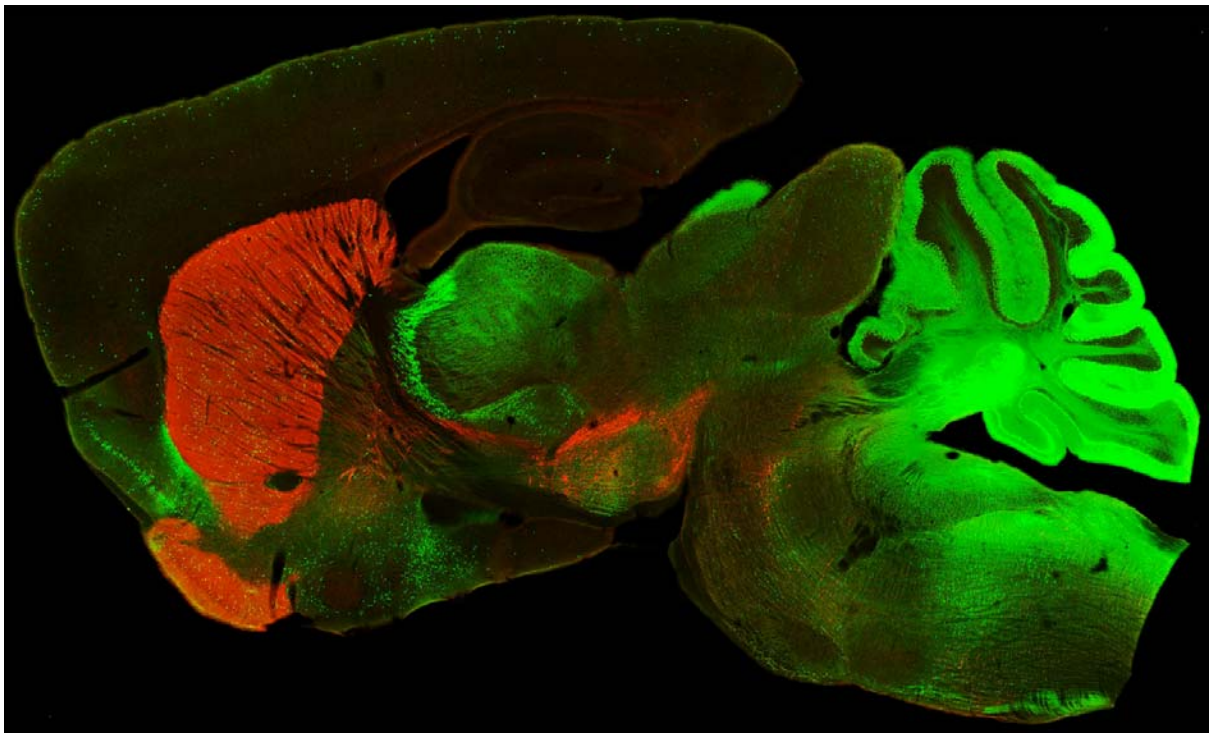
THE
NEUROSCIENCE INSTITUTE
UNIVERSITY OF TENNESSEE HEALTH SCIENCE CENTER

Neuroscience Center of Excellence



Annual Report to the

Tennessee Higher Education Commission

Fiscal year 2011 (7/1/2010-6/30/2011)

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I. ADMINISTRATIVE STRUCTURE

Director:	Professor William E. Armstrong, Ph.D.
	Department of Anatomy and Neurobiology
Co-Director:	Professor Tony Reiner, Ph.D.
	Department of Anatomy and Neurobiology
Administrative Specialist:	Shannon Guyot
IT Specialist/	
Business Manager:	Brandy Fleming

Neuroscience Executive Committee:

Matthew Ennis, Ph.D., Professor and Chair, Department of Anatmy and Neurobiology

Eldon Geisert, Ph.D., Professor and Director, Center for Vision Research, Department of Ophthalmology

Mark LeDoux, M.D., Ph.D., Professor, Department of Neurology

Charles Leffler, Ph.D., Professor, Department of Physiology

William A. Pulsinelli, M.D., Ph.D., Semmes-Murphey Professor and Chair, Department of Neurology

Tony Reiner, Ph.D., Professor and NI Co-Director, Department of Anatomy and Neurobiology

Susan E. Senogles, Ph.D., Associate Professor, Department of Molecular Sciences

Burt Sharp, M.D., Van Vleet Professor and Chair, Department of Pharmacology

Jim Wheless, M.D., Professor, Chief of Pediatric Neurology and LeBonheur Chair, Le Bonheur Hospital/UTHSC

Center Address:

University of Tennessee Health Science Center
875 Monroe Ave., Suite 426, Wittenborg Building
Memphis TN 38163
(901) 448-5956
http://www.uthsc.edu/neuroscience

Organizational Structure:

The Neuroscience Center of Excellence comprises the administrative core and financial engine of the University of Tennessee Health Science Center's (UTHSC) Neuroscience Institute (NI), which is located within UTHSC's College of Medicine in Memphis, TN. Prof. William E. Armstrong is the Director, and Prof. Tony Reiner is the Co-Director. The Director reports to the Executive Dean of the College of Medicine at UTHSC, currently David Stern, M.D. Physically the NI is housed within twelve different departments in the College of

Medicine and some other UT departments, with an administrative suite in Rm 426 Wittenborg Building at UTHSC. Affiliated members reside at UT Knoxville, Oak Ridge National Laboratory, St. Jude Children's Hospital, Christian Brothers University, and at the University of Memphis.

Dr. Armstrong supervises Ms. Brandy Fleming, who is our Webmaster/IT specialist, and also functions as our Business Manager. Ms. Fleming and Dr. Armstrong supervise our administrative assistant Shannon Guyot, who replaced Michele Tungsvanich in Jan. of 2011. Ms. Guyot is a ¾ time employee who works with Brandy on the NI accounting, organizes the seminar series including all travel arrangements, and does NI official correspondence. The Neuroscience Imaging Center is managed by Ms.Yunming Hu, who replaced Ms. Kathy Troughton, who retired on July 1, 2011. Ms Hu reports to Dr. Armstrong (who also serves as Director of the Imaging Center), and supervises a part-time histologist, Zerriyan Jackson. Dr. Andrea Elberger serves as our Director of Confocal Microscopy with the Imaging Center.

II. BUDGET (see Schedule 7, page 6)

A. 2010-11. The FY 2010-11 appropriated budget for the UTNI was $654,945, which included ~ $70,000 non-recurring ARRA and MOE funds. We carried forward $471,877 from the previous year for a total budget of $1,126,822. This carryover continued to partly reflect amounts encumbered but unspent for Graduate Stipends that were picked up previously by NI and are now picked up by UTHSC for the student's first 18 months. In addition, many research projects were funded with start dates from the past FY and therefore are carried over.

This past FY, we expended $602,605 in total personnel costs, including administrative supplements (w/fringe) for the NI Director (who also directs the NI Imaging Center), the NI Co-Director, the Director of Confocal Microscopy, a full-time IT specialist/Business Manager, a ¾ time Administrative Specialist, full time Technical Director of Imaging Center and her replacement (4 month overlap for training), part time histologist in the Imaging Center, matching support for 7 graduate student stipends, and 10 matching postdoctoral fellowships. In addition, NI continued to partner with COM and the Department of Neurology by supporting Dr. Mike McDonald, hired in 2007. NI will pay ~25% of Dr. MacDonald's salary/fringe until October of 2011. Finally, it is important to note that the personnel amount also includes personnel employed under the research projects NI funded this past year, such as technicians.

Neuroscience Imaging Center: In addition to paying the retiring Technical Director of the Imaging Center, Ms. Kathy Troughton (effective July 1, 2011), we were able to hire her replacement Yunming Hu in March, 2011. This overlap provided 4 months of critical training of Ms. Hu. In addition we pay a part-time histologist, Zerriyan Jackson, and we supplement our cost-recovery program to keep user fees low, helping to pay the service contracts on our JEOL 2000 Electron Microscope, our BioRad Confocal Microscope, and the Neurolucida workstation. This year our cost-recovery program took in $38,134, which paid for our part-time

histologist and provided fees against the $44,590 in service contracts and maintenance. This past year we installed the Zeiss 710 Spectral Scanning confocal microscope from our successfully submitted NIH/NCRR grant (Armstrong, PI), and contributed $9,483 toward its total purchase of $475,861 (466,377 was paid by the NIH/NCRR grant). NI also paid to have key card access installed for this facility.

Neuroscience Behavioral Core: This past FY we worked on developing a Behavioral Core. Much of the funding for the renovation of the two rooms in Mooney Building (103, 104) was provided by UTHSC. NI contributed some funds and will continue to do so as needed. NI did provide $30,000 for the purchase of the Digigait Analysis system in the core. The core is managed by NI member Mike McDonald, and the procedures for use and available equipment can be viewed at: http://www.uthsc.edu/neuroscience/behavioral-core/index.php.

Seminars and Symposia: Additional funds went to support travel/lodging/meals ($21,253), honoraria ($7,600), and auditorium rental ($1500) for the Neuroscience Seminar series, for a joint symposium with the Urban Child Institute entitled: "How Pain and Stress in Infancy Shape Our Perceptions and Consciousness" and for a Symposium on Traumatic Brain Injury entitled "Sports Concussions: The Hidden Risks". **(see Appendix 4).**

Research Projects: NI allocated $331,908 in Research projects in 2010-2011, including two clinical pilot projects that received additional matching funds from the College of Medicine. Highlights are detailed under **Goal 3** under Item **X** below.

B. <u>2011-2012</u>. We will carryover $425,879 to the coming fiscal year, and have been appropriated $593,407 for a total of $1,019,286. However, the carryover amount includes unspent, encumbered allocations from the Research Project grants awarded in FY2011. Here is a breakdown of the major anticipated projects for FY2012:

Students: For the coming year, we have awarded matching funds for 6 graduate stipends to PIs with Neuroscience track graduate students. Mentors are located in the departments of Anatomy and Neurobiology, Ophthamology, Neurology and Pharmacology.

Postdoctoral Support: We have awarded 6 postdoctoral matching awards, at ~$15,000 each, for the coming year. The NI Mentors are located in the departments of Anatomy and Neurobiology, Neurology, Ophthamology, and Pharmacology.

Neuroscience Imaging Center: For FY 2012 we plan to hire an additional part-time technician for the preparation of material for light and electron microscopy. This person, like Zerriyan Jackson, will work on a fee for service basis and thus will not incur direct NI funding. We will continue to pay the service contracts on the JEOL 2000 ($16,500), Neurolucida/StereoInvestigator Imaging Station (~$1000), and laser replacement for the BioRad 2000 (~$10,000). The new Zeiss 710 is under warranty until May of 2012, and has been covered for an additional year by payments made at the time of purchase. Again, NI will pay whatever amount necessary after

cost recovery fees are considered. We also expect to pay for year 3 ($19,000) this coming year in advance, in order to obtain a discount offered to us by Zeiss. We will also pay for an upgrade to two microscope objectives for the Zeiss 710.

Neuroscience Behavioral Core: We will continue to support the Behavorial Core in FY 2012, but at this point expenditures are expected to be minimal beyond the $30,000 we provided for the Digigait Analysis System this past year. However should a need arise for additional equipment, or for a part-time assistant to help run behavioral studies, NI would consider additional funding.

NI Faculty: In addition to the administrative supplements provided to Drs. Armstrong, Reiner, and Elberger, we will cover the last 3 months of this final year of partial salary support to Dr. Mike McDonald ($108,089 over the last 4 years) in the Department of Neurology. Dr. McDonald is a behavioral Neuroscientist, specializing in genetic models of Alzheimer's disease. His presence is critical to the further development of translational neuroscience at UTHSC. Dr. McDonald is an Associate Professor and currently recently holds two R01s from NIH, and who has agreed to manage the new NI Behavioral Core facility. NI has committed to the College of Medicine and to the Department of Anatomy and Neurobiology to help recruit into the Methodist Hospital Endowed Chair for Neuroscience vacated by Prof. Dan Goldowitz 4 years ago. It is not certain when and/if this recruitment will be successful, but to be certain this commitment is honored we'll reserve $100,000 for the first year of seed/salary support. NI has committed $500,000 to be spent for the first 4-5 years for this recruit. An advertisement is being development at this writing.

Research Projects: The NI will commit $209,000 to support new clinical and basic science research projects aimed at developing research grant applications during the next FY. Note that this amount does not reflect the carryover of encumbered monies to currently funded research projects, student stipends, or allocated postdoctoral stipends, but rather funds available for new initiatives. This new allocation may include additional postdoctoral support and and support for investigators trying to renew NIH R01s or other renewable grants, or support for groups trying to obtain larger, multi-PI grants. The NI Executive Committee will be meeting this month to determine how best to spend these funds.

Seminar Series and Community Outreach: We will continue to fund the weekly Neuroscience Seminar series and will also sponsor a Neuroscience Symposium in the course of the academic year. We will continue to work with the Urban Child Institute to fund community outreach activities such as Brain Awareness Week and sponsor a symposium with them. We will fund the summer Undergraduate Neuroscience Merit Fellowships to Rhodes and Christian Brothers University students who are doing research projects in Neuroscience towards fulfilling their degree requirements. In addition, we will continue our practice of awarding additional undergraduate Merit fellowships to Memphians attending universities outside of Memphis, but who return to Memphis during summer vacation and who have an interest in Neuroscience.

Schedule 7

CENTERS OF EXCELLENCE/CENTERS OF EMPHASIS
ACTUAL, PROPOSED, AND REQUESTED BUDGET

Institution UTHSC **Center** Neuroscience

	FY 2010-11 Actual			FY 2011-12 Proposed			FY 2012-13 Requested		
	Matching	**Appropr.**	**Total**	**Matching**	**Appropr.**	**Total**	**Matching**	**Appropr.**	**Total**
Expenditures	736,988	700,943	**1,437,931**	765,136	1,019,286	**1,784,422**	803,393	623,078	**1,426,471**
Salaries									
Faculty	500,050	64,291	**564,341**	525,053	44,100	**569,153**	551,305	75,600	**626,905**
Other Professional	41,518	174,339	**215,857**	43,594	163,800	**207,394**	45,774	163,800	**209,574**
Clerical/ Supporting		135,559	**135,559**		148,818	**148,818**		81,307	**81,307**
Assistantships	98,570	111,710	**210,280**	98,570	107,154	**205,724**	103,499	68,775	**172,274**
Total Salaries	**640,138**	**485,899**	**1,126,037**	**667,216**	**463,872**	**1,131,088**	**700,577**	**389,482**	**1,090,059**
Longevity	850	4,087	4,937		2,300	2,300		2,415	2,415
Fringe Benefits	96,000	112,619	**208,619**	97,920	84,127	**182,047**	102,816	63,000	**165,816**
Total Personnel	**736,988**	**602,605**	**1,339,593**	**765,136**	**550,298**	**1,315,434**	**803,393**	**454,897**	**1,258,290**
Non-Personnel									
Travel		14,854	**14,854**		35,000	**35,000**		36,750	**36,750**
Software			**0**		20,000	**20,000**			**0**
Books & Journals			**0**			**0**			**0**
Other Supplies		47,312	**47,312**		159,988	**159,988**		86,031	**86,031**
Equipment		30,000	**30,000**		105,000	**105,000**			**0**
Maintenance		36,706	**36,706**		55,000	**55,000**		57,750	**57,750**
Scholarships			**0**		16,000	**16,000**		16,000	**16,000**
Consultants		7,600	**7,600**		8,000	**8,000**		8,400	**8,400**
Renovation			**0**			**0**			**0**
Imaging Center Recovery		(38,134)	**(38,134)**		(35,000)	**(35,000)**		(36,750)	**(36,750)**
Pilot			**0**		25,000	**25,000**			**0**
New Fac Appts			**0**		30,000	**30,000**			**0**
Startup			**0**		50,000	**50,000**			**0**
Total Non-Personnel	**0**	**98,338**	**98,338**	**0**	**468,988**	**468,988**	**0**	**168,181**	**168,181**
GRAND TOTAL	**736,988**	**700,943**	**1,437,931**	**765,136**	**1,019,286**	**1,784,422**	**803,393**	**623,078**	**1,426,471**
Revenue									
New State Appropriation		654,945	**654,945**		593,407	**593,407**		623,077	**623,077**
Carryover State Appropriation		471,877	**471,877**		425,879	**425,879**			**0**
New Matching Funds	736,988		**736,988**	765,136		**765,136**	803,393		**803,393**
Carryover from Previous Matching Funds			**0**			**0**			**0**
Total Revenue	**736,988**	**1,126,822**	**1,863,810**	**765,136**	**1,019,286**	**1,784,422**	**803,393**	**623,077**	**1,426,471**

III. EXTRAMURAL FUNDING OF NEUROSCIENCE FACULTY

The UT Neuroscience Institute remains one of the largest concentrated Neuroscience programs in the country and has achieved an international reputation as a preeminent center for Neuroscience in the United States. For FY11, as a Neuroscience department (all but one funded member is a Neuroscientist), Anatomy and Neurobiology (13 funded members) ranked ***13th among public university medical schools in NIH funding, and 26th overall (of 47).*** Other participating NI departments that are well ranked include Physiology (6 funded NI members), which was ranked ***8th among public medical schools and 17th overall*** (of 92), and Pharmacology (10 funded members), which was *ranked* ***27th and 40th***, respectively (of 83) The total annual grant dollars (total costs) currently held by faculty associated with the NI at UTHSC (*i.e.,* excluding affiliate members, such as St. Jude) is **$15,589,499**.

The research grants (current year total costs) currently held by individual faculty of the NI are listed by Principal Investigator in **Appendix 1**. Readers should note that this year we are reporting total costs instead of direct costs as these were the values given to us by the research office at UTHSC. We found it too difficult to get direct costs from the business managers of each department. In addition, please note that active grants that are in a no cost extension, but which often have funds, are not listed.

IV. HISTORY OF THE NEUROSCIENCE INSTITUTE

The Neuroscience Center of Excellence at UTHSC was established in 1985 and designated an accomplished Center of Excellence by the Tennessee Higher Education Commission in 1988. In 1998, the Neuroscience Center of Excellence was designated as the University of Tennessee Neuroscience Institute, with dedicated space in the Wittenborg, Link and Johnson buildings. The Neuroscience Center of Excellence award was designed to support graduate and postdoctoral education, to recruit and provide initial support to new neuroscience faculty, to renovate laboratory facilities, to purchase research equipment, to host symposia, a weekly seminar series, and to support community outreach programs such those associated with Brain Awareness Week. The Director from 1985-2002 was Dr. Steven T. Kitai. Dr. David Smith was named director from 2002-2006 (deceased, Sept. 2006), and Dr. William Armstrong has been director since 2006.

The program brings together neuroscience faculty members from the Departments of Anatomy and Neurobiology, Medicine, Molecular Sciences, Neurology, Neurosurgery, Ophthalmology, Pathology, Pediatrics, Pharmaceutical Sciences, Pharmacology, Physiology, Psychiatry, and Surgery, and in the Department of Biochemistry and Cellular and Molecular Biology at the University of Tennessee, Knoxville. Strong affiliations are present with Methodist University Hospital, Le Bonheur Children's Hospital, St. Jude's Children Hospital, the University of Memphis, Rhodes College and Christian Brother's University. The interdepartmental nature of the program and the collaborations it fosters provide the cross-disciplinary

environment necessary for high quality neuroscience research, training and patient care.

In June of 2002, Dr. David V. Smith, Chairman of the Department of Anatomy and Neurobiology, followed Dr. Kitai as Director of UTNI. Dr. Smith reformed the Executive Committee, with Dr. William Armstrong continuing as Co-Director and Director of the Neuroscience Imaging Center. In Dec. of 2005, Dr. Smith became ill with a brain tumor, and Dr. William Armstrong became acting Director. Dr. Armstrong was named permanent Director of NI in 2006.

In spring of 2006 the NI Executive Committee expanded to include two additional clinical neuroscientists, professors Mark LeDoux (Neurology) and Jim Wheless (Pediatrics), and one new basic scientist, professor Charles Leffler (Physiology). Dr. Tony Reiner, a professor in A & N, was named NI Co-Director in 2007, shortly after joining the Executive Committee. The latest member of the Executive Committee is Dr. Matthew Ennis, Chair of Anatomy and Neurobiology, who joined in 2008.

V. FACULTY OF THE NEUROSCIENCE INSTITUTE

The Neuroscience Institute is currently comprised of 88 faculty members in several different departments on the UTHSC campus, including those with primary appointments at St. Jude Children's Research Hospital and at the University of Memphis and Christian Brothers University, and one faculty member at UT Knoxville. Faculties are listed with each department; those with primary appointments outside UTHSC or UTK are so indicated. NI lost 2 clinical faculty members during the FY.

Department of Anatomy and Neurobiology

William E. Armstrong, Ph.D., Professor and NI Director
John D. Boughter, Jr., Ph.D. Associate Professor
Joseph C. Callaway, Ph.D., Associate Professor
Angela Cantrell, Ph.D., Assistant Professor
Alessandra d'Azzo, Ph.D., Affiliated Professor (St. Jude)
Hong Wei Dong, Ph.D., Assistant Professor
Michael A. Dyer, Ph.D., Affiliated Professor (St. Jude)
Andrea J. Elberger, Ph.D., Professor
Matthew Ennis, Ph.D., Professor and Chair
Malinda E. C. Fitzgerald, Ph.D., Adjunct Professor (Christian Brothers Univ.)
Max Fletcher, Ph.D., Assistant Professor
Robert C. Foehring, Ph.D., Professor
Kristin Hamre, Ph.D., Associate Professor

Detlef Heck, Ph.D., Associate Professor

Scott Heldt, Ph.D., Assistant Professor

Paul Herron, Ph.D., Associate Professor

Marcia G. Honig, Ph.D., Professor

Eldridge F. Johnson, Ph.D., Professor

Hitoshi Kita, Ph.D., Professor

Cheng-Xiang Li, M.D., Assistant Professor

Lu Lu, Ph.D., Associate Professor

Peter J. McKinnon, Ph.D., Affiliated Associate Professor (St. Jude)

Guy Mittleman, Ph.D., Adjunct Associate Professor (Univ. Memphis)

James I. Morgan, Ph.D., Affiliated Professor (St. Jude)

Randall J. Nelson, Ph.D., Professor

Guillermo Oliver, Ph.D., Affiliated Associate Professor (St. Jude)

Melburn R. Park, Ph.D., Associate Professor

Anton J. Reiner, Ph.D., Professor and NI Co-Director

Reese S. Scroggs, Ph.D., Associate Professor

Richard J. Smeyne, Ph.D., Affiliated Associate Professor (St. Jude)

Michael Taylor, Ph.D., Affiliated Assistant Professor (St. Jude)

J. Paul Taylor, M.D., Ph.D., Affiliated Associate Professor (St. Jude)

Robert S. Waters, Ph.D., Professor

Robert W. Williams, Ph.D., UT-Oak Ridge National Laboratory Governor's Chair in Computational Genomics Professor

Jian Zuo, Ph.D., Affiliated Professor (St. Jude)

Department of Biochemistry and Cellular and Molecular Biology, UT Knoxville

Rebecca A. Prosser, Ph.D., Associate Professor

Department of Medicine

Tai-June Yoo, M.D., Ph.D., Professor

Department of Molecular Sciences

Susan E. Senogles, Ph.D., Professor

Department of Neurology

Dominic M. Desiderio, Ph.D., Professor
Michael Jacewicz, M.D., Professor
Mark S. LeDoux, M.D., Ph.D., Professor
Michael C. Levin, M.D., Professor
Michael McDonald, Ph.D., Associate Professor
Thaddeus S. Nowak, Ph.D., Professor
Ronald F. Pfeiffer, M.D., Professor
William A. Pulsinelli, M.D., Ph.D., Semmes-Murphey Professor and Chair
Lawrence T. Reiter, Ph.D., Associate Professor

Department of Neurosurgery

Frederick Boop, M.D., Professor and Chair

Department of Ophthalmology

Edward Chaum, M.D., Ph.D., Plough Foundation Professor
Eldon E. Geisert, Ph.D., Professor
Alessandro Iannoccone, M.D., Associate Professor
Monica M. Jablonski, Ph.D., Associate Professor
Tonia S. Rex, Ph.D., Assistant Professor
Jena Steinle, Ph.D., Associate Professor
Dianna A. Johnson, Ph.D., Hiatt Professor

Department of Pathology

F. Curtis Dohan, Jr., M.D., Associate Professor

Department of Pediatrics, Pediatric Neurology and LeBonheur Children's Hospital

Kanwakheet J.S. Anand, M.D., Ph.D., Professor, Pediatrics, Le Bonheur
Masanori Igarashi, M.D., Associate Professor, Pediatric Neurology, Le Bonheur

Kathryn McVicar, M.D., Assistant Professor, Pediatric Neurology, Le Bonheur
Amy McGregor, M.D., Assistant Professor, Pediatric Neurology, Le Bonheur
Robin L. Morgan, M.D., Assistant Professor, Pediatric Neurology, Le Bonheur
Freedom F. Perkins, Jr., M.D., Assistant Professor, Pediatric Neurology, Le Bonheur
Massroor Pourcyrous, M.D., Professor, Pediatrics
James W. Wheless, M.D., Professor and Chief of Pediatric Neurology, Le Bonheur

Department of Pharmaceutical Sciences

Duane D. Miller, Ph.D., Van Vleet Professor and Chairman

Department of Pharmacy

Collin Hovinga, Pharm.D., Assistant Professor

Department of Pharmacology

Suleiman W. Bahouth, Ph.D., Professor
Alex M. Dopico, M.D., Ph.D., Professor and Acting Chair
Francesca-Fang Liao, Ph.D., Associate Professor
Kafait U. Malik, Ph.D., Professor
Kazuko Sakata, Ph.D., Assistant Professor
Shannon G. Matta, Ph.D., Professor
Burt Sharp, M.D., Van Vleet Professor and Chair
Jeffery Steketee, Ph.D., Professor
Steven J. Tavalin, Ph.D., Associate Professor
Fu-Ming Zhou, M.D., Ph.D., Associate Professor

Department of Physiology

Ioannis Dragatsis, Ph.D., Associate Professor
Jonathan Jaggar, Ph.D., Professor
Charles W. Leffler, Ph.D., Professor
Kristen M.S. O'Connell, Ph.D., Assistant Professor
Helena Parfevona, Ph.D., Professor

Mitchell A. Watsky, Ph.D., Professor

Department of Psychiatry

Kenneth Sakauye, M.D., Professor and Vice Chair

Department of Surgery

Syamal Bhattacharya, Ph.D., Professor

University of Memphis

Ramin Homayouni, Ph.D., Associate Professor
Guy Mittleman, Ph.D., Professor

St. Jude Children's Hospital

Michael Dyer, Ph.D., Professor
Alessandra D'Azzo, Professor
Peter McKinnon, Ph.D., Professor
James Morgan, Ph.D., Professor
Guillermo Oliver, Ph.D., Associate Professor
Richard Smeyne, Ph.D., Associate Professor
Michael Taylor, Ph.D., Assistant Professor
J. Paul Taylor, M.D., Ph.D., Associate Professor
Stanislav Zakharenko, Ph.D., Assistant Professor
Jian Zuo, Ph.D., Professor

VI. AREAS OF NEUROSCIENCE RESEARCH

The research programs of the faculty of NI are diverse, representing most areas of modern neuroscience research. Within the program are several strong areas of research focus, where in many instances basic scientists and clinical investigators interact to investigate the mechanisms of diseases of the nervous system. In 2002 participating faculty organized into eight research focus groups, within which there is considerable intellectual interaction and collaborative research. In spring of 2006, 3 of these focus groups were expanded to

include a Translational component emphasizing interaction between clinical and basic research groups.

Neurological and Neurodegenerative Disorders

Neurological diseases include disorders of the nervous system arising from nervous system malfunction or degeneration. Among these are the movement disorders (which include Parkinson's disease, essential tremor, Huntington's disease, dystonia, myoclonus, Tourettes's syndrome, paroxysmal dyskinesias, drug-induced dyskinesias, restless legs syndrome, spinocerebellar ataxias, spasticity, multiple system atrophy, and progressive supranuclear palsy), dementing diseases (notably Alzheimer's), primary motor diseases (such as amyotrophic lateral sclerosis and multiple sclerosis), and diseases of neurotransmission abnormality (such as epilepsy). The integration of genetic, cellular, and physiological information will be required to unravel the pathophysiology of each disorder and improve therapeutics. Due to aging of our population, movement disorders and dementing diseases will place an enormous and increasing financial burden on society. Investigations by this group will play an important role in the breakthroughs needed to understand and treat these diseases. Current areas of focus include: cellular and network physiology of basal ganglia in the context of Parkinson's disease, neurobiology of neuronal dysfunction and death in Huntington's disease, and molecular biology of synaptogenesis in dystonia. Faculty also study the potential protective effects of hypothermia on cerebral ischemic insults, Alzheimer's disease, and molecular mimicry in immune-mediated neurological disease.

Faculty:

M. LeDoux (head)	*Neurology*	R. Nelson	*Anat. & Neurobiology*
A. Cantrell	*Anat. & Neurobiology*	T. Nowak	*Neurology*
I. Dragatsis	*Physiology*	R. Pfeiffer	*Neurology*
E. Geisert	*Ophthalmology*	W. Pulsinelli	*Neurology*
R. Homayouni	*U of Memphis*	A. Reiner	*Anat.y & Neurobiology*
M. Jacewicz	*Neurology*	L. Reiter	*Neurology*
H. Kita	*Anat.y & Neurobiology*	R. Smeyne	*Anat. & Neurobiology/St. Jude*
M. Levin	*Neurology*	R. Waters	*Anat. & Neurobiology*
F-F. Liao	*Pharmacology*	J. Wheless	*Pediatric Neurology/Le Bonheur*

Excitable Properties of Neurons

Behavior, mentation and physiological homeostasis are all a function of neuronal activity in the nervous system. This activity can be encoded by membrane polarity or in the rates and patterns of neuronal action potentials. Information is passed among neurons through synaptic transmission. Whether a neuron fires at any given moment is determined by the interaction of intrinsic membrane properties with synaptic inputs. Research

in this group focuses on these properties from several viewpoints. At the molecular level, studies determine the genetic capacity for producing proteins related to specific ion channels and neurotransmitter receptors. Expression patterns of the proteins in classes of neurons impart a unique signature of ion channels and receptors. Electrophysiological recordings can reveal the properties of ionic currents underlying particular patterns of firing, the modulation of these currents by neurotransmitters, the precise properties of synaptic input, and the plasticity of neuronal activity. At a more global level, neuronal activity can be studied within an intact neuronal network and correlated with behavior. The common goal of this group is to understand how and why neuronal activity occurs in both normal tissue and in neurological disorders.

Faculty:

R. Foehring (head)	*Anat. & Neurobiology*	D. Heck	*Anat. & Neurobiology*
J. Callaway	*Anat. & Neurobiology*	H. Kita	*Anat. & Neurobiology*
A. Cantrell	*Anat. & Neurobiology*	R. Nelson	*Anat. & Neurobiology*
A. Dopico	*Pharmacology*	R. Scroggs	*Anat. & Neurobiology*
W. Armstrong	*Anat. & Neurobiology*	S. Tavalin	*Pharmacology*
M. Ennis	*Anat. & Neurobiology*	R. Waters	*Anat. & Neurobiology*

Sensory Information Processing

Sensory systems extract information from the environment and provide the nervous system an interface with the outside world. Understanding the way in which this information is represented in neuronal activity is the focus of this research group. To understand sensory processing, we need to address the genetic basis of sensory function, the coding of information by individual sensory neurons at several levels of the nervous system, from peripheral receptors to cerebral cortex, and the role of the environment in shaping the responsiveness of these neurons through mechanisms of neuronal plasticity. Interactions between somatosensory and motor cortices, the effects of early alcohol exposure on sensory and motor processing, the control over gustatory information processing by descending influences from limbic forebrain, the genetics of taste processing, the processing of nociceptive (pain) information, and synaptic processing in the olfactory bulb are all areas of research addressed by this group.

Faculty:

M. Ennis (head)	*Anat. & Neurobiology*	R. Scroggs	*Anat. & Neurobiology*
J. Boughter	*Anat. & Neurobiology*	R. Waters	*Anat. & Neurobiology*
C.-X. Li	*Anat. & Neurobiology*	R. Nelson	*Anat. & Neurobiology*
M. Fletcher	*Anat. & Neurobiology*		

Vision and Retina

We rely primarily on our sight to guide us through the world. Our eyes provide the major sensory input to the brain, accounting for one-third of the sensory axons entering the human nervous system. Understanding the normal function of the eye and the way this process is affected by disease is the primary interest of this group. Researchers are addressing the normal development of the eye as well as the genetic basis of function and disease. The current program reflects a comprehensive and synergistic approach to important fundamental questions of eye genetics and development and the application of this new strategy to the treatment of disease. These investigators seek to understand normal and abnormal ocular development and how genes control these events. There is an active program in the application of molecular techniques to the modulation of retinal cell growth and cellular responses to injury using gene therapy. Current areas of focus include prevention and treatment of eye diseases and disorders, eye genetics in development and childhood diseases, retinal degenerative diseases, anterior segment disorders, response of the retina and optic nerve to injury, and genetic control of eye development. The primary goal of the vision and retina research group is to provide a framework for effective communications between research laboratories effecting eventually the translation of basic research to clinical applications.

Faculty:

E. Geisert (head)	*Ophthalmology*	D. Johnson	*Ophthalmology*
E. Chaum	*Ophthalmology*	A. Reiner	*Anat. & Neurobiology*
M. Dyer	*Anat. & Neurobiology/St. Jude*	M. Watsky	*Physiology*
M. Fitzgerald	*Anat./ Neurobiology/CBU*	J. Zuo	*Anatomy Anat. & Neurobiology/St. Jude*
R. Williams	*Anatomy & Neurobiology*	T. Rex	*Ophthalmology*
A. Iannaccone	*Ophthalmology*	J. Steinle	*Ophthalmology*
M. Jablonski	*Ophthalmology*		

Neurogenetics and Development

This group is interested in gaining a deeper understanding of the origins of the impressive structural and functional complexity, diversity, and plasticity of the nervous system. Experimental and technical expertise of this group is broad, ranging from genetic and molecular analysis of the early stages of central and peripheral nervous system development to sophisticated functional assays of neuronal plasticity in response to environmental manipulations. The group is highly collaborative and includes a significant contingent of neuroscientists from St. Jude Children's Research Hospital (primarily the Departments of Developmental

Neurobiology and Genetics). Current research tends to rely heavily on genetically defined lines of rodents. Topics of research interest include: control of cell cycling and cell death in the brain, control of axon outgrowth and neurotrophic interactions during neural development, the formation, elimination and stabilization of synapses, functional maturation and environmental/drug sensitivity of the developing nervous system, genetics of disease vulnerability and outcome, and mechanisms of cell migration in the developing brain.

Faculty:

R. Williams (head)	*Anat.& Neurobiology/Pediatrics*	J. Morgan	*Anat. & Neurobiology/St. Jude*
J. Boughter	*Anatomy & Neurobiology*	P. McKinnon	*Anat./& Neurobiology/St. Jude*
A. d'Azzo	*Anat. & Neurobiology/St. Jude*	G. Mittleman	*Anat. & Neurobiology/U. Memphis*
I. Dragatsis	*Physiology*	G. Oliver	*Anat. & Neurobiology/St. Jude*
A. Elberger	*Anat. & Neurobiology*	A. Reiner	*Anatomy & Neurobiology*
K. Hamre	*Anat. & Neurobiology*	L. Reiter	*Neurology*
M. Honig	*Anat. & Neurobiology*	B. Sharp	*Pharmacology*
R. Homanyouni	*University of Memphis*	R. Smeyne	*Anat. & Neurobiology/St. Jude*
L. Lu	*Anat. & Neurobiology*	R. Waters	*Anat. & Neurobiology*

Mental and Addictive Disorders

Mental and addictive disorders are due to changes in normal brain function. This research group collaboratively explores changes in brain function that might explain mental disorders, such as depression and addiction, and drug-induced changes in brain function that may be responsible for relieving mental disorders or producing addiction. Research is currently being conducted using both *in vivo* and *in vitro* models. Molecular, cellular, neuroanatomical, neurophysiological, neurochemical, morphological and behavioral approaches are all being used to study the neuroscience of mental and addictive disorders. Research efforts are currently focused on depression and antidepressants and drugs of abuse, including cocaine, amphetamine, nicotine, ethanol and toluene. Several collaborative efforts currently exist within the group, including studies on drug effects on ion channels, drug-receptor adaptations, developmental neuroplasticity and interactions between stress and drugs.

Faculty:

A. Dopico (Acting Head)	*Pharmacology*	J. Steketee	*Pharmacology*
B. Sharp (Head)	*Pharmacology*	S. Tavalin	*Pharmacology*

A. Elberger	*Anatomy & Neurobiology*	F. Zhou	*Pharmacology*
S. Matta	*Pharmacology*	K. Hamre	*Anat. & Neurobiology*
S. Heldt	*Anat. & Neurobiology*	K. Sakata	*Pharmacology*

Neural Cell Signaling

The function, growth and survival of neural cells are regulated by extracellular and intracellular signals. One example is the release of neurotransmitter from a presynaptic neuron, which is sensed by the postsynaptic neuron via receptors that recognize specific neurotransmitter molecules. This information is relayed to the cell's interior by a series of elaborate and interdependent signaling intermediates and results in a change in the cell in response to its environment. This diverse group of researchers is investigating those processes that are collectively referred to as signal transduction using neural or neural-derived cell systems. Indeed, most drugs that are currently used in the management of neurological disorders, such as ADHD, depression, schizophrenia, Parkinson's disease and others, exert their effects on signaling components. The goal of this group is to understand the involvement of signal transduction in both the normal functioning of neural cells and those pathological changes that are manifested in neurological disorders. Current areas of emphasis include: G-protein-coupled receptor signaling and regulation, growth factor receptor signaling, apoptosis, cellular migration, and mechanisms of neuronal injury and repair.

Faculty:

S. Senogles (Head)	*Molecular Sciences*	M. Jablonski	*Ophthalmology*
S. Bahouth	*Pharmacology*	D. Johnson	*Ophthalmology*
E. Chaum	*Ophthalmology*	M. LeDoux	*Neurology*
R. Foehring	*Anat. & Neurobiology*	K. Malik	*Pharmacology*
T. Yoo	*Medicine*	S. Tavalin	*Pharmacology*
J. Jaggers	*Physiology*	R. Waters	*Anat. & Neurobiology*

Translational Neuroscience

The NI promotes three **Translational Neuroscience** focus groups.

Focus 1: Neurodegenerative Diseases (Leader, M. LeDoux, M.D., Ph.D., Neurology, UTHSC)

Human thought and behavior are a function of nervous system activity. Neurodegenerative diseases attack both, often simultaneously, and in the worst cases lead to years of debilitation and death, with the aged especially vulnerable. The substantial burden on the family as well as the health care system is obvious. Dissection of specific human neurological diseases in order to identify therapeutic targets and implement disease-modifying therapies requires expert clinical neurologists and neuroscientists with skill sets that cover

the gamut from neurophysiology and neuropharmacology, to molecular neurobiology and neurogenetics. The NI contains several strong areas of disease-specific research, where basic scientists and clinical investigators interact to investigate the mechanisms of relatively common sensory-motor disorders like Parkinson's disease. Concomitantly, clinical neuroscience research related to many of the movement disorders is robust. Thus, the framework is in place at UTHSC for a vigorous program of translational Neuroscience research in the area of neurodegenerative diseases.

Neurodegenerative disease impacts a significant percentage of the U.S. population, and in many disorders the occurrence increases with age. For example, Parkinson's disease currently affects ~1.5 million people in the U.S., but 1 in 100 people over the age of 65 are afflicted, with the average age of onset being 60 years (National Parkinson's Foundation; CDC). Although the national prevalence of Alzheimer's disease is ~1.5% (afflicting some 4 million people), the frequency increases to 3% for men and women between ages 65-74, and it is estimated that 50% of those reaching 85 may have the disease (CDC; NIMH)! Multiple sclerosis currently afflicts some 400,000 U.S. citizens, but Tennessee has a rate higher than the national average. Neuropathy (a.k.a., neuritis), a peripheral nervous system inflammation producing pain, loss of sensation, and/or loss of muscular control, may be the most common single nervous system disorder, as it also accompanies many diseases of non-neuronal primary origin. Most notably, neuropathy accompanies 80% of the cases of type II diabetes, a disease found in some 8 million Americans and in a disproportionately high percentage of Tennesseans. Most recently, investigators studying traumatic brain injury (TBI) have linked TBI sympoms and pathology to a variety of neurodegenerative disesases, especially Alzheimer's and Parkinson's disease. The NI has made a concerted effort to support TBI initiatives this year (see below).

This year, NI funded several investigators studying neurodegenerative disease or TBI: Ioannis Dragtasis ("Generation of a Mouse Model for Spastic Paraplegia 17"), Eldon Geisert ("Crystallin Network and Neuroprotection"), Andrea Elberger ("Novel Drug Effects on Traumatic Brain Injury"), Anton Reiner ("Pilot Studies for Head Traumatic Brain Injury"), Monica Jablonski ("Ocular Toxicity and Pharmacokinetics Studies of a Novel Drug and Nanoparticle Delivery System"), Jena Steinle ("Mechanism of Actions of a Novel Beta-Adrenergic Receptor Agonist that Prevents/Reverses Diabetic Retinopathy"), Fuming Zhou ("An Electrophysiological Data Acquisition and Analysis System for Intact Animals"), Mark Ledoux ("DigiGait Imaging System for Neuroscience Behavioral Core"). In addition, we have approval from the College of Medicine to recruit a senior scientist studying neurodegenerative disease. NI is committed to this effort and will offer help with seed money and/or salary.

Translational Research Areas:

The primary efforts of NI faculty have been in the areas of Parkinson's disease, Alzheimer's disease, Huntington's disease, TBI, and multiple sclerosis. Presently there are clinical trials covering Parkinson's, Huntington's disease, dystonia, restless legs syndrome, neuropathy and multiple sclerosis in the Dept. of

Neurology at UTHSC. In support of this clinical research, many basic scientists in the NI are studying the related brain areas, including neuroanatomists, neurophysiologists and neurogeneticists. Translational research initially will focus on the genetic basis of disease and its susceptibility to treatment. Disease-associated DNA polymorphisms and their gene products will represent a strategic target for the group. ***In the Spring of 2011, NI sponsored a symposium on Traumatic Brain Injury and Sports Concussions (see Appendix 4).***

Focus 2: Brain, Mind and Behavior (Leader, Alex Dopico, Ph.D., Acting Chair, Pharmacology, UTHSC.)

The central nervous system is the target of the drugs that are abused by individuals at all ages. It is the reinforcing properties of these drugs that initially lead to abuse. Subsequently, long-term changes in brain chemistry and morphology take place, resulting in drug craving and severe disruption of normal behavior and social functioning. A translational approach to drug abuse research will foster interactions between basic and clinical investigators that engender a more powerful understanding of the impact of drugs of abuse on brain and behavior. Routine cooperation and collaboration between basic and clinical scientists will also result in the identification risk factors for abuse within subpopulations of Tennesseans, along with novel therapies that target high risk groups.

Memphis is no exception to the national trend in drug abuse and its co-morbid disorders (e.g., depression). Compared to 5 of its 8 neighboring states, Tennessee has higher rates of illicit drug use by its entire population (National Household Survey on Drug Abuse, 1999 and 2000). The association between depression and drug abuse is shown based on national figures. The high level of drug abuse amongst Tennesseans 12 years of age or older involves a large number of individuals: 286,000 persons per month used various illicit drugs (e.g., cocaine, marijuana), of which 48,000 were teens between 12 and 17 years of age. In addition, one million three hundred thirteen thousand (1,313,000) Tennesseans, age 12 or older, used tobacco – a known gateway to the use of illicit drugs. Of these, 78,000 teens used tobacco products. On a national scale, the interaction between illicit drug abuse and depression is demonstrated by the markedly increased prevalence of substance abuse among all individuals aged 12 or older who suffered a major depressive episode during 2004: 28.8% of those who suffered a major depressive episode used illicit drugs compared to 13.8% of those who did not experience a major depressive episode. Moreover, the prevalence of heavy alcohol use or cigarette smoking was higher in those who suffered a major depressive episode (alcoholism 9.2% vs. 6.9%; cigarette smoking 25.5% vs. 15.1%).

Translational Research Areas:

- Drug abuse and co-morbid disorders

A major goal of this focus is the development of new definitions for clinical subtypes that depend on specific neurochemical, genetic and brain imaging patterns in patients, along with accurate behavioral profiling

of antecedent history and response to intervention utilizing specific agents in clinical trials. These studies will entail reciprocal interactions between basic and clinical investigators, along with critical support from core facilities for genotyping (i.e. ID of single nucleotide polymorphisms, repeats, inversions, translocations, etc.) of probands and multigenerational families. fMRI imaging facilities will be critical in order to gain insight into brain dysfunction and its response to drug trials. Basic scientists will apply molecular, electrophysiological, neurochemical, behavioral and fMRI imaging technologies in animal models to understand fundamental aspects of the interaction between drugs of abuse and co-morbid disorders. Many of these interactions are based on known clinical observations, although novel clinical data, which further refine the hypotheses of basic neuroscientists, will undoubtedly derive from meticulous, high resolution, multi-parameter clinical studies. Our existing electrophysiological, neurochemical and behavioral equipment, facilities and faculty expertise in these areas are strengths of UTHSC. Existing genetic models along with novel knock-ins of homologous human mutations in mice will be powerful arrows in the quiver of basic scientists. This will require molecular expertise for the development of suitable genetic constructs and reliable, committed core expertise to generate, breed, validate and house recombinant mice. Adolescents are especially vulnerable to dependence on drugs of abuse, and this dependence is often a lifelong struggle. Therefore, initially, these studies will focus on adolescents in both human populations and animal models.

- Vulnerability to, and developmental effects of drug abuse

Vulnerability to drug abuse is little understood, but certainly varies with age, as do the effects of drugs of abuse on brain function. Both vulnerability to abuse and drug effects may in turn reflect age-dependent alterations in neuronal connectivity and neuron function within the brain regions and circuits that subserve the associative learning and reinforcing properties of drugs and the response to environmental stressors and co-stimuli associated with drug seeking behavior. Thus, basic and clinical collaborations will identify biological markers of vulnerability to drug abuse in human populations and animal models of drug exposure initiated within the following time periods: gestation, adolescence, young adult, and geriatric. These studies will utilize the core fMRI imaging and genotyping technologies, along with the range of approaches mentioned in the foregoing paragraph.

Focus 3: Brain Development (Leader, Rob Williams, Ph.D.)

Understanding brain development is key to understanding adult cognition and behavior. Developmental dysfunctions can occur through inheritance, through pre- and perinatal trauma or toxicity, or even from the lack of meaningful social interaction during early life. Disorders with a strong clinical base (e.g., LeBonheur, Boling Center) include autism, learning disabilities, attention deficit disorders and epilepsy. Basic research ranges from genetic and molecular analysis of the early stages of central and peripheral nervous system development, to sophisticated functional assays of neuronal plasticity in response to environmental manipulations. We also anticipate considerable overlap with the Drug Abuse focus group as relates to brain development (see above).

The group is highly collaborative and includes a significant contingent of neuroscientists from St. Jude Children's Research Hospital (primarily the Departments of Developmental Neurobiology and Genetics) and the University of Memphis. The genetics aspect in particular has received worldwide recognition in providing the Mouse Brain Library as well as other shared, web-based data sources. Last but not least, both clinicians and researchers in this area have strong ties to the Urban Child Institute to lead us out of the parochial realm of a medical school to be engaged and enriched by multidisciplinary approaches that focus on children aged 9 months to 3 years.

Translational Research Areas:

- Autism

Autism and associated autism spectrum disorders (ASDs) have received a major focus from funding agencies and represent an exciting window into understanding higher brain function. ASDs are brain development disorders characterized by abnormal social interactions, communication abilities, patterns of interests, and patterns of behavior. Whereas NIH lists frank autism prevalence at about 0.1%, according to the National Autism Association, 1 in 150 children have an ASD. To date, researchers have found several genes associated with ASDs. Fortunately for UT, the study of ASDs has a strong clinical component at the Boling Center and UT Pediatrics. There is a core of basic scientists within the NI interested in ASDs, covering behavioral, genetic and neuronal developmental aspects of animal models. We have the potential to develop strong collaborations with the Univ. of Memphis and Vanderbilt University. ***This past year, we awarded another 6 months of funding for a clinical Pilot Project (Dr. Kathryn MacVicar) in Pediatric Neurology, Le Bonheur Hospital/UTHSC, on serum protein analysis of autistic children. This project will run through Dec. of 2011.***

- Pediatric Epilepsy

Epilepsy is a relatively common disorder affecting ~1% of the U.S. populace (Epilepsy Foundation; Center for Disease Control). More striking is that some 10% of the population will suffer a seizure during their lifetime. Characterized by uncontrolled brain seizure activity, epilepsy can have multiple origins (genetic, trauma) and a spectrum of seizure types. For children, the first year of life carries the highest risk, where seizures can be damaging and life threatening. Childhood epilepsy (~ ½ of the epilepsy cases nationwide) is more likely to be associated with genetic origins compared to adults, where stroke and accidents play greater roles. Epilepsy also targets minorities and those of lower socio-economic status with greater frequency. While in many cases seizures are well controlled with medication, a significant number of children are resistant to medical treatment, and other treatments carry significant side effects. "Designer drugs" for epilepsy provide increased hope of a better quality of life for many young patients with epilepsy. Neurologists and Neurosurgeons at Le Bonheur are investigating anti-seizure medications not yet on the market, and will be

using state of the art magnetoencephalography to assess drug actions on human brain activity. This work could benefit from translational interactions as basic researchers discover the mechanisms of actions of anti-epileptic drugs and help refine compounds to more precisely target seizure activity while avoiding debilitating side effects. Additional neurophysiological investigation of excised, epileptic tissue would help uncover the mechanisms underlying epileptic foci.

VII. FACULTY PUBLICATIONS

The Neuroscience faculty at UTHSC is consistently productive, both in terms of peer-reviewed publications and participation in the national neuroscience community. Their competitiveness for extramural funding is the strongest possible measure of the faculty's excellence, as it reflects not only the quality of their research and publications, but also their national and international reputations. Lists of 1) peer-reviewed journal publications during the last academic year, as cited in PubMed, and 2) presentations at the 2010 meeting of the Society for Neuroscience in San Diego, CA, are presented in **Appendix 2**. These PubMed-cited publications do not include the many chapters, reviews and other articles written by NI faculty. Faculty members of NI are indicated in **bold** in **Appendix 2.**

VIII. GRADUATE AND POSTDOCTORAL TRAINING

The Graduate education at UTHSC has moved away from department-based graduate programs to a single Integrated Program in Biomedical Sciences (IPBS) for students in the health sciences. Students matriculate into this integrated program, which in its first year requires broad interdisciplinary training in cell and molecular biology and in systems biology. Within the IPBS, each student chooses one of a number of tracks, of which Neuroscience is one. Students who enter the graduate program are eligible for predoctoral stipends and a waiver of tuition. UTNI funds matching level stipends for the second and third year for students in the Neuroscience Track. UTHSC has agreed to pay all IPBS stipends prior to placement in labs, during which time they take coursework and do research rotations.

Students in the Neuroscience track take a sequence of several graduate courses. In the first year, students enroll in Cell and Molecular Biology, Neuroscience Seminar, Systems Biology (which includes the nervous system), and Neuroscience Student Symposium. In future years, each student continues with Neuroscience Seminar and Neuroscience Student Symposium and must take Functional Neuroanatomy. In addition, the student chooses two elective courses from among Cellular Neuroscience, Behavioral Neuroscience or Developmental and Molecular Neurobiology. A wide variety of additional courses are available to Neuroscience graduate students on the UTHSC campus, including courses in biochemistry, physiology, pharmacology, histology, and genetics.

In addition to their coursework, graduate students register for four laboratory rotations during the first year of graduate study in order to help them choose a research mentor. They typically enter a laboratory during their second year and begin to acquire the specialized training they will need to complete their doctoral dissertations. The Ph.D. degree is granted through the College of Graduate Health Sciences. The degree requires a minimum of six semesters of graduate work and normally requires from three to five years to complete.

During the past academic year, the NI supported one partial graduate student and awarded matching stipends to 6 others. In addition 10 postdoctoral fellows were supported with matching funds. Three graduate students previously supported by the NI were awarded the Ph.D. NI has taken a more active role in the national recruitment efforts for the graduate program (see Goals below and **Appendix 4**).

IX. NEUROSCIENCE SEMINARS AND SYMPOSIA

During the 2010-2011 academic year, the NI sponsored the weekly Neuroscience Seminar Series, hosting 25 seminars. Of these, 19 neuroscientists from outside UTHSC and 6 within the NI presented their recent research findings to UT faculty and students. The NI seminar series serves as the basis for a graduate course, Neuroscience Seminar (ANAT 821), which is attended by all neuroscience track IPBS graduate students and within which they read papers by and meet with the visiting scientists. This seminar program is vital to the Neuroscience Track of the Graduate Program and to the entire UT neuroscience community, serving to keep our faculty and students abreast of recent developments and, perhaps even more important, to showcase our strengths to national and international leaders in neuroscience research visiting our campus. NI also assists in the Student Seminar course (course director William Armstrong), where students give seminars and receive critical feedback from their colleagues. A complete list of FY 2010-2011 seminar speakers and their topics is provided in **Appendix 3**. In addition, the NI sponsored a Symposium entitled "**Brain Trauma Symposium: Sports Concussions: The Hidden Risks"** with internationally renowned speakers Christopher Nowinski and, Robert Stern from Boston University and the Sports Legacy Institute (http://www.uthsc.edu/neuroscience/symposia.php). Dr. Armstrong and NI Co-Director Dr. Tony Reiner organized the symposium and Dr. Reiner mediated the proceedings. NI provided online registration, refreshements, and parking for this free public event. This symposium had 269 registrants and included scientists, health care workers, athletic trainers, athletes and coaches from the Mid-South. A flyer for the symposium can be viewed in **Appendix 4**. The symposium received coverage from two news stations that included interviews with NI members (these are available on the NI website) and a guest editorial in the Commercial Appeal. NI also collaborated again with the Urban Child Institute for a symposium on **"How Pain and Stress in Infancy Shape Our Perceptions and Consciousness".** This symposium had over 120 attendees (primarily those involved with care of infants to preK children) and received news coverage in the Commercial Appeal and the University Record (**Appendix 4**). Speakers were Drs. Matt Ennis from

Anatomy and Neurobiology at UTHSC, and Sunny Anand, Division Chief of Critical Care Medicine at LeBonheur Children's Hospital and St. Jude Children's Hospital.

X. GOALS OF THE INSTITUTE AND RECENT ACCOMPLISHMENTS

Four long-range goals of the UT Neuroscience Institute were established in 1985 and set to promote excellence in Neuroscience research, education and patient care at UTHSC. In the past 4 years we have made a concerted effort to promote Neuroscience at UTHSC, providing funds for numerous clinical and basic science research projects, and funding postdocs in NI labs.

Goal 1. Augment our already strong research efforts in Neuroscience by a) recruitment of new faculty, b) renovation of facilities, c) acquisition of equipment, d) developing major programmatic activities, and e) creating a focal point to promote the exchange of information among our research faculty.

1a. Faculty recruitment. We added no new recruits to NI this past year. However we are now partnering with the College and Medicine and Anatomy and Neurobiology with a recruitment to fill the vacant Methodist Hospital Endowed Chair in Neuroscience. NI will commit $500,000 over 5 years toward the seed/salary package to a successful recruit. The ad for this recruitment is being developed and should go out in late September, 2011.

1b. Renovations. NI has designated space in the Neuroscience Imaging Center (3rd floor Link Building) and an Administrative Suite (426 Wittenborg building) containing a conference room, 4 offices and a common room. ***This year we assisted UTHSC in the renovation of two rooms in the Mooney Building to establish the Neuroscience Behavioral Core (http://www.uthsc.edu/neuroscience/behavioral-core/index.php). The core went online in September of 2011.***

1c. Acquisition of equipment/Imaging Center In the past, NI has contributed matching funds for multi-user equipment grants, including those obtained from NIH for an electron microscope, for two confocal microscopes, for a computerized light microscope for three-dimensional neuronal reconstructions, and a high resolution digital camera attachment for the electron microscope, all are located in the Neuroscience Imaging Core and are maintained and supervised by a dedicated Technical Director (Yunming Hu) provided by the NI. The web site for the Imaging Center is constantly refreshed: (http://www.uthsc.edu/neuroscience/imaging-center/index.php?doc=m_content.inc) and features on line scheduling. Our Bio-Rad confocal microscope is no longer covered by a service contract, and as mentioned previously, ***we installed a Zeiss 710 spectral scanning laser confocal scanning microscope last year.*** This year, NI funded two NI members to purchase additional

equipment for multipurpose use within NI. Funds for a DigiGait Behavioral Analysis System were awarded to Dr. Mark Ledoux, and this item is now in the NI Behavioral Core. Funds for an *in vivo* multiunit recording system were awarded to Dr. Fuming Zhou.

1d. Developing major programmatic activities. Several areas of research focus exist within the NI and are consolidated into seven research groups. These areas include: 1) Neurological and Neurodegenerative Disorders, 2) Vision and Retina, 3) Neurogenetics, Development and Evolution, 4) Sensory Information Processing, 5) Excitable Properties of Neurons, 6) Mental and Addictive Disorders and 7) Neural Cell Signaling. These areas of focus provide for interaction among faculty in different departments and promote collaborative research activities, focused journal clubs, and other programmatic interactions conducive to interdisciplinary neuroscience research and training. The details of this organization are provided above.

NI has embarked on a mission to support the acquisition of large scale, programmatic grants by supporting Research Project grants, and to further clinical neuroscience research on campus. Current funded examples of the types of projects we seek are Dr. R. Williams Human Brain project, who has established an informatics center for mouse neurogenetics (http://www.genenetwork.org/webqtl/main.py).

1e. Creating a focal point to promote the exchange of information among our research faculty. The organization of the NI into research focus groups is a primary means of promoting interactions among NI faculty and students. In addition, there are several other avenues for the exchange of information:

1) Over 200 posters describing the interdisciplinary Graduate and Postdoctoral Program in Neuroscience are distributed yearly to undergraduate institutions around the country.

2) The NI Neuroscience Seminar series is a major mechanism for interaction among neuroscience faculty and students and brings outstanding neuroscientists from around the world to the UTHSC campus. During the past year, there were 25 seminars: 19 by visiting neuroscientists and 6 by UTNI faculty. Announcements are mailed to all participating faculty and students and are posted at various points throughout the UTHSC campus.

3) There are several web servers maintained by NI or by NI faculty. The main NI site provides information on the NI and is a recruitment tool to attract first-rate neuroscience students and faculty. This site, at http://www.uthsc.edu/neuroscience/index.php was recently restrucured by our webmaster Ms. Brandy Fleming, and now includes all of the services offered by the Neuroscience Imaging Core, the Behavioral Core, a list of NI supported research projects, the Neuroscience Undergraduate Scholars, Neuroscience Track students, and many other items. Other servers are run by NI member Rob Williams and offers Neuroscience faculty worldwide an avenue to present their research findings and search neurogenetic data, and is used daily by more than 100 scientists throughout the world. The servers may be found at: http://www.nervenet.org, http://www.genenetwork.org/, http://www.mbl.org/, http://www.complextrait.org/, and include the

GeneNework, Mouse Brain Library, Complex Trait Analysis, Virtual Microscopy, Web QTL Project, among others.

4) NI also maintains 3 additional servers for NI members. One server is for file exchange for users of the Imaging Center. All images are now digitally acquired from our confocal and electron microscopes, and these can be uploaded to this site by users, stored for a month, and downloaded at their convenience during that period. We also maintain a server for archiving all of our NI business, and a third server is maintained for the department of Anatomy and Neurobiology.

5) NI maintains online scheduling calendars for the NI Imaging Center, Behavioral Core, and two conference rooms.

Goal 2. Promote education and research training in Neuroscience at the predoctoral (including undergraduate and graduate students, dental, medical and other professional students and minority students) and postdoctoral (including Ph.D.s, interns and residents) levels of students at UT and other Tennessee institutions.

2a. Training for underprivileged students continues to be active and supported by NI neuroscientists and their laboratories through funds from the state of Tennessee, the college of Pharmacy, and Rust College. NI involvement comes primarily under the **Prescience Program** (part of a Summer Research Scholars Program administered by UTHSC graduate college), which provides financial support for summer research internships, and is administered by NI member Prof. E. J. Johnson. The **Prescience Program** provides basic science career exposure (research laboratory apprentice-preceptorship) and basic science skills reinforcement activity for scholarly oriented high school and college minority students. Students are paired with an undergraduate apprentice with a Ph.D. or M.D. biomedical scientist preceptor in a one-to-one relationship. This association and environment are designed to inform the student of the undergraduate prerequisites and essential course work that are required to pursue doctoral studies and to inform them of the demands and relevance of communication skills, mathematics, and science to the conduct of biomedical research.

2b. This year marks the sixth year for awarding ***Undergraduate Neuroscience Scholarships*** to outstanding undergraduates at Rhodes College, Christian Brothers University and other undergraduate insitutions with Neuroscience programs. The Rhodes and CBU scholars work on independent projects for their undergraduate thesis. The scholars for 2011 were Heather Callaway from Emory University (a returnee, Dr. Robert Waters), Rachel Hassan (a returnee from Rhodes College, Dr. Larry Reiter), Ashley Ladd (Rhodes College, Dr. Reiter), Catherine Gluszek (Christian Brothers University, Dr. Scott Heldt) , and Allison Umfress (Duke University, Dr. Alessandro Iannaccone). The mentors are in diverse departments, including Ophthalmology, Neurology, and Anatomy and Neurobiology.

2c. In 2010 -2011 NI supported the stipends of 6 students. ***We continue to support the recruitment of graduate students into the Neuroscience Track of Interdisciplinary Program for Biomedical Sciences by creating and circulating a flyer to 200 different undergraduate biology, psychology, and neuroscience programs nationwide.*** A copy of the flyer can be found in **Appendix 4.** We recently pledged matching funds for another 6 Neuroscience Track students for FY 2011-2012. NI provides a conference room for many activities, including student classes.

2d. In 2010-2011 NI supported matching funds for 10 postdoctoral students, and have committed to 6 postdocs for FY 2011-2012.

Goal 3: Hasten the application of the latest and most promising scientific information to the clinical treatment of neurological diseases (*e.g.*, Parkinson's disease, Alzheimer's disease, stroke, spinal cord injury, neurotrauma, brain tumors, and multiple sclerosis) by integrating educational and research programs.

3a. The Neuroscience Seminar series and Symposia encourage participation by the faculty, and collaborative research activities, especially those between basic scientists and clinical faculty. Several of the research focus areas of the NI are devoted primarily to study of the basic biology of human disease, including the groups for Neurological and Neurodegenerative Disorders, Neuro-oncology, Vision and Retina, and Mental and Addictive Disorders. This aim was addressed by our Neuroscience seminar series (**Appendix 3**) and two annual symposia (**Appendices 3, 4**), which are detailed above.

3b. Research Projects funded by NI. During 2010-2011 the NI and its Executive Committee continued programmatic support of Neuroscience Research on campus. Proposals were solicited and awarded on merit after review by the executive committee and some outside reviewers. Proposals included those for shared equipment as well as research proposals. We allocated $331,380, funding 13 different scientists from 7 different departments.

-**Basic Science**. Of these 11 projects, two were for shared pieces of equipment, one for a video system to analyze gait disorders in preclinical studies of mice and rats with neurodegenerative disorders (to Mark Ledoux, M.D.), and another to record electrical activity simultaneous in several brain regions in awake/behaving animals (to Fuming Zhou, Ph.D.). Additional projects were awarded to the following scientists, listed by departments:

<u>Anatomy and Neurobiology</u>
-Andrea Elberger/Bob Moore "Novel Drug Effects on Traumatic Brain Injury", $30,000
-Detlef Heck "Processing and propagation of synchronous neuronal activity in the neocortex", $2,908
-Tony Reiner "Pilot Studies for Head Traumatic Brain Injury", $50,000

Ophthalmology
-Jena Steinle "Mechanism of Actions of a Novel Beta-Adrenergic Receptor Agonist that Prevents/Reverses Diabetic Retinopathy", $30,000
-Eldon Geisert "Crystallin Network and Neuroprotection", $30,000
-Monica Jablonski "Ocular Toxicity and Pharmacokinetics Studies of a Novel Drug and Nanoparticle Delivery System"$30,000

Neurology
-Mark LeDoux "DigiGait Imaging System for Neuroscience Behavioral Core", $30,000

Pediatrics/LeBonheur
-Kathryn McVicar "Biomarker Discovery in Children with Autism plus Familial Autoimmune History", $25,000
-Massroor Pourcyrous "Detection and Quantification of Brain-Derived Circulating Endothelial Cells (BCECs) in Newborn Infants with Cerebrovascular Injury", $25,000

Pharmacology
-Steve Tavalin "New Pathways Controlling Ionotropic Glutamate Receptors", $20,000
-Fuming Zhou "An Electrophysiological Data Acquisition and Analysis System for Intact Animals", $30,000

Physiology
Ioannis Dragatsis "Generation of a Mouse Model for Spastic Paraplegia 17", $30,000

-**Clinical Research.** Included were the continued funding of two clinical pilot project lines for patient-based research on children **(infant epilepsy biomarkers, and autism biomarkers).** These two clinical projects were matched by COM. Dr. Massroor Poucyrous, M.D., Professor of Pediatrics, finished her second year of funding. Kathyrn McVicar, Assistant Professor of Pediatrics, is in her third year of funding of her project on autism.

-**Neurotrauma Research**. NI is actively supporting traumatic brain injury research, and recently awarded a 1 year development project on Traumatic Brain Injury to NI co-director Dr. Tony Reiner, who is working in collaboration with the Department of Ophthalamology on neuroprotective drugs effecive in concussive injury, and to Andrea Elberger and Bob Moore, who are working with Pharmaceutical Sciences to develop neuroprotective drugs in the cannabinoid family. Both researchers are using an air cannon designed in the Department of Ophthalamology in order to deliver precise concussive head blows, mimicking explosion induced concussions.

-**Postdoctoral Research Awards.** The NI approved matching funds on a competitive basis for 10 postdoctoral fellows or research associates for FY 2010-2011. These awards are $15,000 each. We will fund 6 postdocs in FY 2011-2012 at the same level.

Goal 4: Interact with the faculty of other UT campuses and neighboring undergraduate institutions

Some NI faculty are involved in some large multi-institutional grant programs, involving a number of

universities (listed above). There is considerable collaboration between NI faculty on the UTHSC campus and investigators at St. Jude Children's Research Hospital and at the University of Memphis.

In addition to research collaborations, we continue to sponsor the Neuroscience Seminar Series on the UTHSC campus, which is often attended by faculty and students from other Memphis institutions, and our faculty are involved in workshops and seminars at other institutions and at national meetings. Our Translational Neuroscience Symposia, such as the "**Brain Trauma Symposium: Sports Concussions: The Hidden Risks"** symposium in April of 2011 (**Appendix 4**), bring together clinical and basic research scientists from our various local sites and outside of UTHSC.

NI continues its community interaction with Urban Child Institute with a community forum during Brain Awareness Week at the Urban Child Institute. This program, entitled **"How Pain and Stress in Infancy Shape Our Perceptions and Consciousness"** was directed toward parents, teachers, and other professionals involved in the care and early instruction of children (**Appendix 4**). The program was organized by NI member Dr. Paul Herron, and was hosted by NI Director William E. Armstrong. Two talks were featured, one by Dr. Matt Ennis (Anatomy and Neurobiology at UTHSC), and the keynote by Dr. Sunnay Anand (Lebonheur Children's Hosptial and St. Jude). Data from both animal and human studies presented by these expert speakers revealed that pain sensation develops very early in life, even *in utero*, whereas historically neonates were thought relatively insensitive to pain. Indeed, studies show that newborns actually have a lower threshold for pain, and that exposure during an early, critical period of development can permanently alter their pain perception in the adult by changing the way neural pathways and circuits in the brain are organized.

APPENDIX 1

External Funding of Neuroscience Institute Faculty

FY 2010-2011

P.I.	*Project Name*	*Agency*	*Project Period*	*FY 2011 Total Cost*
Bahouth, S.	PKA targeting: A novel mechanism for GPCR resensitization USPHS HL05848	NIH-HLB	12/1/2010-11/30/2011	$370,000
Boughter, J.	Sensory Coding in Taste USPHS Grant DC-000353-27	NIH/ NIDCD	7/1/2010-6/30/2011	$283,050
Chaum, Edward	Proprietary Study	Private Industry	7/1/2010-6/30/2011	$764,785
Chaum, Edward	Closed-Loop Infusional Anesthesia Biosensor Platform for Casualty Care in the Battlespace	US ARMY MEDICAL RES, MCMR-AAA-VACQUISITION ACTIVITY	7/19/2010-8/18/2011	$277,757
Chaum, Edward	Proprietary Study	Private Industry	6/29/2011-12/31/2013	$31,245
Chaum, Edward	Proprietary Study	Private Industry	6/20/2011-12/31/2012	$900
Chaum, Edward	Proprietary Study	Private Industry	1/18/2011-12/31/2012	$31,780
Chaum, Edward	Automated Screening of Diabetic Retinopathy by Content-1 R01 EY017065-06	NIH - NEI	7/1/2010-6/30/2011	$764,785
Dopico, Alex M.	Ethanol Actions on SLO Channels From Arteries VS Brain-5 R01 AA11560-14	NIH - NI AAA	7/1/2010-6/30/2014	$350,218
Dopico, Alex M.	Vasodilation via selective pharmacological targeting of BK channel beta1subunits-1 R01 HL104631-02	NIH - NHLBI	6/1/2011-5/31/2015	$387,087
Dragatsis, Ioannis	Role of NGF in Familiar Dysautonomia-1 R07 NS061842-04	NIH-NINDS	4/1/2011-3/31/2012	$312,988
Ennis, M.	Computational and experimental analysis of noradrenergic function in early senory processing-R01 DC008702	NIH/NIDCD Cornell Subcontract	07/01/09 06/30/10	$89,803

Ennis, M.	Metabotropic Glutamate Receptors in the Olfactory Bulb USPHS 5R01DC003195-15	NIDCD	7/1/2010-6/30/2011	$134,611
Foehring, Robert C.	Slowly Inactivating K+ Channels in Neoxortical Pyramidal Cells-1 R01 NS044163-08	NIH-NINDS	7/1/2010-6/30/2012	$316,182
Geisert, Eldon E.	Modulators of Retinal Injury-1R01 EY017841-04	NIH-NEI	8/1/2010-7/31/2011	$325,215
Hamre, K.	Gender and genetic effects on sleep:wake parameters following ethanol exposure-1 R21AA017718-01A2	NIH - NI AAA	8/1/2010-7/31/2011	$224,484
Hamre, Kristin M.	INIA: Mouse Resources Core	NIH - NI AAA	2/1/2011-1/31/2012	$67,351
Hamre, Kristin M.	Proprietary Study	Private Industry	9/30/2010-3/31/2011	$9,047
Heck, Detlef H.	Cerebellar Moculation of Frontal Cortical Function-NS063009	NIH-NINDS-U of Memphis	3/1/2011-2/28/2012	$88,038
Heck, Detlef H.	CNCNS: Cerebella Cortico-Nuclear Interactions-NS067201	NIH-NINDS-Emory University	9/1/2010-8/30/2011	$128,230
Heck, Detlef H.	Coordination Of Orofacial And Respiratory Movements USPHS Grant NS-060887-03	NIH/NINDS	3/1/2011-2/28/2012	$317,275
Heldt, Scott A.	The Role of Amygdala GABAergic Transmission in Fear and Anxiety-7 R21 MH086727-03	NIH-NIMH	4/1/2011-3/31/2012	$168,567
Iannaccone, Alessandro	ARRA-Auto-Antibodies as serum biomarkers for age-related macular degeneration-1 R21 EY018416-02	NIH-NEI	8/1/2010-7/31/2011	$185,000
Jablonski, M.	A Novel Drug and Nanoparticle Delivery System for the Treatment of Age-related Macular Degeneration: Toxicity and Pharmacokinetics Studies	UT Research Foundation	1/1/2011-12/31/2011	$15,000

Jablonski, M.	Genetic Modulation of Glaucoma-1 R01 EY021200-01	NIH - NEI	1/1/2011-12/31/2011	$373,750
Jaggar, J.	Calcium channels in arterial smooth muscle cells-1 R01 HL094378-03	NIH - NHLBI	4/1/2011-3/31/2012	$370,000
Jaggar, J.	Calcium signaling in cerebral arteries-1 R01 HL067061-09	NIH - NHLBI	4/1/2011-3/31/2012	$409,388
Johnson, D.	ARRA-Cell Type-Specific Roles of RB in Retinal Differentiation-EY014867	St. Jude	9/1/2010-8/30/2011	$150,523
Kita, H.	Synaptic Transmissions in the Basal Ganglia-1 R01 NS057236-04	NIH-NINDS	4/1/2011-3/31/2012	$250,390
Kita, H.	Rhythmicity and Synchrony in the Basal Ganglia-1 R01 NS047085	NIH-NINDS	8/1/2010-7/31/2011	$210,149
LeDoux, Mark S.	Cooperative Huntington's Observational Research Trial (COHORT)	University of Rochester	11/9/2010-6/30/2011	$5,625
LeDoux, Mark S.	The Role of THAP1 in Dystonia-1 R01 NS069936-01A1	NIH-NINDS	8/20/2010-7/31/2014	$323,750
Leffler, Charles W.	Control of Neonatal Circulation-R01 HL034059-27	NIH - NHLBI	4/1/2011-3/31/2012	$381,100
Leffler, Charles W.	Hydrogen Sulfide in Newborn Cerebral Circulation9/14/2011302 R01 HL042851-21	NIH - NHLBI	8/1/2010-7/31/2015	$246,510
Liao, Francesca-Fang	PTEN, Cell Cycle and Neurofibrillary Degemeration-5 R01 AG031893-04	NIH-NIA	4/1/2011-3/31/2013	$270,329
Malik, K.	Angiotensins, Prostaglandins-Adrenergic Interactions USPUS HL01934-36	NIH-HLBI	4/1/2011-3/31/2013	$520,927
McDonald, M.	Chronic Sialidase Effects on Amyloid Aggregation and Associated Pathology USPHS AG031253-03	NIH-NIA	9/1/2010-8/31/2011	$460,676

McDonald, M.	Gd3s Knockdown to Improve Cognitive And Motor Deficits In Models Of Parkinsonism USPHS Grant NS065063-03	NIH-NINDS	2/1/2011-1/31/2014	$317,275
Miller, D.	Treatment with KZ-41 and OTP promotes wound healing in a radiation combined injury USPHS AI080534-03	NIH-NIAID	9/22/2010-8/31/2013	$386,400
Nelson, R.	Modulation of Primate Somatosensory Cortical Responses USPHS NS036860-14	NIH-NINDS	4/1/2011-3/31/2012	$281,689
O'Connell, K.	Cell Biology of Cardiac Kv Channels USPHS HL087591-05	NIH-HLBI	2/1/2011-1/31/2012	$246,510
Parfenova, H.	Heme oxygenase and cerebral vascular injury USPHS HL099655-07	NIH-HLBI	6/1/2011-5/31/2014	$370,000
Parfenova, H.	Cerebrovascular Stress and Circulating Endothelial Cells USPHS NS063936-02	NIH-NINDS	2/1/2011-1/31/2015	$317,275
Pfeiffer, R.	Northwestern Subcontract	Subcontract	5/1/2011-11/29/2011	$7,494
Reiner, A.	Neural Control of Choroidal Blood Flow USPHS Grant EY-005298-24	NIH-NEI	4/1/2011-3/31/2015	$373,750
Reiner, A.	Organization of The Cortical Projection to the Basal Ganglia USPHS Grant NS-057722-04	NIH-NINDS	3/1/2011-2/28/2013	$312,988
Reiner, A.	Proprietary Study	Private sponsor	3/15/2011-3/14/2012	$80,777
Reiter, L.	Proteomics in Drosophila to Identify Autism Candidate Substrates of Ube3a USPHS NS059902-03	NIH-NINDS	12/1/2010-8/31/2012	$316,355
Reiter, L.	Proteomics in Drosophila to Identify Autism Candidate Substrates of Ube3a USPHS NS059902-04S1	NIH-NINDS	9/1/2010-8/31/2012	$29,600

Rex, T.	RPB Career Development Award	Research to Prevent Blindness	12/1/2010-11/30/2014	$50,000
Rex, T.	Treatment of traumatic vision loss in new mouse model of blast injury-W81XWH-10-1-0528	US ARMY MEDICAL RES, MCMR-AAA-VACQUISITION ACTIVITY	9/1/2010-8/31/2013	$246,283
Sharp, B.	ARRA CHALLENGE 2-Neuron-Specific Candidate Gene Expression and Adolescent Vulnerability to Smoking-1RC 2DA028962-02	NIH-NIDA	9/1/2010-8/31/2011	$1,104,333
Steinle, J.	Beta-Andrenergic Receptor Agonists Inhibit Diabetic Retinopathy	International Retinal Research Foundation	10/1/2010-9/30/2011	$62,000
Steinle, J.	Topical Therapy for Diabetic Retinopathy	Oxnard Foundation	1/1/2011-12/31/2013	$165,000
Steketee, J.	Cortical Mechanisms of Cocaine Sensitization USPHS DA023215-04	NIH-NIDA	6/1/2011-5/31/2013	$284,249
Tavalin, S.	Mechanisms fo CaM Kinase II Signal Transduction-MH0063232	Vanderbilt University	2/1/201-1/31/2012	$19,856
Wheless, J.	Children with CAE Subcontract	NIH	11/01/05 07/31/10	$50,916
Williams, R.	Systems Genetics of the HPA-1 U01 AA017590-04	NIH - NI AAA	7/1/2010-6/30/2012	$229,538
Williams, R.	INIA: Robust Systems Genetric of Alcohol and Stress Effects on CNS-5 U01 AA13499-10	NIH - NI AAA	2/1/2011-1/31/2012	$339,071
Zhou, F.M.	Regulation of Basal Ganglia Output Neurons USPHS NS058850-03	NIH-NINDS	09/01/08 08/31/13	$185,625
Zhou, F.M.	Non-Transporter Cocaine Mechanisms in Dopamine System DA021194-03	NIH-NIDA	09/01/07 06/30/11	$196,000
Total				**$15,589,499**

APPENDIX 2

Faculty Publications and Society for Neuroscience Presentations

FY 2010-2011

1) Peer-reviewed publications for 2010-2011 (cited in PubMed):

Adebiyi, A., Narayanan, D., & **Jaggar, J. H.** (2011). Caveolin-1 assembles type 1 inositol 1,4,5-trisphosphate receptors and canonical transient receptor potential 3 channels into a functional signaling complex in arterial smooth muscle cells. [Research Support, N.I.H., Extramural]. *The Journal Of Biological Chemistry, 286*(6), 4341-4348.

Ahn, S., Duke, C. B., 3rd, Barrett, C. M., Hwang, D. J., Li, C. M., **Miller, D. D.**, & Dalton, J. T. (2010). I-387, a novel antimitotic indole, displays a potent in vitro and in vivo antitumor activity with less neurotoxicity. *Molecular Cancer Therapeutics, 9*(11), 2859-2868.

Ahn, S., Hwang, D. J., Barrett, C. M., Yang, J., Duke, C. B., 3rd, **Miller, D. D.**, & Dalton, J. T. (2011). A novel bis-indole destabilizes microtubules and displays potent in vitro and in vivo antitumor activity in prostate cancer. *Cancer Chemotherapy and Pharmacology, 67*(2), 293-304.

Ahn, S., Kearbey, J. D., Li, C. M., Duke, C. B., 3rd, **Miller, D. D.**, & Dalton, J. T. (2011). Biotransformation of a novel antimitotic agent, I-387, by mouse, rat, dog, monkey, and human liver microsomes and in vivo pharmacokinetics in mice. *Drug Metabolism and Disposition. 39*(4), 636-643.

Alberts, R., **Lu, L.**, **Williams, R. W.**, & Schughart, K. (2011). Genome-wide analysis of the mouse lung transcriptome reveals novel molecular gene interaction networks and cell-specific expression signatures. *Respiratory Research, 12*, 61.

Allensworth, M., Saha, A., **Reiter, L. T.**, & **Heck, D. H.** (2011). Normal social seeking behavior, hypoactivity and reduced exploratory range in a mouse model of Angelman syndrome. *BMC genetics, 12*, 7.

Anand, K. J., Eubanks, J. W., 3rd, Kelly, D. M., Meier, J. W., Saltzman, J. A., Crisler, S. C., Kraus, G. J., Spentzas, T., & Chesney, R. W. (2010). *Clinical pediatrics, 49*(12), 1147-1152.

Andero, R., **Heldt, S. A.**, Ye, K., Liu, X., Armario, A., & Ressler, K. J. (2011). Effect of 7,8-dihydroxyflavone, a small-molecule TrkB agonist, on emotional learning. *American Journal of Psychiatry, 168*(2), 163-172.

Aquilina, K., & **Boop, F. A.** (2011). Nonneoplastic enlargement of the pituitary gland in children. [Case Reports]. *Journal of Neurosurgery. Pediatrics, 7*(5), 510-515.

Ariga, T., Yanagisawa, M., Wakade, C., Ando, S., Buccafusco, J. J., **McDonald, M. P.**, & Yu, R. K. (2010). Ganglioside metabolism in a transgenic mouse model of Alzheimer's disease: expression of Chol-1alpha antigens in the brain. *ASN Neuro, 2*(4).

Armstrong, W. E., Wang, L., Li, C., & Teruyama, R. (2010). Performance, properties and plasticity of identified oxytocin and vasopressin neurones in vitro. *Journal of Neuroendocrinology, 22*(5), 330-342.

Baek, R. C., Broekman, M. L., Leroy, S. G., Tierney, L. A., Sandberg, M. A., **D'Azzo, A.**, Seyfried, T. N., & Sena-Esteves, M. (2010). AAV-mediated gene delivery in adult GM1-gangliosidosis mice corrects lysosomal storage in CNS and improves survival. *PloS One, 5*(10), 1-16.

Bannister, J. P., Thomas-Gatewood, C. M., Neeb, Z. P., Adebiyi, A., Cheng, X., & **Jaggar, J. H.** (2011). Ca(V)1.2 channel N-terminal splice variants modulate functional surface expression in resistance size artery smooth muscle cells. *The Journal of Biological Chemistry, 286*(17), 15058-15066.

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Basuroy, S., Tcheranova, D., **Bhattacharya, S.**, **Leffler, C. W.**, & **Parfenova, H.** (2011). Nox4 NADPH oxidase-derived reactive oxygen species, via endogenous carbon monoxide, promote survival of brain endothelial cells during TNF-alpha-induced apoptosis. *Journal of Physiology, 300*(2), C256-265.

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McKinnon, P. J., Chen, J., Epe, B., Smerdon, S. J., Taucher-Scholz, G., & Lavin, M. F. (2010). CK2 phosphorylation-dependent interaction between aprataxin and MDC1 in the DNA damage response. [Research Support, Non-U.S. Gov't]. *Nucleic acids research, 38*(5), 1489-1503.

Bhattacharya, S., Ray, R. M., **Chaum, E.**, **Johnson, D. A.**, & Johnson, L. R. (2011). Inhibition of Mdm2 sensitizes human retinal pigment epithelial cells to apoptosis. *Investigative Ophthalmology & Visual Science, 52*(6), 3368-3380.

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Brager, A. J., Ruby, C. L., **Prosser, R. A.**, & Glass, J. D. (2010). Chronic ethanol disrupts circadian photic entrainment and daily locomotor activity in the mouse. *Alcoholism, Clinical and Experimental Research, 34*(7), 1266-1273.

Brager, A. J., Ruby, C. L., **Prosser, R. A.**, & Glass, J. D. (2011). Acute ethanol disrupts photic and serotonergic circadian clock phase-resetting in the mouse. *Alcoholism, clinical and experimental research, 35*(8), 1467-1474.

Brennan, R. C., Federico, S., Bradley, C., Zhang, J., Flores-Otero, J., Wilson, M., Stewart, C., Zhu, F., Guy, K., & **Dyer, M. A.** (2011). Targeting the p53 pathway in retinoblastoma with subconjunctival Nutlin-3a. *Cancer Research, 71*(12), 4205-4213.

Broadway, S. J., **Ogg, R. J.**, Scoggins, M. A., Sanford, R., Patay, Z., & **Boop, F. A.** (2011). Surgical management of tumors producing the thalamopeduncular syndrome of childhood. *Journal of Neurosurgery. Pediatrics, 7*(6), 589-595.

Brooks, I. M., & **Tavalin, S. J.** (2011). Ca2+/calmodulin-dependent protein kinase II inhibitors disrupt AKAP79-dependent PKC signaling to GluA1 AMPA receptors. *Journal of Biological Chemistry, 286*(8), 6697-6706.

Bryant, J. L., **Boughter, J. D.**, Gong, S., **LeDoux, M. S.**, & **Heck, D. H.** (2010). Cerebellar cortical output encodes temporal aspects of rhythmic licking movements and is necessary for normal licking frequency. *The European Journal of Neuroscience, 32*(1), 41-52.

Buharalioglu, C. K., Song, C. Y., Yaghini, F. A., Ghafoor, H. U., Motiwala, M., Adris, T., Estes, A. M., **& Malik, K. U.** (2011). Angiotensin II-induced Process of Angiogenesis is Mediated by Spleen Tyrosine Kinase via VEGF Receptor-1 Phosphorylation. *American Journal of Physiology. Heart and circulatory Physiology. 301*(3):H1043-55.

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Butler, A. B., **Reiner, A.**, & Karten, H. J. (2011). Evolution of the amniote pallium and the origins of mammalian neocortex. [Review]. *Annals of the New York Academy of Sciences, 1225*, 14-27.

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Caudle, K. E., Barker, K. S., Wiederhold, N. P., Xu, L., **Homayouni, R.**, & Rogers, P. D. (2011). Genomewide expression profile analysis of the Candida glabrata Pdr1 regulon. *Eukaryotic Cell, 10*(3), 373-383.

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APPENDIX 3

Neuroscience Seminar Speakers

FY 2010-2011

THE NEUROSCIENCE INSTITUTE
UNIVERSITY OF TENNESSEE HEALTH SCIENCE CENTER

NEUROSCIENCE SEMINAR SERIES
SCHEDULE

FALL 2010

Jeffery D. Steketee, Ph.D. September 14, 2010
Professor
Department of Pharmacology
UTHSC

Title: Repeated Cocaine and the Medial Prefrontal Cortex

Mark S. LeDoux, M.D., Ph.D. September 21, 2010
Professor
Department of Neurology
Director, Dystonia and Huntington Disease Clinics
UTHSC

Title: Genetics of Primary Dystonia: Interactions in Time and Space

Ben Philpot, Ph.D. September 28, 2010
Host: Larry Reiter
Associate Professor
Department of Cell and Molecular Physiology
University of North Carolina Chapel Hill

Title: A New Angle on Angelman Syndrome

Maria Grant, Ph.D. October 5, 2010
Host: Jena Steinle
Professor
Department of Pharmacology
University of Florida, Gainesville

Title: Circadian Dysregulation of Diabetic Endothelial Progenitor Cells: Is it Time to Repair?

Frank LaFerla, Ph.D. October 12, 2010
Host: Mike McDonald
Chancellor's Professor
Neurobiology & Behavior
School of Biological Sciences
University of California, Irvine

Title: "Treating Alzheimer's Disease with Stem Cells"

Timothy E. Holy, Ph.D. October 19, 2010
Host: Matt Ennis
Associate Professor
Department of Anatomy & Neurobiology
University of Washington in St. Louis

Title: "The Prying Nose: Olfaction to Hormones, and Back"

David L. Hill, Ph.D. October 26, 2010
Host: John Boughter
Professor
Department of Psychology
University of Virginia

Title: "Plasticity in the Gustatory Brainstem During Development"

Hansruedi Büeler, Ph.D. November 2, 2010
Host: Francesca-Fang Liao
Associate Professor
Department of Anatomy & Neurobiology
University of Kentucky

Title: "Molecular Mechanisms and Gene Therapy of Parkinson's Disease"

Robert E.W. Fyffe, Ph.D. November 30, 2010
Host: Robert Foehring
Professor of Neuroscience, Cell Biology and Physiology
Associate Dean for Research Affairs
Wright State University

Title: "Synapse Specific Channel Clustering in Spinal Motoneurons"

Martin Deschênes, Ph.D. December 7, 2010
Host: Detlef Heck
Professor
Integrative Neuroscience Research Axis
Centre de Recherche

Université Laval Robert-Giffard
Québec, Canada

Title: "The Whisking CPG: In Search of Inspiration"

Lucas Pozzo-Miller, Ph.D. December 14, 2010
Host: Fu-Ming Zhou
Professor
Department of Neurobiology
University of Alabama at Birmingham

Title: "BDNF Actions on Both Sides of Synapses: TRPC Channels, MeCP2 and the Cellular Neuropathology of Rett Syndrome"

NEUROSCIENCE SEMINAR SERIES
SCHEDULE

FALL 2011

Andrew C. Liu, Ph.D. February 1, 2011
Assistant Professor
Department of Biological Sciences
University of Memphis

Title: "Functional Genomics Approaches Towards the Understanding of the Mouse Circadian Clock Network"

Charles A. Weaver, Ph.D. February 8, 2011
Host: Danielle Helton
Professor
Department of Psychology and Neuroscience
Baylor University

Title: "Flashbulb Memory: Remembering, Forgetting, and Distorting Our Memories of Extraordinary Events"

Hitoshi Kita, Ph.D. February 15, 2011
Professor
Department of Anatomy & Neurobiology
UTHSC

Title: "Dopamine Depletion Alters Activity of Basal Ganglia Neurons"

Michelle Gray, Ph.D. February 22, 2011
Host: Tony Reiner
Assistant Professor
Department of Neurology
University of Alabama Birmingham

Title: "Exploring the Contribution of Astrocytes to Huntington's Disease Pathogenesis"

Charles R. Gerfen, Ph.D. March 1, 2011
Host: Fu-Ming Zhou
Senior Investigator
Laboratory System Neuroscience
NIMH

Title: "Cre Driver Lines to Study Basal Ganglia Circuits"

Dax Hoffman, Ph.D. March 8, 2011
Host: Robert Foehring
Molecular Neurophysiology and Biophysics Unit
NICHD

Title: "Voltage Gated Channel Regulation of Dendritic Integration and Plasticity"

Aaron B. Bowman, Ph.D. March 22, 2011
Host: Larry Reiter
Assistant Professor
Department of Neurology
Vanderbilt University Medical Center

Title: "Gene-Environment Interactions in Neurodegenerative Disease"

Brett Jennings, Ph.D. March 29, 2011
Postdoctoral Trainee
Department of Pharmacology
UTHSC

Title: Neuro-humoral Mechanisms of Hypertension and Associated Pathophysiology: Contribution of Cytochrome P450 1B1

Grazyna Adamus, Ph.D. April 5, 2011
Host: Alessandro Iannaccone
Professor
Ocular Immunology Lab
Casey Eye Institute
Oregon Health & Science University

Title: "Advances in the Immunology of Retinal Degeneration"

Cynthia J.M. Kane, Ph.D. April 12, 2011
Host: Kristin Hamre
Professor
Department of Neurobiology and Developmental Sciences
University of Arkansas for Medical Sciences

Title: "Neuroimmune Targets of Ethanol: Signaling Between Microglia and Neurons"

Xian-Jie Yang, Ph.D. April 19, 2011
Host: Monica Jablonski
Professor
Department of Ophthalmology
Director
Developmental Neurobiology Laboratory
Jules Stein Eye Institute
University of California, Los Angeles

Title: "Regulation of retinal network formation by cell-extrinsic signals"

Thomas N. Seyfried, Ph.D. April 26, 2011
Host: Mike McDonald
Professor
Department of Biology
Boston College

Title: "Ganglioside Storage Disease: On the Road to Management"

George L. Gerstein, Ph.D. May 3, 2011
Host: Detlef Heck
Emeritus Professor
Department of Neuroscience
The Mahoney Institute of Neurological Sciences
University of Pennsylvania

Title: "The Hunting of the Synfire Chain"

J. Paul Taylor, M.D., Ph.D. May 10, 2011
Associate Member
Department of Developmental Neurobiology
St. Jude Children's Research Hospital

Title: " VCP: The Rosetta Stone of Age-related Degeneration"

TRANSLATIONAL NEUROSCIENCE SYMPOSIUM
April 28, 2011
"Brain Trauma: Sports Concussions: The Hidden Risks "

Christopher Nowinski
CEO and Founder, Sports Legacy Institute
Co-Director, Center for the Study of Traumatic Encephalopathy
Boston University School of Medicine

Title: "Solving the Sports Concussion Crisis"

Dr. Robert Stern, Ph.D.
Professor and Director, Alzheimer's Disease Clinical & Research Program
Co-Director, Center for the Study of Traumatic Encephalopathy
Boston University

Title: **"**Chronic Traumatic Encephalopathy: The Long Term Effects of Repetitive Brain Trauma**"**

APPENDIX 4

Neuroscience News, Events and Graduate Training Flyer

FY 2010-2011

The Neuroscience Institute
University of Tennessee Health Science Center
Presents

Brain Trauma Symposium

Sports Concussions: The Hidden Risks

Thursday April 28th, 2011

University of Memphis Student Center Ballroom
7:30-9:30 PM

Speakers:

Chris Nowinski, Sports Legacy Institute
"Solving the Sports Concussion Crisis"

Dr. Robert Stern, Boston University
"Chronic Traumatic Encephalopathy: The Long Term Effects of Repetitive Brain Trauma"

For Free Required Registration go to
http://www.uthsc.edu/neuroscience/symposium.php

THE NEUROSCIENCE INSTITUTE
UNIVERSITY OF TENNESSEE HEALTH SCIENCE CENTER

THE URBAN CHILD INSTITUTE™

Brain Awareness Night

"How Pain and Stress in Infancy Shape Our Perceptions and Consciousness"

March 24, 2011
A Presentation for the General Public

The Urban Child Institute — **600 Jefferson Avenue**
5:30-6:30pm Refreshments — **6:30-8:30pm Presentations**

SPEAKERS

Dr. Matthew Ennis, Ph.D

Simon R. Bruesch Professor and Chair, Department of Anatomy and Neurobiology
University of Tennessee Health Science Center

"Adult perception of pain is shaped by early infant experiences"

The developing brain has a small window of time when the capacity to perceive pain is set. This "critical" period occurs when neurons in the brain are establishing and refining the connections that sense and feel pain. This talk will discuss how brief but intense pain during this narrow neonatal period can permanently affect pain perception in the adult.

Dr. J.S. Anand, MMBS, D.Phil., FAAP, FCCM FRCPCH

Professor of Pediatrics, Anesthesiology & Neurobiology, University of Tennessee Health Science Center, Division Chief, Pediatric Critical Care Medicine, Le Bonheur Children's Hospital, St.Jude Chair for Critical Care Medicine

"Consciousness, Pain & Stress in Early Life: How it shapes who we are and what we become"

Pain is perhaps the earliest sensation to develop and appears to be inextricably linked with human consciousness - the sense of who we are. This lecture proposes a bond between pain and consciousness, looking at it from the vantage point of early development.

Professional training hours (CEUs) will be provided by the UT Neuroscience Institute. For more information, Contact D. Paul Herron, Neuroscience Institute (901-448-5824) Space is limited.

Please pre-register with Ms. Stephanie Cook, The Urban Child Institute (901-385-4221); scook@theurbanchildinstitute.org Attendance is free.

THE COMMERCIAL APPEAL
Memphis, Tennessee
Printer-friendly story
Read more at commercialappeal.com

Early experience of pain has lasting effects

Lessened pain sensitivity, lack of coping strategies and poor cognitive development are some of the consequences researchers are studying.

By K.J.S. Anand and Matthew Ennis, Special to Viewpoint

Saturday, March 12, 2011

About 9,000 newborn infants are receiving intensive care in the U.S. today, and many will be exposed to medical procedures that cause pain, such as needle sticks and circumcisions. Babies often receive less pain-relieving medicine before invasive procedures or after surgery than adults do. An inflammatory response lasting from hours to days will follow, leading to increased pain sensitivity around the damaged tissue. In the past, this also went untreated, primarily due to the mistaken belief that "babies don't perceive or remember painful experiences."

Medical researchers and the general public are keenly interested in the effects of early pain experiences on brain development and whether such experiences affect pain perception and behavior in adulthood.

Cutting-edge research by University of Tennessee Health Science Center neuroscientists on the consequences of neonatal pain will be the topic of a public symposium at on March 24.

Among the topics we will discuss at the symposium is the earliest perception of pain and consciousness in human infants. Research demonstrates that human infants perceive pain, as determined by physiological and behavioral responses, at their earliest developmental stages, even before birth.

A critically important question is: What are the lasting consequences of the early experience of pain? Emerging evidence indicates that neonatal pain can have profound and perhaps permanent effects on development. For example, premature babies receiving painful clinical procedures during intensive care later exhibited a lower reaction to pain. In fact, there was a strong correlation between the number of painful procedures and the resulting reduction in pain sensitivity.

At the March 24 event we will discuss animal research that shows that experience of pain during an early stage of development known as the "sensitive or critical period"

permanently alters pain perception in the adult in a manner remarkably similar to that in humans. These studies further show that pain during the critical period permanently changes the way neural pathways and circuits in the brain are organized.

Such studies have only scratched the surface as the human brain is bewilderingly complex, with 100 billion cells, each with 7,000 to 10,000 connections. Further research using modern techniques to map and visualize neurons and their connections will be needed to reveal all the effects of neonatal pain on the brain and behavior.

Taken together, converging human and animal studies demonstrate that painful experiences in early life may leave a legacy of altered sensitivity to subsequent pain. One of the consequences that has been observed is a lowered sensitivity to pain in later life. Intuitively, one might think this is beneficial. However, this may not be the case because pain serves to warn and protect a person against further injury. In addition to changes in pain perception, lack of coping strategies, psychosocial problems and poor cognitive development continue to plague these children throughout their childhood, often leading to abnormal behaviors in adult life.

A major question in clinical studies and in the treatment of infants is whether such changes require conscious sensory perception of pain in the neonate. The symposium will include a discussion of clinical work that indicates that pain and consciousness may be inextricably linked. During anesthesia, pain is the last sensation lost before we become unconscious. On regaining consciousness, pain is the first sensation that we become aware of, much before sight, sound or smell are regained. If pain and consciousness occur so closely together, could they be linked and possibly converge in common brain areas? These intriguing questions will be explored in the symposium.

Findings from laboratory and clinical studies highlight the fact that early painful experiences will be "remembered" by the developing brain, perhaps for the entire life of the individual. This work has also led to increased awareness by pediatricians, health care providers and the public that newborns are sensitive to pain at the earliest stages of development. Within the medical arena, these discoveries will stimulate the development of better anesthetic approaches for fetal surgery, ways of preventing pain in premature babies or easing the pain of immunization in infants.

K.J.S. Anand is division chief of Pediatric Critical Care Medicine at Le Bonheur Children's Hospital. Matthew Ennis is chairman of the Department of Anatomy and Neurobiology at the University of Tennessee Health Science Center.

The symposium featuring Dr. Anand and Dr. Ennis will begin at 6:30 p.m. on March 24 at The Urban Child Institute at 600 Jefferson. A reception will be held from 5:30 p.m. to 6:30 p.m.; RSVP to scook@tuci.org.

This is one in a series of monthly guest columns on the importance of public/private investment in early childhood. For more information, call The Urban Child Institute at

385-4233 or visit theurbanchildinstitute.org.

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Guest Column: Risks of sports concussions are deadly

With better awareness and management of head injuries, safer equipment and rule changes to reduce head contact, athletes, especially young ones, can be protected.

By Anton J. Reiner and William E. Armstrong, Special to Viewpoint

Friday, April 15, 2011

The concussion that University of Memphis starting quarterback Cannon Smith suffered in the Tigers' third game last fall is perhaps the most well-known recent concussion in Memphis sports. But it is far from the only one.

Based on nationwide figures from the Centers for Disease Control, about 500 children between the ages of 5 and 18 suffer sports-related concussions that lead to emergency room visits in Shelby County annually. Nationally, 5 percent of high school and college athletes who play high-contact sports such as football and hockey suffer concussions each season.

While the vast majority of athletes recover with time, repeated concussions, and even repeated blows to the head that do not result in concussions, can have disastrous consequences. The suicide this year of Dave Duerson sent a shock wave through the NFL, and raised awareness about the seriousness of sports-related head trauma.

Duerson, 50, was a popular four-time Pro Bowl safety and a key member of the Super Bowl champion 1986 Chicago Bears and 1991 New York Giants. Before his retirement in 1993, he was known for his hard-hitting play.

As a member of the panel that reviews retired players' claims under the NFL disability plan, Duerson would have become aware that repeated blows to the head over time cause a degenerative condition of the brain called chronic traumatic encephalopathy (CTE), which results in depression and dementia. He would have learned that CTE, first identified in former boxers, is now known to also be common in retired football and hockey players, based on postmortem brain analysis.

Duerson, who had expressed his concern to a close friend that he might have CTE, sent a text message shortly before he shot himself to death in February, asking that his brain be donated to the NFL brain bank for medical study.

In addition to memory loss and dementia, CTE can also cause extreme personality changes, and the dangers are not limited to retired professional athletes.

Owen Thomas, a 21-year-old lineman for the University of Pennsylvania football team, committed suicide in April 2010 after a sudden slide into depression; he was later found to have CTE. He had no known concussions, and his CTE is thought to have stemmed from either unrecognized concussions, or a cumulative effect of sub-concussive head blows during his years playing football.

A chronic neurodegenerative condition such as CTE, however, is not the only danger associated with repeated head injury. Mismanagement of concussions can also result in rapid, dire outcomes. In one 2006 incident, Zack Lystedt, a 13-year-old junior high school football player in Maple Valley, Wash., returned to a game after a concussion, only to experience a second one, leading to brain bleeding and swelling. He survived thanks to prompt medical care, but it was nearly three years before he could stand.

In the aftermath of the Lystedt case, the state of Washington passed a law requiring that any youth athlete showing concussion symptoms be allowed to return to play only after medical clearance. Nine other states have passed similar laws and 19 additional states, including Tennessee, are considering doing so.

The proposed Tennessee law would also require coaches to complete a concussion management course, and require student athletes, their parents and/or guardians to acknowledge receipt of local educational policies concerning concussion management. In July 2010, the Tennessee Secondary School Athletic Association Board of Control unanimously approved a rule to this effect.

TSSAA executive director Bernard Childress specifically noted that four high school football players had died the prior year in North Carolina of a second concussion shortly after the first, and he did not want to see this happen in Tennessee.

On April 28, the Neuroscience Institute of the University of Tennessee Health Science Center will sponsor a symposium on "Sports Concussions: The Hidden Risks" at 7:30 p.m. at the University of Memphis University Center Ballroom. The speakers will be Chris Nowinski of the Sports Legacy Institute affiliated with Boston University, and Dr. Robert Stern of the Boston University Center for the Study of Traumatic Encephalopathy.

Nowinski is a former Harvard football player and WWE wrestler who suffered a life-altering concussion in 2003 during his wrestling days. His symposium comments will focus on how football can be played more safely, while still remaining a physical and exciting game.

Stern is a leader of the research team that has identified CTE in deceased football players, and will study the brain of Dave Duerson.

Protecting athletes, particularly young ones, against head injury is important. Better awareness and management of head injuries is part of the solution, as are rule changes to reduce head contact. Improved equipment safety, such as the better helmet safety standards currently being considered by the U.S. Congress, would also help.

Torn knee ligaments and damaged shoulder joints can be repaired surgically, but brain damage is permanent.

Anton J. Reiner, Ph.D., is a professor of anatomy and neurobiology at the University of Tennessee Health Science Center. William E. Armstrong, Ph.D., is director of the Neuroscience Institute at UTHSC.

For more information about the April 28 symposium and sports-related brain injury, e-mail Brandy Fleming of the UTHSC Neuroscience Institute at bmfleming@uthsc.edu, call 448-5960 or visit uthsc.edu/neuroscience/symposium.php.

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Letter: Catching up on concussion risks

Staff Reports

Sunday, May 22, 2011

Your May 15 article on the courageous efforts of Justin Greenwood to recover from and cope with the effects of a debilitating football brain injury highlight the dangers of even a mild concussion suffered shortly after a first. In recognition of this danger, the Tennessee legislature is considering a law requiring that any youth athlete showing concussion symptoms be held from play until medical clearance.

Many other states have passed or are considering similar laws. In July 2010, the Tennessee Secondary School Athletic Association Board of Control unanimously approved a rule to this effect. The proposed Tennessee law would also require coaches to complete a concussion management course and require student athletes, their parents and/or guardians to acknowledge receipt of local educational policies concerning concussion management. The hope is that measures will prevent others from experiencing the life-altering and sometimes even fatal effects of a second concussion shortly after a first.

To raise public awareness of this concern, The Neuroscience Institute of the University of Tennessee Health Science Center held a symposium on April 28 titled "Sports Concussions: The Hidden Risks." It highlighted the dangers of multiple concussions for brain health and less well-known dangers associated with repeated sub-concussive blows to the head, which have led to dementia in boxers and are known to have been the cause of memory loss and personality disorders in many former football and hockey players.

Dr. Anton Reiner Dr. William Armstrong

Neuroscience Institute, The University of Tennessee Health Science Center Memphis

Neuroscience Institute Hosts Symposiums in Spring

The Neuroscience Institute hosted two major events in the spring: the Brain Awareness Symposium and the Brain Trauma Symposium. Both events brought leaders in the neuroscience field to the area to discuss current findings and issues.

Matthew Ennis, PhD, chairman, Department of Anatomy and Neurobiology, and K.J.S. Anand, MMBS, PhD, division chief, Critical Care Medicine at Le Bonheur Children's Hospital and St. Jude Children's Research Hospital, spoke on the topic of "How Pain and Stress In Infancy Shape Our Perceptions and Consciousness" at the annual Brain Awareness Symposium held at the Urban Child Institute on March 24. They presented data from both animal and human studies, which show that pain sensations develop very early in life. Furthermore, studies show that newborns have relatively low thresholds for pain and that experiences during development alter their perceptions of pain. The event was open to the public and attended by a number of people working with children in Memphis as well as UTHSC faculty, students and staff.

Drs. K. J. S. "Sunny" Anand (left), Paul Herron (middle), and Matthew Ennis (right), discuss perceptions of pain in infancy at the Brain Awareness Symposium.

Moderator William Armstrong, PhD, director of the Neuroscience Institute, stated that Dr. Ennis and Dr. Anand "presented compelling data that will lead to better pain management for surgery in premature and early neonates, as well as for other potentially painful procedures such as immunizations."

While the Brain Awareness Symposium concerned the neuroscience of pain management in babies, the Brain Trauma Symposium: Hidden Risks of Sports Concussions, focused on traumatic brain injury in athletes. Chris Nowinski, president of the Sports Legacy Institute in Boston, former Harvard football player and WWE wrestler, along with Robert Stern, PhD, director, Clinical Core, Boston University (BU) Alzheimer's Disease Center and co-director, Center for the Study of Traumatic Encephalopathy at BU, addressed the treatment and prevention of brain injuries associated with sports concussions. Concussions, and even sub-concussive events when repeated, can lead to memory loss, depression, and neurodegenerative conditions later in life. Many regional athletic trainers, athletes and coaches, as well as UTHSC faculty, students and staff, attended this event, held at the University of Memphis on April 28. Tony Reiner, PhD, co-director of the Neuroscience Institute, moderated the symposium.

From left to right: Dr. William Armstrong, Christopher Nowinski, Dr. Robert Stern, and Dr. Tony Reiner speak at the Brain Trauma Symposium on traumatic head injuries in athletes.

Both events were featured in The Commercial Appeal and in coverage on local television news programs.

Fighting Rising Waters: UTHSC Gives Back

The floods of 2011 were a trying time for the city of Memphis. Waters had not risen with such intensity since the Great Flood of 1927. Trees were down, power was out, and homes were heavily flooded. However, that did not stop the city of Memphis or the people of the University of Tennessee Health Science Center from banding together and pitching in to help with relief efforts.

One major task given was to place sandbags among historical landmarks such as the Pyramid in Downtown Memphis.

"It was a pleasant environment and I was able to meet people from various walks of life who had the same intentions -- bettering and helping the community." said Valvarie Jordan, employment recruiter for UTHSC and participant in the relief efforts, who felt great about pitching in and representing the Health Science Center. "A lot of team work took place. Everyone helped each other without being told what needed to be done."

For those who had been victims of the flooding, the UTHSC Department of Psychiatry offered free counseling sessions for children and adults. The goal of the counseling was to help victims cope with the stress from a disaster as well as depression in order to rebuild their lives.

The university opened the doors of the Goodman Family Residence Hall for faculty, staff, and students diplaced by the floods. The 150-bed housing facility offered victims a suite in the residence hall complete with four bedrooms, two baths, a living room area and a small kitchen.

Employment recruiter Valvarie Jordan joins in the sandbagging efforts on the Mississippi River after the May 2011 floods.