

HIGHLIGHTS & FUTURE OF THE RESEARCH CLUSTERS

Objective of the HBSC

To enhance interdisciplinary research and training in UH Health, particularly in neuropsychology, neuroscience, biomedical and neuro-engineering, biostatistics, and high performance computing. Investigators from five different colleges (CLASS, Engineering, NSM, Pharmacy, and Optometry) and two university wide research centers (Texas Institute for Measurement, Evaluation, and Statistics -TIMES and the Texas Learning and Computation Center - TLC2) will share core research facilities and laboratories. Support for the HBSC will create collaborative research, training, and program administrative spaces for investigating complex systems in health, developmental disabilities, and education.

Interdisciplinary Collaboration

• Biomedical Research-

The HBSC will enhance biomedical research in methods and statistics, computational physiology, data mining, bioinformatics, imaging, data warehousing, and high-speed networking and data storage, and allow expansion into computational neuroscience.

• Neuroscience-

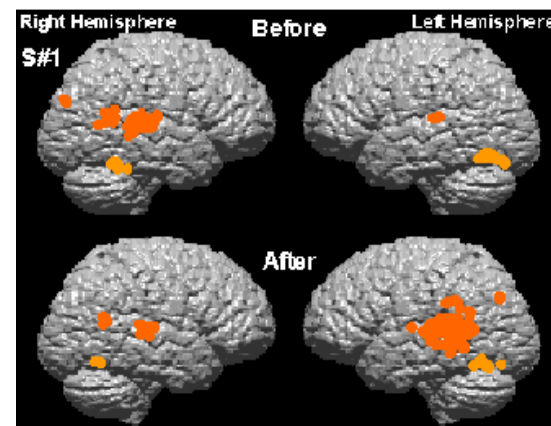
The HBSC will provide the first shared, interdisciplinary laboratories for UH neuroscientists investigating complex problems such as the neural basis for drug and alcohol addiction, neuronal regeneration, and the biochemical processes that regulate circadian rhythms and their role in health and disease.

• Neuropsychology-

The HBSC will house UH's nationally recognized Ph.D. program in clinical neuropsychology, and its research on the development of individuals with disabilities due to genetic and environmental factors, as well as brain injuries, with a special focus on the evaluation of treatment efficacy.

Neuropsychology-

Texas Center for Learning Disabilities (TCLD), directed by **Jack M. Fletcher**, Ph.D., ABPP, Hugh Roy and Lillie Cranz Cullen Distinguished University Professor in Psychology, is one of four national research centers on learning disabilities established through the National Institute of Child Health and Human Development. TCLD research focuses on the biological, behavioral, cognitive, and genetic factors associated with risk and intervention response in spina bifida, autism, mental retardation,



traumatic brain injury, and learning disabilities. Support for the HBSC will relocate TCLD to UH main campus and make possible recruitment of a prominent researcher in the genetics of disabilities.

Training in Brain Trauma Injury & Rehabilitation **H. Julia Hannay**, Ph.D., John and Rebecca Moores Professor of Psychology, and former Director (1987-2010) of the Clinical Neuropsychology training program in the Department of Psychology, prepares Ph.D. students to conduct clinical research in brain trauma injury, assessment & rehabilitation through her multicenter research and clinical collaborations with UT Health Science Center-Houston, Memorial Herman-TIRR, MD Anderson Cancer Center, and Baylor College of Medicine, which have been funded principally by the National Institute of Neurological Disorders and Stroke and the National Institute on Disability and Rehabilitation Research.

Neuropsychological Deficits in Alzheimer's Disease Patients has been an ongoing research focus of **Paul Massman**, Ph.D., current Director of Clinical Neuropsychology Training. As a partner of the Texas Alzheimer's Research Consortium (TARC), Massman investigates the biomarkers (e.g., cortisol) and neuropsychological/psychiatric functioning in Alzheimer's patients.

Neuroscience -

Understanding Degenerative Diseases

Michael Rea, Ph.D., Director of the Neuroscience Division to be housed in the HBSC researches the biochemical processes responsible for the generation and synchronization of circadian rhythms, and the significance of these mechanisms in human health and disease, such as in the maintenance of the myelin sheath, which could be relevant to our understanding demyelinating diseases, including Multiple Sclerosis.



Donald Fox, Ph.D. explores cell death in the normal developing retina and regulation of retinal energy metabolism. **Yuen Sum (Vincent) Lau**, Ph.D. pioneered the first known chronic mouse model that resembles symptomatology in Parkinson's disease and has proven useful for translational research and the development of new, neuroprotective therapies.

Neural Basis of Addiction to Drug and Alcohol. **Adriana Alcantara**, Ph.D. uses behavioral, neuroanatomical and pharmacological procedures to study the cellular and molecular basis of compulsive drug intake and relapse relevant to understanding biological and possible genetic factors involved in drug addiction.

Neuroplasticity in Restoring Neural Function. **Leigh Leasure**, Ph.D. researches experience-driven structural, chemical and cellular changes in the brain. Her goal is to harness neuroplastic mechanisms in order to improve neural function, particularly in states of injury or degeneration, such as stroke, aging and neurotoxicity.

Understanding Epilepsy and Seizures. **Jokubas Ziburkus**, Ph.D. investigates basic mechanisms of epileptogenesis and seizures through the in vitro study of cell network interactions using a multidisciplinary approach synthesizing neurophysiology, imaging, molecular biology, immunohistochemistry, and modeling. Understanding the distinct cell subtype roles and neuromodulators allows his team to investigate rescuing seizure phenotypes by pharmacological manipulations and cell-specific therapies.

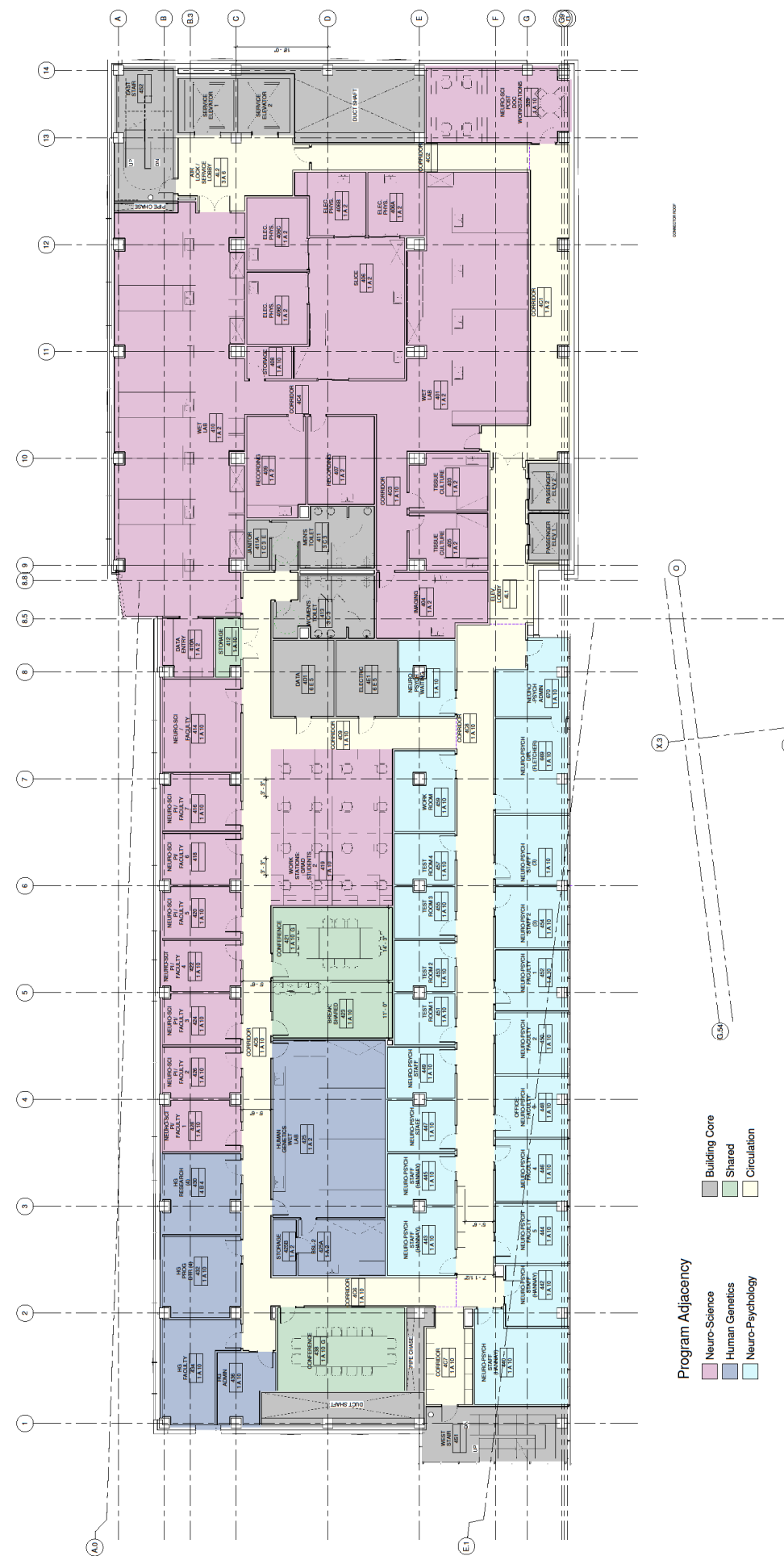
Biomedical Research -

Statistical and Research Support Services. **TIMES**, directed by **David Francis**, Ph.D., Hugh Roy and Lillie Cranz Cullen Distinguished University Chair in Psychology, conducts research in health and education while providing statistical support services to UH-based investigators. Services include experimental design and statistical analysis, data collection, management and warehousing support, project management, development and validation of instruments and procedures, computer programming and IT support for research, and statistical quality control. In addition, TIMES and TLC2 provide research administration and financial services to HBSC and UH-based investigators.

Human Mind- Empirical Findings and Modeling. **S. Lennart Johnsson**, Ph.D., Hugh Roy and Lillie Cranz Cullen Distinguished University Chair in Computer Science and Engineering and director of TLC2, leads research on high performance computing, networking, and data storage. The HBSC provides opportunities previously lacking at UH to develop understanding of the human mind through research collaborations among neuroscientists, neuropsychologists, and large scale computational scientists studying brain processes involved in understanding language, vision, cognition, and disorders of learning.

Sustained Monitoring of Physiological Variables. **Ioannis Pavlidis**, Ph.D., Eckhard Pfeiffer Professor of Computer Science, investigates the unobtrusive and sustained monitoring of physiological variables, and has applied these methods to understand the effects of stress on human performance.

Biomedical Informatics and Biometrics. **Ioannis Kakadiaris**, Ph.D., Eckhard Pfeiffer Professor of Computer Science, Biomedical Engineering, and Electrical & Computer Engineering conducts research in biometrics and biomedical informatics that will be transformed by HBSC space that will allow simultaneous acquisition of multiple datasets from the same individual.



Building Impact:

The project will provide 30,058 nsf of integrated research space in HBSC that is 100% dedicated to biomedical and behavioral research and will allow the university to recruit key new faculty in areas of human genetics, biomedical engineering, and computational neuroscience and psychology, and to create a unique interdisciplinary graduate program in behavioral neuroscience. This is an interdisciplinary area that is rapidly developing and has impact in medical areas, engineering and basic science through influencing the ability of individuals to function well in society in areas of education, recover from accidents/trauma, optimize children's progress and health, and deal with many behavioral problems in our society.

The work accelerated by the increased collaboration should have impact in several areas.

- Children learning and optimal intervention with those facing special learning difficulties.
- Optimal interpretation of large data sets arising from biomedical/bio-chemical studies relating to brain function.
- Improved diagnosis and intervention options that are more effective for evidence based treatment of a wide range of behavioral disorders.

This project is expressly designed to enhance daily interactions related to research and to create new opportunities for synergy among tenure-track and research faculty engaged in biomedical and behavioral research on complex systems by creating shared investigator labs and shared spaces for graduate students from all disciplines, improving program adjacencies, and creating shared facilities such as conference rooms and break-out areas. We also anticipate future expansion in computational neuroscience and computational psychology.

The Complex Systems Supercluster (CSS) will be team directed by scientists and engineers, with Dr. David Francis, Hugh Roy and Lillie Cranz Cullen Distinguished University Chair and Chairman of the Department of Psychology, Director of TIMES and Co-Director of the TLC2 as the point person. In addition to Francis, the CSS will be directed by Dr. Jack Fletcher, Hugh Roy and Lillie Cranz Cullen Distinguished University Professor of Psychology, Dr. Lennart Johnsson, Cullen Professor of Computer Science and Engineering, Dr. Michael Rea, Professor of Biology and Biochemistry, and Dr. Haluk Ogmen, Professor of Electrical and Computer Engineering and Director of the Center for Neuroengineering and Cognitive Science.



Houston • Texas

Featuring

- *Interdisciplinary Research*
- *Facility for Complex Systems Collaboration*
- *Educational Training*
- *Clinical Services*
- *Community Engagement*
- *Furthering UH & TMC Ties*

