



Graduate Brochure

School of Graduate Studies

Interdisciplinary Neuroscience Graduate Program

Offering PhD and MD/PhD degrees

The Interdisciplinary Neuroscience Graduate Program is based at the LSU Neuroscience Center of Excellence, a multi-disciplinary center. The Neuroscience Center fosters inter-actions and collaborations among neuroscientists and has created a rich and stimulating environment for graduate education. In addition to pre-doctoral training, post-doctoral training is also available.

The program offers pre-doctoral research training in fundamental neurosciences. The program leads to a Ph.D. in neuroscience and is offered by faculty members from twelve departments of the Health Sciences Center and the University of New Orleans. The breadth of research programs of the faculty encompasses all major areas of human cellular and molecular neurosciences, including the neurobiology of disease. Training is designed to provide students a broad, general knowledge of neuroscience along with more intensive training in a highly specialized topic for academic and/or industrial research or teaching positions. Specific faculty research interests are listed at the beginning of the next column.

Nicolas G. Bazan, M.D., Ph.D.

Director, Boyd Professor, Ernest C. and Yvette C. Villere Chair of Ophthalmology, Professor of Biochemistry and Molecular Biology and Neurology, Chair; Executive Research Council – Translational Research Initiative LSUHSC

The unraveling of survival cell signaling in experimental epilepsy, stroke, Parkinson's, Alzheimer's and retinal degenerations are investigated in this laboratory by applying a multidisciplinary approach using primary cell culture, transgenic and knock-out animals, molecular biology and mediator lipidomics strategies. This research focuses on novel signaling pathways of essential fatty acids and platelet-activating factor. Dr. N. Bazan and his colleagues have found novel neuronal survival pathways as new therapeutic experimental targets. The goal is to ultimately translate into the clinic the mechanisms identified in the basic neuroscience laboratory.



Haydee E.P. Bazan, Ph.D.

Professor, Ophthalmology, Bio-chemistry & Molecular Biology and Neuroscience

Molecular mechanisms of inflammation, cornea wound healing and dry eye. The studies target mechanisms of neuroregeneration relevant to understanding and treating complications generated by corneal nerve damage. A multifaceted approach is used in the laboratory that includes corneal surgery in animal models, genetic models, functional tests, cell culture, lipidomic analysis, and molecular and cell biology approaches.



Ludmila Belayev, M.D.

Associate Professor - Research, Neurosurgery and Neuroscience

Development and evaluation of animal models of stroke, traumatic brain injury, neuroprotection, neurobehavioral, and histopathology.

Jeffrey Erickson, Ph.D.

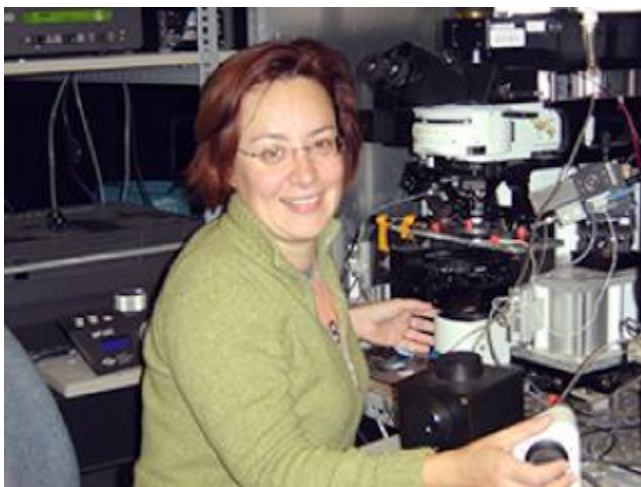
Associate Professor, Pharmacology and Neuroscience

Synaptic vesicle transport proteins: molecular and cellular biology of vesicular neurotransmitter transporters. Recent work from our laboratory indicates that vesicular glutamate transporter VGLUT1 does more than just control quantal size. VGLUT1 interacts with adaptor proteins involved in vesicle endocytosis and possibly even exocytosis to modulate vesicle release probability. This has broad implications for synaptic plasticity of cortical excitatory neurons in physiologic and pathologic states.

Hamilton Farris, Ph.D.

Assistant Professor - Research, Otorhinolaryngology and Neuroscience

The underlying neural mechanisms that mediate sensory acuity by integrating the methodologies of psychophysics and neurophysiology. Our overall goal is to understand how pathologies of attention (e.g., deficit, schizophrenia) affect sensory processing.



Sonia Gasparini, Ph.D.

Assistant Professor - Research, Cell Biology & Anatomy, and Neuroscience

Dendritic excitability and synaptic integration in hippocampal and entorhinal cortex neurons. We use electrophysiological techniques (dendritic and somatic recordings) combined with multiphoton imaging and uncaging to study how synaptic inputs arriving to a neuron are integrated to generate an output. Our ultimate goal is to understand how information is processed and stored in the brain regions that are essential for memory formation.

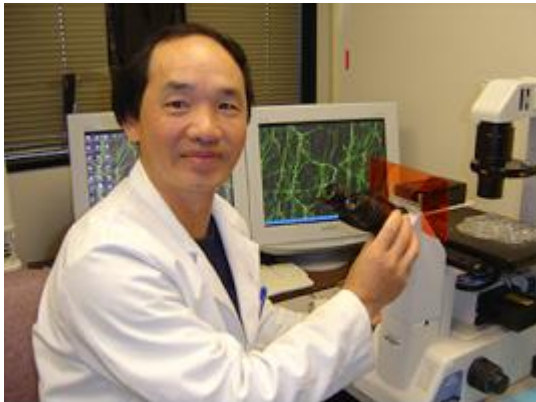


Drs. XiaoChing Li, William Gordon

William C. Gordon, Ph.D.

Associate Professor - Research, Ophthalmology and Neuroscience

Cell biology of retina under normal and pathological conditions; neuronal cell death and neuroprotection. Our laboratory uses an integrative approach, combining histology at the light and electron microscope levels, immunolocalization, auto-radiography, and electronic monitoring of retinal health with electroretinographic and optical coherence tomographic methods. These are applied to our rodent models of blinding eye diseases which include age-related macular degeneration (laser-induced choroidal neo-vascularization) and retinitis pigmentosa (transgenic animals which contain mutated human genes linked to photoreceptor death). Experimental approaches include enhancement of in-house protective mechanisms and/or blockade of discrete steps within the cell death pathway.



Jiucheng He, M.D., Ph.D.

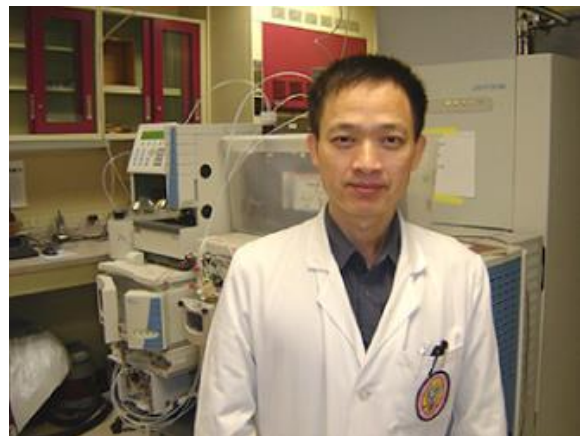
Assistant Professor - Research, Ophthalmology and Neuroscience

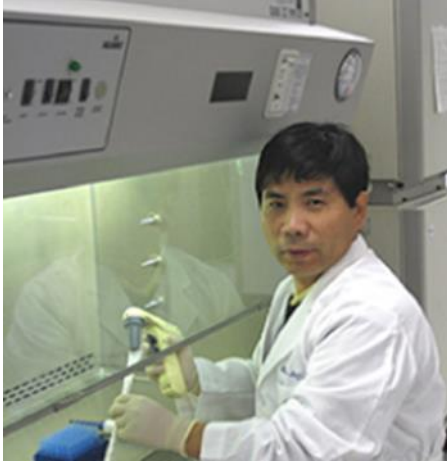
Mechanisms of corneal wound healing and corneal myofibroblast biology.

Song Hong, Ph.D.

Assistant Professor, Ophthalmology and Neuroscience

Lipidomic pathways that regulate inflammation, angiogenesis, and choroid neovascularization. Lipid biochemistry and biology related to human health and diseases including retinal degeneration.





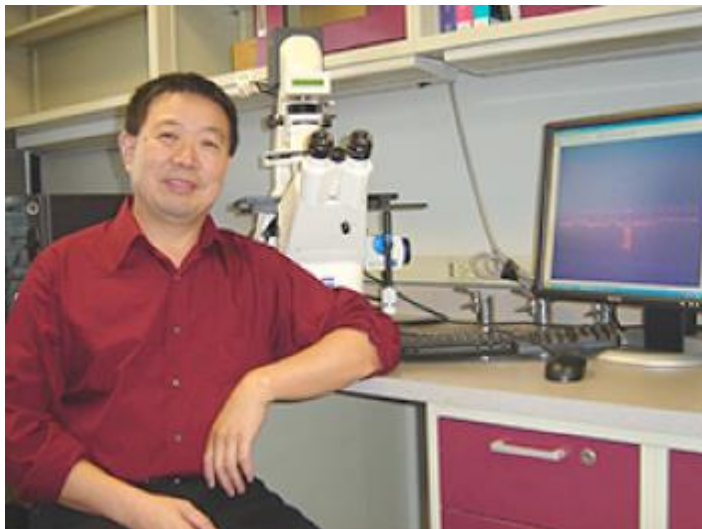
Minghao Jin, V.M.D., Ph.D.

Assistant Professor, Ophthalmology and Neuroscience

We use molecular biology, proteomics, cell culture and gene knockout approaches to study the molecular mechanism of photoreceptor degeneration in inherited childhood blindness known as Leber's congenital amaurosis, the retinoid visual cycle essential for regeneration of the visual pigment responsible for sensing light, and signaling pathway of interphotoreceptor retinoid-binding protein in cone photoreceptor function and retinal cell survival.

We use an integrative approach (e.g., genomics, bioinformatics, and behavioral analysis) to study

developmental plasticity, neurogenesis, vocal learning, and language related developmental disorders.



Youming Lu, M.D., Ph.D.

Professor, Neurology and Neuroscience

Dr. Lu's research has focused on excitatory synaptic transmission, synaptic plasticity and synaptic ion channel degeneration. Dr. Lu is interested in identifying and characterizing the specific cellular and molecular signaling processes that cause the aberrant changes of excitatory synaptic transmission. Dr. Lu and his research team have recently discovered that DAPK1 functions as an essential signaling molecule for synaptic ion channel degeneration in brain disorders.

Dr. Lu has also identified that Epac mutations in autism impairs excitatory synaptic transmission that is associated with abnormal social behaviors. Dr. Lu and research team have applied multiple advanced research techniques including gene-targeting, proteomics and double and single whole-cell patch clamp recordings from the central neurons and developed several mutant strains of mice including DAPK1^{-/-} mice, Epac2^{-/-} mice and conditional Epac1^{-/-} mice. Ultimately, Dr. Lu and his research team will apply these discoveries for developing the practical strategies in the treatment of Alzheimer's diseases, brain injury such as stroke and neuronal developmental disorders including autism.



Walter J. Lukiw, Ph.D.

Associate Professor, Ophthalmology, Genetics and Neuroscience

Age-related macular degeneration (AMD), Alzheimer's disease (AD), bioinformatics, brain aging, brain-specific gene transcription, DNA arrays, gene expression analysis and profiling, memory acquisition and storage, messenger RNA (mRNA) splicing, micro RNA (miRNA) complexity, neurofilaments, neurotoxicology (focus on aluminum, copper, iron, lead and mercury), normal brain aging, schizophrenia, synaptogenesis,

synaptic plasticity and the primary culture of human brain cells. My laboratory's main research focus is on furthering our understanding of the regulation of human brain-specific gene expression in health and disease, and on the role that chromatin structure, epigenetics, neurotoxic metals, transcription factors and micro RNAs affect this process.



Bok Kyoo Jun, PhD

Instructor-Research, Neuroscience, Cell Biology & Anatomy I am interested in precisely defining and characterizing the lipids that comprise the brain and retina. We know that at the onset of brain disease and retinal degeneration the component lipids begin undergoing changes, where some disappear, some are reduced, some increase, and some appear for the first time.

My research is centered around mass spectrometry. I extract the lipids of interest and analyze them by conventional mass spectrometry or by MALDI (imaging) mass spectrometry. I have access to two colonies of mice that have been genetically altered so that they now have characteristics of two blinding eye diseases, Age-related macular degeneration (AMD) and retinitis pigmentosa (RP).



Jennifer Lentz, PhD

Research Assistant Professor, Department of Otorhinolaryngology and Biocommunications and Neuroscience — The overall goal of my research is to develop a therapeutic approach to prevent or cure the deafness and blindness associated with Usher syndrome (Usher), the most common genetic cause of combined deafness and blindness. Currently, there are 3 clinical sub-types of Usher syndrome based on the severity and age of onset of deafness and blindness, and in some patients, the presence of vestibular areflexia (balance disorder). Genetically, there are 12 known genes associated with Usher syndrome; 6 for Usher type 1, 3 for Usher type 2, and

2 for Usher type 3. At LSUHSC-NO we focus on Usher syndrome type 1C, which affects the Acadian populations of south Louisiana and Canada. Approximately 6-8% of type 1 Usher cases are caused by mutations in the USH1C gene, which encodes the protein harmonin. The

USH1C.216G>A (216A) mutation accounts for all cases of Usher 1 in Acadian populations. My laboratory created a mouse model of USH1C by knocking-in the 216A mutation responsible for the combined deafness, blindness and vestibular dysfunction in an Acadian patient of south Louisiana. My laboratory uses this Usher mouse model to understand the underlying mechanisms that lead to the dual sensory loss associated with Usher syndrome, and to develop therapies aimed at preventing or curing deafness and blindness.



Xiao Ching Li, PhD

Associate Professor, Cell Biology & Anatomy, and Neuroscience —

Songbirds provide a unique model system for integrative studies of developmental neural plasticity and vocal learning, because both song behavior and the underlying neural circuitry are tractable. As with language learning in human infants, juvenile zebra finches learn to sing from an adult tutor during a developmentally restricted sensitive period. During this time, a series of molecular, cellular, and behavioral events, including gene expression, neurogenesis, neuronal differentiation, circuit formation, and sensory/motor learning, unfold in a well-orchestrated temporal order. The interplay between an innate developmental program and sensory/motor learning experience eventually gives rise to a learned song.

We are interested in:

- 1) the dynamic genomic programs underlying the successive stages of song circuit development in songbirds and,
- 2) how the intrinsic genomic programs interact with learning experience to shape a neural circuit and give rise to its behavior output. Multidisciplinary approaches are used in our research, which include genomics and system biology analysis of gene and miRNA expression and behavioral manipulation of sensory/motor learning experience.



Janet L. Rossi, MD

Assistant Professor of Pediatrics, Section of Critical Care and Neuroscience —

Cerebral Edema is a common complication of many different diseases in the Pediatric Intensive Care Unit. Multiple different pathways are involved in the development of cerebral edema for example immunology, neuroendocrine, metabolic, cardiovascular, neurologic, signal transduction, cytoskeletal organization, DNA replication and repair are just a few of the pathways that contribute to the development of cerebral edema with different levels of contributions depending on the underlying cause of the cerebral edema. Traumatic Brain Injury (TBI) is one disease process that develops cerebral edema in children but begins with all systems in homeostasis before the injury. The injury then sets in motion alterations in every pathway, culminating in the

development of cerebral edema resulting in neurological decline and life-long deficits. Using a closed head mouse model of pediatric TBI we are investigating the stimulus leading to the disruption of pathways leading to cerebral edema. Understanding the stimulus that disrupts multiple pathways will lead to identifying potential targets for repair.



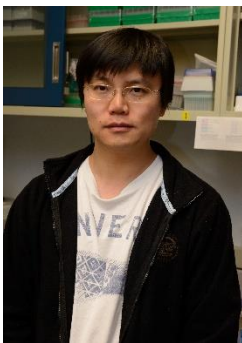
Xiaolin Tian, PhD

Assistant Professor-Research, Cell Biology and Anatomy and Neuroscience — Cellular degradation pathways help maintain cell homeostasis and promote normal development, differentiation and aging. Malfunction in the clearance mechanisms contributes to a range of human diseases including neural developmental and neurodegenerative disorders. The goal of my research is to understand how lysosome-mediated autophagy and ubiquitin proteasome system, the two major cellular clearance mechanisms, promote the development and degeneration of our nervous system.

Chunlai Wu, Ph.D.

Assistant Professor, Cell Biology & Anatomy, and Neuroscience

We combine the powerful fly genetics with proteomic and biochemical approaches to understand the mechanisms underlying learning and memory, mental retardation and age-related neural disorders such as Parkinson's disease and Alzheimer's disease. **Key words:** *Fly disease model, ubiquitination, proteomics*



Yuhai Zhao, PhD

Assistant Professor/Research, Neuroscience, Cell Biology and Anatomy — Adult hippocampal neurogenesis is vital to the maintenance and plasticity of cognitive functions such as learning, memory and emotion. Mounting evidence suggests that loss of normal adult hippocampal neurogenesis is implicated in the cognitive impairment in AD. Restoration of hippocampal neurogenesis helps improve cognitive function in AD mice models. Wnt/ β -

catenin signaling pathway is an important regulating mechanism for the adult hippocampal neurogenesis. We have recently identified significant upregulation of a specific inhibitor of Wnt- β -catenin pathway in AD. In the meantime, through array analysis and algorithm calculation a miRNA linked to that inhibitor gene was also discovered. This research will focus on the interplay between miRNA and hippocampal neurogenesis and how this may be implicated in AD pathology and behavioral dysfunction.



Jorgelina Calandria, PhD

Assistant Professor, Research, Cell Biology & Anatomy and Neuroscience
— Our lab is interested in genetic components of diseases and how they may be modified to produced new therapies for diseases. **Key words:** *geneomics.*



Nicolas G. Bazan, MD, PhD Program

The core program includes neuroscience courses (medical neuroscience, investigative neuroscience, molecular neurobiology, and synaptic organization of the brain) and related courses (cell biology, biochemistry, and molecular biology). Rotation through faculty laboratories is required and provides students with research experience from the beginning of their tenure. Students participate in neuroscience seminars and colloquia, Neuroscience Center retreats, and other science activities sponsored by the LSU Health Sciences Center. Students are encouraged to become actively involved in the Greater New Orleans Chapter of the Society for Neuroscience.

Sir John Vane,

Nobel Laureate in Physiology or Medicine, 1982

"for his work on aspirin and the subsequent discovery of prostacyclin" and

Dr. Nicolas G. Bazan

Research Facilities

The faculty laboratories are located in modern buildings with state-of-the-art equipment. In addition, the Health Sciences Center Core Laboratory, which is a service facility, provides oligonucleotide and peptide synthesis and sequencing, amino acid analysis and purification, mass spectrometry, flow cytometry, transgenic facility, gene microarray, two-photon and confocal microscopy, and phosphoimaging. Equipment for high-speed sequencing of DNA is also available.

Extensive library facilities are available at the Isché Health Sciences Library of the Health Sciences Center and the Earl K. Long Library at the University of New Orleans. A comprehensive Computer Services Center is available on campus.

Financial Aid

Graduate stipends are available from the Neuroscience Center, individual departments, and the LSU Health Sciences Center Graduate School. Supplements can be obtained from faculty grants and other sources for those students who are highly qualified. Fellowships from NIH, NSF, and

the Howard Hughes Foundation are also available on a competitive basis. Students who are selected to receive stipends are not required to pay tuition but are responsible for activity fees.



Drs. Joseph Moerschbaecher and Nicolas G. Bazan presenting an award and plaque to **Dr. Bengt Samuelson**, *Nobel Laureate in Physiology or Medicine, 1982*

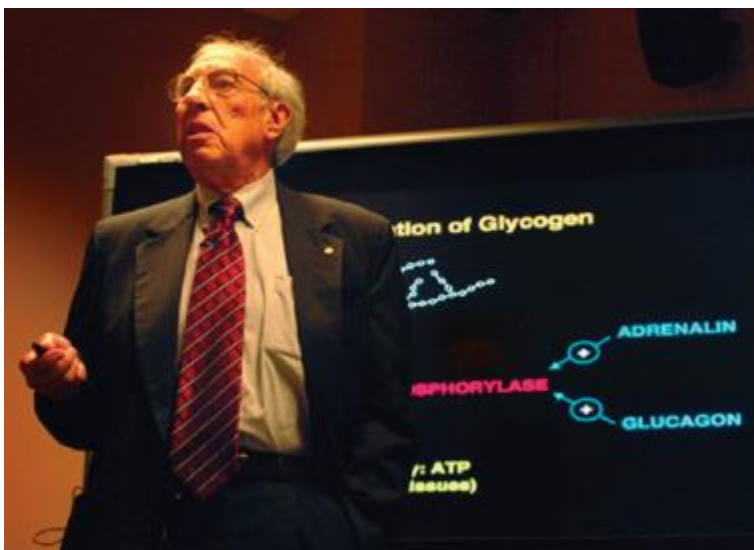
Applying

Applicants must hold a bachelor's degree or the equivalent thereof. Students should have taken courses in biology, chemistry, mathematics, physics, and computer science.

The General Test of the Graduate Record Examinations is required (minimum score 1,200), and the Subject Test in any area of science is recommended. Admission is determined by test scores, written recommendations, a written statement of interests and goals, and a personal interview.

Student Group

Approximately 110 students are enrolled in the LSU Health Sciences Center Graduate School, of whom 15-20 are enrolled in the neuroscience program. The Interdisciplinary Neuroscience Program accepts up to five students per year.



Dr. Edmond Fischer, *Nobel Laureate in Physiology or Medicine, 1992*, presenting his Chancellor's Award Lecture in Neuroscience

Location

The LSU Health Sciences Center is near the heart of historic downtown New Orleans, within 10 minutes of the French Quarter. Exciting yearly events in New Orleans include Mardi Gras and the Jazz and Heritage Festival.

The city is famous for its jazz, cuisine, and cultural activities, such as the symphony, museums, and opera. The city is located only 90 minutes from the Gulf of Mexico; the subtropical climate permits a variety of year-round activities. The New Orleans metropolitan area has a population of approximately 1.2 million and has five major universities.



Dr. Marshall W. Nirenberg,
*Nobel Laureate in Physiology or
Medicine, 1968*
"for deciphering the genetic code"
(shared with Gobind Khorana &
Robert Holley)
with Neuroscience Center of
Excellence Students

Living and Housing

The cost of living in the New Orleans area is generally below the national average. A recently remodeled

dormitory with an exercise area and health facility is available on the Health Sciences Center campus. Living accommodations are also available in the historic Garden District, Uptown, and the Warehouse District, all of which offer distinctive Greek Revival and Victorian architecture.

Additional accommodations can also be found throughout the city at a reasonable cost. Health care is available on campus through the Student Health Center of the LSU Medical School.

Information

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Director

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