Imaging Innovations); Zeiss Axiovert 200 fluorescence microscope with Varel and phase contrast. Electrical engineering bay (640 sq.ft.) with testing equipment, soldering stations, neuromorphic circuit design and modeling software. Molecular biology and wet-lab bay (800 sq.ft), with centrifuges, electrophoresis equipment, PCR DNA amplifier, and multi-well plate reader. Two 200-sq.ft. cell culture rooms with biosafety hoods, centrifuges, incubators, refrigerators, microscopes, -80°C freezer, and water baths. Benchtop autoclave in Neurolab, and large autoclave on 2nd floor. Departmental imaging facility in the Petit building at Georgia Tech: 200 sq. ft. room with 4x10 ft. air table, Zeiss 510 Meta NLO 2-photon/confocal microscope (inverted, photo right), and, sharing the same femtosecond Coherent Mira900 laser, custom-built upright 2-photon microscope. This facility also includes a state-of-the-art Beckman-Coulter fluorescence-activated cell sorter.