The Biology Department
Program of Study

The Biology department offers students a top-tier education. Our degree programs place a strong emphasis on preparing students to excel in various career fields.

B.S. degree in Biology
with concentration options in:
  Integrative Biology
  Cell and Molecular Biology
  Plant Biology
  Neurobiology
  Pre-medical Sciences
  Grades 7-12 Biology Teacher Certification
B.S degree in Microbiology and Immunology

M.S. degree in Biology
M.S. degree in Biotechnology

Ph.D. degree in Cell and Molecular Biology
Ph.D. degree in Neurobiology
In this publication, we have highlighted the areas of specialization, and impressive achievements in research, including numerous new grants and original research publications of our faculty. I am extremely proud to be leading a Department that provides a friendly and supportive environment for students, faculty, fellows, and staff with a strong international reputation for excellence in teaching and research. Over the past 10 years, several faculty members have joined the Department providing exceptional research opportunities for undergraduate and graduate student training.

Within the Biology Department, we have faculty with national and internationally recognized research programs that are at the forefront in the areas of Cell and Molecular Biology, Infectious Disease, Neuroscience and Regenerative Medicine. Our faculty study fundamentally important biological processes that include behavior, bioinformatics/computational biology, developmental biology, epigenetics, gene regulation, learning and memory, macromolecular structure/function, neurodegeneration, plant biology, proteomics/genomics and stem cell biology.

The Department is home to the San Antonio Cellular Therapeutics Institute (SACTI), South Texas Center for Emerging Infectious Diseases (STCEID), and the UTSA Neurosciences Institute. The Department also houses the Brain Health Consortium, which was formed to bring together renowned researchers to study wide-ranging aspects of the brain. This initiative led to the recruitment of Dr. Jenny Hsieh, whose research strives to decipher the gene regulatory mechanisms that control neural stem cell fate to understand the causes of epilepsy and develop better therapeutics. The Department has also begun new collaborations with San Antonio researchers at the U.S. Army Institute of Surgical Research and the Texas Biomedical Research Institute.

Part of the success of our research programs is due to the involvement of UTSA students. Each year, undergraduate, graduate and postdoctoral scholars work directly with faculty and are engaged in state-of-the-art research projects. Biology is home to several National Institutes of Health funded student-training programs, including the Maximizing Access to Research Careers - Undergraduate Student Training in Academic Research (MARC-U*STAR) and the Research Initiative for Scientific Enhancement (RISE).

The faculty in the Department of Biology are known for both teaching and research excellence; Drs. Cassill and Sponsel received distinguished teaching awards within the past few years. The Department of Biology is one of the largest departments at UTSA, with 73 full-time faculty, 18 staff, 144 doctoral and master's students, and more than 2,245 undergraduate majors. The Department offers B.S. Degree in Biology and a B.S. in Microbiology and Immunology. Within these degrees we offer a broad curriculum with concentrations available in Cell and Molecular Biology, Integrative Biology, Neurobiology, and Plant Biology. At the graduate level we offer the M.S. in Biology, the M.S. in Biotechnology, and Ph.D. programs in Cell and Molecular Biology or Neurobiology. These programs offer core graduate courses in molecular biology, biochemistry and neuroscience, as well as advanced courses in a wide range of specialty areas reflecting the research interests of our faculty.

The Department offers numerous events, including journal clubs and research seminars, to develop the skills necessary for students to have successful careers in a wide variety of disciplines, such as secondary school teaching, microbiology, molecular biology, biotechnology, genetics, and neuroscience, and careers in the Health Sciences including medicine, dentistry, veterinary science and related allied health disciplines.

In summary, the faculty and staff of the Department of Biology are very excited about our future as we continue to grow, and we welcome you to work with us as we develop educational and research opportunities for students in the Biological Sciences. I encourage you to explore the pages of individual Biology Faculty, to come to our numerous seminars offered during the week and to stop by and visit with me during our quarterly coffee times.

Garry Sunter, Ph.D.
Professor and Department Chair
# Faculty and Specializations

**Cell & Molecular Biology**
- J. Aaron Cassill, Ph.D.
  - Professor and Roland K. and Jane W. Blumberg Professorship in Biosciences
- Luis S. Haro, Ph.D.
  - Professor
- Brian P. Hermann, Ph.D.
  - Associate Professor
- Richard LeBaron, Ph.D.
  - Professor
- Martha J. Lundell, Ph.D.
  - Professor
- John R. McCarrey Ph.D.
  - Professor and Kleberg Distinguished University Chair in Cellular & Molecular Biology
- Kirsten Hanson, Ph.D.
  - Assistant Professor
- Hans W. Heidner, Ph.D.
  - Professor
- Chiung-Yu Hung, Ph.D.
  - Assistant Professor
- Karl E. Klose
  - Professor and Robert J. Kleberg Jr. and Helen C. Kleberg College of Sciences Professorship
- Soo Chan Lee, Ph.D.
  - Assistant Professor
- Jose L. Lopez-Ribot, Pharm.D., Ph.D.
  - Professor and Margaret Batts Tobin Distinguished Chair in Biotechnology
- Robert D. Renthal, Ph.D.
  - Professor
- Stephen P. Saville, Ph.D.
  - Associate Professor
- Janakiram Seshu, Ph.D.
  - Professor
- Garry Sunter, Ph.D.
  - Professor and Department Chair
- Yufeng Wang, Ph.D.
  - Professor
- Guoquan Zhang
  - Professor

**Cell & Molecular Biology and Microbiology & Immunology**
- Bernard Arulanandam, Ph.D., MBA
  - Professor and Jane & Roland Blumberg Professorship in Biology and Vice President for Research
- James P. Chambers, Ph.D.
  - Professor
- Mark Eppinger, Ph.D.
  - Associate Professor
- Thomas G. Forsthuber, M.D., Ph.D.
  - Professor and Jesse H. and Mary Gibbs Jones Chair in Biotechnology
- M. Neal Guentzel, Ph.D.
  - Professor
- Soo Chan Lee, Ph.D.
  - Assistant Professor
- Stephen P. Saville, Ph.D.
  - Associate Professor
- Janakiram Seshu, Ph.D.
  - Professor
- Garry Sunter, Ph.D.
  - Professor and Department Chair
- Yufeng Wang, Ph.D.
  - Professor
- Guoquan Zhang
  - Professor

**Plant Molecular Biology & Biochemistry**
- Jurgen Engelberth, Ph.D.
  - Associate Professor
Valerie Sponsel, Ph.D., D.Sc.
Professor

Neurobiology and Cell & Molecular Biology
Astrid E. Cardona, Ph.D.
Associate Professor

Jenny Hsieh, Ph.D.
Professor and Semmes Foundation Chair in Cell Biology and Director of UTSA Brain Health Consortium

Hyoung-gon Lee, Ph.D.
Associate Professor and John H. Doran, M.D., F.A.C.P., Distinguished Professorship in Peripheral Neuropathy

Chin-Hsing Annie Lin, Ph.D.
Associate Professor

Lindsey Macpherson, Ph.D.
Assistant Professor

Asif M. Maroof, Ph.D.
Assistant Professor

George Perry, Ph.D.
Professor

Neurobiology
Alfonso Apicella, Ph.D.
Associate Professor

Edwin J. Barea-Rodriguez, Ph.D.
Professor and Roland K. & Jane W. Blumberg Professorship in Biosciences and Associate Dean for Student Success and Instructional Innovation

Anthony Burgos-Robles, Ph.D.
Assistant Professor

Melanie Carless, Ph.D.
Associate Professor

Gary Gaufo, Ph.D.
Associate Professor

David B. Jaffe, Ph.D.
Professor

Isabel A. Muzzio, Ph.D.
Associate Professor

Carlos A. Paladini, Ph.D.
Professor

Clyde F. Phelix, Ph.D.
Professor

Fidel Santamaria, Ph.D.
Professor

David M. Senseman, Ph.D.
Associate Professor

Kelly J. Suter, Ph.D.
Associate Professor

Todd W. Troyer, Ph.D.
Associate Professor

Matthew Wanat, Ph.D.
Assistant Professor

Nicole Y. Wicha, Ph.D.
Associate Professor

Charles J. Wilson, Ph.D.
Professor and Ewing Halsell Distinguished Chair in Biology
Cell & Molecular Biology
Aaron Cassill, Ph.D.
Professor and Roland K. & Jane W. Blumberg Professorship in Biosciences

Research Focus
I am interested in issues that prevent students from successfully completing their education. I am especially interested in problems encountered by students transferring from community college to four-year institutions and increasing the number of underrepresented students entering research careers.

Selected Publications and Funding
- Piloting a Pre-Research Program “Bootcamp” to Educate and Pre-Screen Undergraduate Students. Gail Taylor, Danielle Gordon, J. Aaron Cassill & Edwin Barea- Rodriguez 5th Annual Conference on Understanding Intervention that Broaden Participation in Research Careers, Baltimore, MD 5/10-12/12
- GEEMS Program to Prepare Highly Qualified Math and Science Teachers. Christine Moseley and Aaron Cassill, Science and Math Teacher Imperative, Association of Public and Land-Grant Institutions, Alexandria, VA 6/6-8/12
- NSF Noyce Scholarships- "Scholarship Support for Community College Transfer Students" PI Cassill, $637,188 8/1/15-7/31/20

Link to Publications
https://www.ncbi.nlm.gov/sites/myncbi/1dsM8iS5v3_A7/bibliography/48011320/public/?sort=date&direction-ascending

- $1,392,192 9/1/13-8/31/18
- NSF S-STEM Scholarships- “Retaining Emerging Alamo College Talent in STEM (REACT-STEM)” PI Cassill, $637,188 8/1/15-7/31/20
Research Focus
The Herman laboratory studies the basic biology of spermatogonial stem cells (SCCs), which are adult tissue stem cells responsible for sperm production in the mammalian testis and which are essential for male fertility. Ongoing studies in the lab are focused on:
1) how the pool of SCCs forms during development,
2) determining how SCC fate is regulated,
3) how SCC loss due to chemotherapy can be prevented, and
4) how SCCs can be used to treat male infertility.
Thus, our work has potential implications for basic stem cell biology, reproduction, as well as translational significance for treatment and prevention of male infertility.

Training Opportunities
We utilize mice (including genetic models, Cre/lox, etc.) and nonhuman primate animal models and work with human testicular tissues. Our approaches are multidisciplinary, including in vitro SSC culture, in vivo SSC transplantation assay for SSCs, immunofluorescence, as well as conventional and high-throughput molecular biology and genomic approaches and examine gene expression at the level of individual cells (e.g., single-cell RNA-seq) which allows us to investigate heterogeneity among cells within a population employ bioinformatics strategies to explore these data.

Selected Publications and Funding


Link to Publications

Active Funding
- NIH R01 HD090007, Origin and functional significance of the spermatogonial stem cell barcode.
- NIH R01 HD090080 (PI: Chris Geyer, East Carolina University), The role of retinoid exposure in specification of the foundational SSC pool

Current Graduate Students
- Lorena Roa De La Cruz (Ph.D.)
- Anukriti Singh (Ph.D.)
- Victoria Diaz (M.S.)
- Max Mayo (M.S.)
Richard LeBaron, Ph.D.
Professor

Research Focus
My research is focused on human cell interactions with molecules of the extracellular matrix (ECM), through cell surface receptors called integrins. I focus on two ECM molecules. One is called BIGH3, a proapoptotic protein playing roles in cancer progression, and promoting diabetes complications in the renal and ocular systems. We are dissecting the molecular signaling pathway that induces apoptosis. The other is called lubricin, a protein that is crucial for articular joint lubrication. Human temporomandibular joint (TMJ) can develop a disorder (TMD) that can be exceedingly painful and occurs more frequently in females of birth-giving years, indicating a hormonal response. My lab discovered that estrogen blocks lubricin gene expression. We are presently documenting discovery in female and male TMJ cells and how that leads to TMD.

Training Opportunities
We study molecular mechanisms that we believe underlie development of three human diseases; lubricin roles in TMD (see above), and BIGH3 roles in diabetic complications in the ocular and renal system, and in cancer progression. Our methodology and techniques include eukaryotic cell isolation, immortalization and long-term cultures, introducing mechanical stimuli to select cells, characterization of new cell lines, cell harvesting from necropsies, light and fluorescence microscopy and imaging, cell attachment and migration assays, expressing and isolating recombinant protein, column chromatography, use of expression vectors in selected cells, siRNA, standard and real-time RT-PCR, DNA and protein gels and blots, and general lab procedures.

Selected Publications and Funding
BIGH3 Diabetic Retinopathy
- Lubricin (Prg4) TMJ / TMD

BIGH3 Tumor Progression

BIGH3 Diabetic Nephropathy

Link to Publications
https://www.ncbi.nlm.nih.gov/pubmed/?term=richard+leBaron

Active Projects
- NIH. LeBaron, Richard (P1) Estrogen Negatively Modulates Proteoglycan-4 Expression in TMJ
- San Antonio Area Foundation. LeBaron, Richard (P1) Development of a Monoclonal Antibody Product to Diminish Apoptosis in Diabetic Renal, Ocular and Vascular Complications. Projects active, funding is pending
- BIGH3 roles in diabetic retinopathy
- BIGH3 roles in diabetic nephropathy
- Molecular and cellular mechanisms of BIGH3 effects on tumor progression

Current Graduate Students
- Veena Karthikeyan (M.S.)
- Valeria Lozano (M.S.)
- Shweta Mogare (M.S.)
- Komal Ramzanali (M.S.)
Research Focus
Research in the Lundell laboratory is primarily focused on how neurons in the central nervous system of Drosophila acquire unique cell fates during development. In particular, we are examining the genetic pathway that leads to the specification of neurons that synthesize serotonin. Serotonin is a neurotransmitter conserved throughout the animal kingdom and has been associated with locomotion, learning, memory, and several human neural disorders.

The Drosophila serotonin cell lineage includes six cells: two serotonin producing neurons, a neuron that produces the neuropeptide corazonin, a motor neuron and two cells that undergo apoptosis. We have characterized a number of genes that are essential in specifying these different cell fates, and are investigating the genetic interactions between these genes.

Training Opportunities
The Lundell lab uses a combination of genetics, molecular biology, immunohistochemistry, confocal microscopy and behavior paradigms to study the genes that regulate neurogenesis in Drosophila.

Selected Publications and Funding


Links to Publications
https://www.ncbi.nlm.nih.gov/sites/myncbi/1m5T0b0QzuA2/bibliography/47799631/public/?sort=date&direction=ascending

Active Projects
- ZFH-2 promotes Notch-induced apoptosis in the CNS and appendages of Drosophila Melanogaster.
- Hunchback prevents Notch-induced apoptosis in the serotonin lineage of Drosophila Melanogaster.
- ZFH-2 and the Springer retrotransposon define a new gene insulation system in Drosophila.
Research Focus
Our research is centered on the development, differentiation, and epigenetic regulation of mammalian germ cells and stem cells, and on the role of the epigenome as a mediator of environmental effects. Our experimental systems include mice, baboons, and other mammals. We are interested in 1) the potential for assisted reproductive technologies (e.g. IVF), adverse lifestyles (e.g. poor diet, lack of exercise), or environmental exposures (e.g. disruptive chemicals) to induce disease-causing epimutations in the sperm that are transmitted to a male’s offspring, 2) epigenetic specification and maintenance of spermatogonial stem cell fate, 3) maintenance of enhanced genetic integrity in germ line and pluripotent cells, 4) regulation of gene expression in germ cells and stem cells, 5) X-chromosome activity or inactivity in germ cells, 6) epigenetic reprogramming during gametogenesis, and 7) developing the baboon as a nonhuman primate model for studies of stem cell-based therapies.

Training Opportunities
Opportunities exist for training in association with any of the research foci listed above. Specific technical approaches include – bulk and single-cell analysis of gene expression by RNA-seq, and gene regulation including transcription factor binding or histone modifications by ChIP-seq, DNA methylation by methyl-seq, chromatin accessibility by ATAC-seq, and promoter-enhancer interactions by HiC; derivation and culture of pluripotent stem cells including ES and iPS cells or germ cells to analyze transitions in cell fate in vitro; differentiation of pluripotent cells to form germ cells or specific differentiated somatic cell types; analysis of mutation frequencies using a mutation-reporter transgene; analysis of the impact of the environment on the germline epigenome (induction of epimutations).

Selected Publications and Funding

Funding:
- NIH R01 Grant – “Epimutations in offspring produced by assisted reproductive technologies”
- NIH P50 Grant – “Germline-mediated intergenerational epigenetic inheritance of paternal epimutations induced by a high-fat diet”
- Nancy Smith Hurd Foundation – “Developing and Assessing the Efficacy and Safety of Stem Cell Therapies”
- Kleberg Distinguished University Chair in Cellular & Molecular Biology

Link to Publications

Active Projects
- Analysis of epimutations in mice and men maintained on a high fat diet +/- exercise and in the offspring of those males
- Analysis of epimutations in mice produced by assisted reproductive technologies
- Analysis of epigenetic specification and maintenance of spermatogonial stem cell fate
- Analysis of epimutations induced by exposure in utero to endocrine disruptors
- Development of the baboon as a preclinical model for testing the efficacy and safety of stem-cell based therapeutic approaches
- Development of “Epigenetic reprogramming in a dish” – an in vitro model for transgenerational epigenetic inheritance.

Current Graduate Students
- Yu-Huey (Michelle) Lin (PhD)
- Jake Lehle (PhD)
- Stephanie Villalon (M.S.)
Cell & Molecular Biology

and

Microbiology & Immunology
Research Focus
The Arulanandam Laboratory studies the basic mechanisms of immune defenses at mucosal sites. Mucosal surfaces form the major interface between the host and the environment, and constitute the first line of defense against bacterial pathogens. (A) Using ‘omics’ based approaches, we are investigating host immunity and pathogenesis associated with pulmonary and genital Chlamydia trachomatis in murine and guinea pig models of infection. (B) Acinetobacter baumannii has emerged as an important nosocomial pathogen. We are focused on characterization of A. baumannii virulence factors using gastrointestinal (GI) and pulmonary infection models to delineate the role of these virulence factors in bacterial GI colonization and pathogenesis.

Training Opportunities
We utilize animal models including mice, rats, and Guinea pigs to study pathogenesis and host immune responses following Gram-negative bacterial infection. We employ various immunological techniques/tools, such as confocal microscopy, flow cytometry and ELISpot, to study immune cell activation and migration in response to bacterial infection. We also generate primary cells to establish cell coculture systems to delineate underlying immune protective mechanisms. Additionally, we track bacterial dissemination using a small animal whole body imaging system and evaluate infection induced respiratory dysfunction with the FlexiVent, a small animal ventilator. We also apply molecular and biochemical tools to generate cellular and subunit vaccine candidates against bacterial pathogens. My lab provides training opportunities to students who are interested in studying mucosal immunity against bacterial infection.

Publications and Funding
- May HC et al. (2019). Thioredoxin-A is a virulence factor and mediator of the type IV pilus system in Acinetobacter baumannii. PloS one 14, e0218505.
- Ketter PM et al. (2018). Acinetobacter baumannii gastrointestinal colonization is facilitated by secretory IgA which is reductively dissociated by bacterial thioredoxin A. mBio 9.

Link to Publications

Active Projects
- Host microRNA mediated anti-chlamydial immunity at mucosal surfaces
- Development of prophylactic and therapeutic treatments against multidrug-resistant Acinetobacter infection

Current Graduate Students
- Chaitrali Atre (M.S.)
- Bayley Caldwell (M.S.)
- Faria Mahjabeen (M.S.)
Astrid E. Cardona, Ph.D.
Associate Professor

Research Focus
Neuroinflammation-Microglia and neuronal communication in autoimmunity: My research is focused in understanding the mechanisms of tissue damage in Multiple Sclerosis and Diabetic retinopathy.
- Clarifying the protective and detrimental roles of the innate immune system.
- Determining the origin of tissues injury and factors that account for disease progression.
- Testing neuroprotective therapies via modulation of innate immune cell function.

Training Opportunities
My laboratory focuses on the functional interactions between immune cells, microglia, neurons and blood vessels, utilizing experimental mouse models of disease, immunological assays, flow cytometry, fluorescent activated cell sorting, microscopy and molecular biology approaches.
Motivated trainees with a clear interest for a career in biomedical science have opportunities to participate in my research via independent study, thesis/dissertations and work-study. Training is provided to acquire experience in how to choose, design and expedite new experiments. An important goal is also to develop excellent communication skills, written and oral. This involves becoming an engaged lab member who can present his/her own work, and actively participates in the execution of research, lab meetings, seminars, journal clubs, scientific conferences, and in generation of written reports and scholarly products.

Selected Publications and Funding

Funding:
• National Institutes of Health-National Eye Institute R01 EY029913. Role: PI 07/31/19-08/01/2023. Microglia mediated inflammation in Diabetic Retinopathy
• National Institutes of Health/NIAID-UTMB Subaward. Role: Co-I (PI Stephens) 08/01/2019-07/31/2024. Role of inflammation in cerebral pathology caused by malaria
• San Antonio Medical Foundation Collaborative Research Grant. Role: PI (UTSA) A new approach that preserves islet function and reduces immunogenicity for transplantation

Link to Publications

Active Projects
• Understanding the role of Microglia mediated inflammation in Diabetic Retinopathy
• Role of inflammation in cerebral pathology caused by malaria
• A new approach that preserves islet function and reduces immunogenicity for transplantation
• Role of human CX3CR1 polymorphic variants in models of multiple sclerosis and diabetic retinopathy

Current Graduate Students
• Borna Sarkar (Ph.D.)
• Kaira Church (Ph.D.)
• Derek Rodriguez (Ph.D.)
James P. Chambers, Ph.D.
Professor

Research Focus
Dr. Chambers is an established Biochemist of long-standing with national/international recognized expertise in many aspects of the enzymology of inherited lysosomal storage diseases, i.e., Gaucher and Pompe's Disease, glyconjugate characterization, receptor mediated channel function, i.e., Ca2++Mg2+ Dependent ATPase, and biosensor sensing element development (antibody, RNA aptamer, DNA-branched chain nucleic acid, and dendrimer based formats) for detection/diagnosis of Influenza and bacterial pathogens.

Training Opportunities
Dr. Chambers has trained over the years many Undergraduate, Masters, and Doctoral level students in his laboratory. In 1992, Dr. Chambers implemented the first free-standing Ph.D. program here at UTSA, and trained its first two students. He is recipient of numerous research and teaching awards.

Selected Publications and Funding
- Chambers, et al., "IgA modulates respiratory dysfunction as a sequel to pulmonary chlamydial infection in neonates." Pathogens and Disease, 74: 2016.

Link to Publications

Active Projects
- "Characterization and purification of an acid phosphatase from Acinetobacter baumannii".
- "Carboxyphosphotransferase and abiotic synthesis of ATP via pyrophosphate hydrolysis".

Current Graduate Students
- Elizabeth Moreno-Smiley (M.S.)
- Imraan Ali (M.S.)
Research Focus
The focus of Dr. Eppinger’s research is on the application of microbial genomics to address fundamental questions in emerging infectious diseases. His current interests are directed towards large-scale sequencing and phylogenomic studies investigating major public health threats, such as Shiga toxin producing *Escherichia coli* and multidrug resistant (MDR) enteric bacteria of clinical importance. Experimental approaches include:

1. **Microbial Genome Sequencing** – the gathering of sequence data as prerequisite to capture the genome architecture and genomic diversity in environmental or clinical settings
2. **Phylogenomics** – the development of bioinformatics tools to survey the genomic plasticity within pathogen populations and elucidate the ancestry of microbial species
3. **Microbial Diversity** – the discovery of subtle yet important genetic variations in gene content and activity
4. **Pathogenicity** – the study of virulence determinants and dynamic host-pathogen interactions

Data from this research provides crucial insights into the make-up of bacterial pathogens and how genomic variants relate to differences in evolutionary and ecological niches that underlie human transmissibility, infectivity and disease outcome. Most importantly, this research can help to initiate countermeasures in an attempt to decrease human morbidity rates.

Training Opportunities
Dr. Eppinger’s research program offers an opportunity for students to be trained in a high-throughput microbial genomics and infectious disease laboratory. The research program, which is focused on microbial genomics, incorporates several fields of science, and has exposed students to aspects of microbiology, ecology, (patho-) genomics, epidemiology, molecular biology, and bioinformatics and has provided individual projects for students, which have been completed within the scope of a Work Study, Research Volunteer, MS thesis or Ph.D dissertation project.

Selected Publications and Funding

Link to Publications

Active Projects
- Phylogenomic framework for virulence studies of *Escherichia coli* O157:H7
- Genome and virulence traits of multidrug resistant (MDR) enteric bacteria
- Analysis and Training in Defense of Biological and Digital Threats
Thomas Forsthuber, M.D., Ph.D.
Professor and Jesse H. and Mary Gibbs Jones Chair in Biotechnology

Research Focus
Erroneous activation of the immune system can lead to autoimmune diseases such as multiple sclerosis (MS). Dr. Forsthuber’s lab pursues several lines of investigation to understand how the immune system, in particular T cells, contribute to autoimmune diseases and how to modulate T cell immunity for therapeutic purposes in humans. Specifically, he studies immune mechanisms in the central nervous system in experimental autoimmune encephalomyelitis (EAE), the animal model for MS. Moreover, he studies human autoimmune heart disease in a model called experimental autoimmune myocarditis. His research is aimed towards direct applicability to human diseases, for example by developing novel drugs for autoimmune diseases and biomarkers to monitor the efficacy of treatments for autoimmune diseases.

Training Opportunities
Work in the laboratory focuses on better understanding the pathologic immune mechanisms that drive autoimmune diseases such as MS, T1D, and autoimmune myocarditis. Specifically, we study immune mechanisms in the central nervous system during experimental autoimmune encephalomyelitis (EAE), the animal model for MS. The lab has generated transgenic and knockout mouse models to investigate the role of important autoimmune disease-related genes such as HLA-DR. We use immunologic, cell biology, and molecular biology methods such as cytokine detection assays, flow cytometry, RT-PCR and many other assays in our studies.

Selected Publications and Funding

Link to Publications

Active Projects
- M2 proteomics of the EAE model of multiple sclerosis
- NETs and lipid peroxidation in EAE
- MIF inhibition as a novel treatment for autoimmune myocarditis
- The role of ERK in neuroinflammatory disease

Current Graduate Students
- Carol Chase Huizar (Ph.D.)
- Rachel Robinson (Ph.D.)
- Austin Negron (Ph.D.)
- Natalia Herrera (M.S.)
- Dora Vukmirovic (M.S.)
Research Focus

Dr. Guentzel's research expertise is in microbial pathogenesis and immunology. Initially, he worked with cholera (*Vibrio cholerae*) and was the first to show motility as a virulence factor for any bacterial pathogen and extensively characterized an animal model for studies of cholera pathogenesis and putative vaccines for cholera. He also studied pathogenesis of the major fungal pathogen *Candida albicans* and developed a new animal model for candidiasis.

His current research interests are on the STD agent *Chlamydia trachomatis*, the select agent *Francisella tularensis*, and the multi-drug resistant wound and nosocomial (hospital acquired) pathogen *Acinetobacter baumannii*.

Training Opportunities

Current studies have focused on pathogenesis and putative vaccines for *Chlamydia trachomatis*, the world's leading cause of bacterial STD, which is often asymptomatic but if left untreated can induce ascending infection in the uterus and fallopian tubes, causing pelvic inflammatory disease (PID) and complications such as ectopic pregnancy and infertility in women, and infant pneumonia in children with serious respiratory sequelae later in life.

The lab’s studies on the select (bio-threat) agent *Francisella tularensis* have helped to define the virulence determinants of this pathogen and characterized the immune response and protection afforded by putative attenuated vaccine stains. *Acinetobacter baumannii* is a multi-drug resistant, important wound, nosocomial (hospital acquired), and pulmonary pathogen with a high mortality, which is being studied for mechanisms of colonization, pathogenesis and control by targeting virulence factors.

Selected Publications and Funding


Link to Publications


Active Projects

- *Acinetobacter baumannii*
- *Chlamydia trachomatis*
- *Francisella tularensis*
- Microbial pathogenesis
- Vaccines
Despite great strides in malaria control during the past decade, *Plasmodium* parasites still caused over 200 million clinical cases of malaria during 2015, leading to over 400,000 deaths. The parasite forms responsible for malaria exclusively infect red blood cells, but all mammalian *Plasmodium* infections must initiate in the liver. This liver stage of parasite development has emerged as a key target for antimalarial chemoprophylaxis, as it precedes both disease and transmission back to the mosquito vector. Successful interventions against liver stages can thus protect both individuals and populations, a key challenge for the malaria elimination agenda. Our research program is dedicated to identification of the most desirable compounds for liver stage-directed chemoprotection.

In addition to our compound screening program, we focus on novel assay development and chemical biology approaches to interrogating the unique cell biology that supports syncytial growth during the *Plasmodium* liver stage, and the rapid cellularization process that ends the liver stage, generating thousands of individual parasites that invade red blood cells, and cause disease.

**Training Opportunities**

We work with the rodent malaria models, *P. berghei* and *P. yoelii* using both in vitro and in vivo approaches, and a variety of experimental techniques. We have developed a robust method linking confocal microscopy to online image processing to automate parasite identification, and subsequent high resolution imaging, in both live and fixed infected hepatoma cells.

Our research thus relies heavily on the quantitative analysis of such parasite images to both elucidate fundamental questions of *Plasmodium* liver stage biology and host–parasite interactions, and identify desirable small molecules for antimalarial drug development.

**Selected Publications and Funding**


**Active Projects**

- Phenotypic profiling of antimalarial compounds
- Antimalarial drug discovery: assay development and small molecule screening to identify compounds with novel or desirable killing mechanisms
- Cell biology of the syncytium to single cell transition during liver stage development
- Host-parasite interactions

**Current Graduate Students**

- James McLellan (Ph.D.)
- Daniel Ferguson (Ph.D.)
The primary focus of my research laboratory is the design and development of alphavirus-based vectors and vaccines. Alphaviruses are small RNA viruses that are spread to humans and other vertebrates through the bites of infected mosquitoes. Alphaviruses possess a number of properties that support their use as vectors for expressing foreign genes of interest. Therefore, these viruses have been researched extensively for use as recombinant vaccines.

We are using Sindbis virus, the prototype alphavirus, to develop and evaluate new strategies for targeting alphavirus vectors, or alphavirus-expressed antigens to immunologically relevant cell types such as dendritic cells. An additional project focuses on the development of an alphavirus-based influenza vaccine.

Selected Publications and Funding


Link to Publications

Active Projects
An influenza A virus vaccine based on a M2e-modified alphavirus.
Chiung-Yu Hung, Ph.D.
Assistant Professor

Research Focus
The Hung laboratory studies host-pathogen interactions, specifically host immunity to fungal infections with *Coccidioides* species. These fungi are known to live in the soil in the southwestern United States and parts of Mexico and Central and South America. An estimated 150,000 people in the United States become infected with *Coccidioides* annually. *VF* is typically transmitted by inhalation of airborne spores of *Coccidioides* spp. The most common clinical presentation of coccidioidomycosis is pulmonary disease while dissemination of infection to skin, bone and central nerve system can occur. Patients who present with severe acute pneumonia, chronic pulmonary *VF* and disseminated coccidioidomycosis require antifungal therapy, which is potentially lifelong with currently available drugs. There is an urgent and unmet need to develop better chemotherapies and a vaccine against *Coccidioides* infection.

Training Opportunities
Our laboratory has the expertise, instruments and infrastructure to provide multidisciplinary training opportunities to students who are interested in immune mechanisms against fungal infection, vaccine development, production of recombinant antigens, and discovery of novel fungal chemotherapies. Students will gain hands-on experience in the following cutting-edge technologies to study host immune response and fungal pathogenesis.

Selected Publications and Funding

Active projects
- NIAID-NIH HHSN27200004 Task Order A20. “Therapeutics testing in murine models of coccidioidomycosis” Date: 08/06/2019-12/31/2019 Role: Subcontract PI at UTSA
- Meridian Bioscience Inc. Contract# “Coccidioides diagnostic antigens” Date: 05/01/2006-Present. Role: PI
- MiraVista Diagnostic Lab Contract# “Development of Coccidioides diagnostic antigens” Date: 11/01/2018-08/31/2020. Role: PI

Current Graduate Students
- Natalia Castro-Lopez (Ph.D.)
- Dustin Fetch (M.S.)
Karl E. Klose, Ph.D.
Professor and Robert J. Kleberg Jr. and Helen C. Kleberg College of Sciences Professorship

Research Focus
Dr. Klose’s lab is interested in bacterial pathogenesis -- how bacteria cause disease. Dr. Klose has worked most extensively with *Vibrio cholerae*, the bacterium that causes cholera, and is also researching *Francisella tularensis*, the bacterium that causes tularemia, or rabbit fever.

Cholera is found only where there are widespread problems with sanitation, so improving water and food supplies would eliminate the disease. Since that is unlikely to occur, a safe, cheap, effective vaccine is needed that would protect people. To design such a vaccine, the lab is addressing questions such as: How does *V. cholerae* know that it is in a human body and that is the place to express genes necessary for its survival and disease potential? What are the genetic factors responsible for *V. cholerae* to cause disease? How does this organism persist in aquatic environments, which lead to human infection?

Very little is known about *F. tularensis* or about tularemia. It is a highly virulent organism and can easily be aerosolized, so it is classified by the Centers for Disease Control (CDC) as a Category A select agent with the highest potential to be used as a biological weapon. The lab is working to identify genetic factors responsible for *F. tularensis* to cause disease and to develop suitable vaccine candidates to protect against tularemia infection.

Training Opportunities
We utilize a variety of techniques to allow students to address the scientific questions associated with bacterial pathogenesis, including genetics, molecular biology, biochemistry, immunology, vaccinology, genomics, and a variety of imaging techniques.

Selected Publications and Funding
- A Critical Region in the FlaA Flagellum Facilitates Filament Formation of the *Vibrio* cholerae Flagellum
- Closed Genome Sequence of *Vibrio cholerae* O1 El Tor Inaba Strain A1552

Link to Publications

Active Projects
- The genetic basis of virulence of *Vibrio cholerae*
- Development of an effective vaccine against tularemia

Current Graduate Students
- Mylea Echazarreta (Ph.D.)
- Cameron Lloyd (Ph.D.)
- Mark Cristner (M.S.)
- Adrian Mejia-Santana (M.S.)
- Patrick Halloran (M.S.)
- Christian Troas (M.S.)
Research Focus
My laboratory studies a broad range of fungi that pose serious threats to public health. In particular, one of the goals of my research is to elucidate the interactions between hosts and human pathogenic fungi, which will subsequently contribute to the development of therapeutic options. My research takes advantage of the Mucor dimorphism as a tool to elucidate fungal pathogenesis and host responses against life-threatening fungal infections. Another goal is to define the roles of the enteric mycobiota (fungi in the GI tract) in gastrointestinal diseases. This could provide information for better understanding of the etiology and novel factors associated with eating disorders, which would facilitate the development of innovation and improved treatment options.

Training Opportunities
Mucormycosis caused by fungi in the order Mucorales is an opportunistic fungal infection recently recognized as an emerging infectious disease. My research involves studying the host-pathogen interface. Mucor is a dimorphic fungus and the different morphogenic stages (spores/hyphae vs. yeast) result in different host-pathogen interactions. The key question is: what difference(s) between spores and yeast makes hosts respond differently? Our goal is to identify key virulence factors conserved in mucormycosis fungi, which enable the fungi to escape innate immunity.

Another research goal is to define the roles of the enteric mycobiota in GI tract diseases and eating disorders. My research will elucidate the dynamics of the fungal population in the gut of patients with GI tract diseases such as inflammatory bowel diseases or irritable bowel syndrome.

Selected Publications and Funding

Link to Publications

Active Projects
- Effect of Mucor morphology on interactions with hosts.
- Characterization of mycobiome and interactions between intestinal bacteria and fungi in gastrointestinal diseases.
- Genetics on calcineurin and dimorphism in Mucor.

Current Graduate Students
- Sandeep Vellanki (Ph.D.)
- Alexis Garcia (Ph.D.)
- Colm Rorex (Ph.D.)
- Broderick Turner (M.S.)
Research Focus
Research in the laboratory has provided important insights into the pathogenesis of candidiasis, the main fungal infection affecting an increasing number of immune- and medically-compromised patients. This work encompasses from the basic biology of the cell wall, biofilm formation, adhesion and morphogenetic conversions, to the use of animal models to better understand virulence and host responses, to the more clinical aspects such as antifungal drug discovery and development, drug resistance, vaccines, and nanobiotechnological approaches, with the ultimate goal of devising new strategies for the diagnosis, prevention and treatment of candidiasis.

Training Opportunities
For students at all levels (from undergrads to postdoctoral fellows) to be trained in a variety of contemporary and state of the art techniques related to fungal pathogenesis and antifungal drug development. Techniques include (among others) biofilm formation and susceptibility testing, high throughput screening, advance microscopy, nanobiomedicine, and animal models of fungal infections.

Selected Publications and Funding

Link to Publications

Active Projects
- National Institute of Allergy and Infectious Diseases (NIAID), National Institutes of Health (NIH). R21AI140823-01, “Screening a Target-Based Repurposing Library for Activity against Fungal Pathogens and Subsequent Preclinical Development of Leading Candidates”.

Current Graduate Students
- Gina Wall (Ph.D.)
- Olabayo Harry Ajetunmobi (Ph.D.)
Robert Renthal, Ph.D.
Professor

Research Focus
Biochemistry and biophysics of cell membranes.
What are the biophysical mechanisms of folding and oligomerization of membrane-embedded proteins?
How do oligomeric channels form in membranes?

Chemical communication by insects and ticks. How do ant colonies establish and maintain interaction networks? What semiochemicals and chemoreception-related proteins are involved in mate and host identification by tick and fly vectors of human diseases?

Tick immune system. Why do tick vectors harbor pathogenic bacteria, such as Lyme disease spirochetes, instead of killing or expelling them? How do Lyme disease bacteria evade the tick immune system?

Training Opportunities
Fluorescence spectroscopy. Membrane protein oligomerization is measured by fluorescence resonance energy transfer (FRET), using artificial membrane patches known as nanodiscs. Functions of chemoreception-related proteins are studied by fluorescence spectroscopy.

Lipidomics and proteomics. Cuticular lipids, sensory appendage proteins, salivary/midgut proteins, and hemolymph proteins are analyzed by high performance liquid chromatography coupled to a high resolution tandem mass spectrometer. Individual glands and sensory appendages are examined by imaging mass spectrometry.

Selected Publications and Funding
- Renthal, R., Lohmeyer, K., Borges, L., & Perez de Leon, A. A. Surface lipidome of the lone star tick, Amblyomma americanum, provides leads on semiochemicals and lipid metabolism. Ticks & Tick- borne Diseases, 10, 138-145 (2019)

Link to Publications

Active Projects
- Analysis of pheromones in the fire ant venom sac
- Tarsal chemoreceptors in ticks and flies (supported by USDA contract)
- Proteome of tick salivary/midgut secretions

Current Graduate Students
- Kevin Tang (M.S.)
- Jaee Shah (M.S.)
- German Garcia (M.S.)
Stephen Saville, Ph.D.
Associate Professor

Research Focus
The Saville lab conducts research on the fungal pathogen *Candida albicans* and specifically how it is able to cause disease in humans. The fungus forms part of the normal microbiome of humans, existing as a commensal on the mucosal surfaces of the mouth, vagina or GI tract of 30-50% of the population. It is, however, capable of causing a wide range of diseases from superficial, generally treatable conditions such as oropharyngeal candidiasis (OPC; oral thrush) and vulvovaginal candidiasis (VVC; “yeast” infections) to a much more serious, life-threatening disease should the fungus disseminate to the deep organs.

The major cellular attribute linked to *C. albicans*’ capacity to cause disease is its ability to alter its growth form from single celled “yeast” to an elongated form called a hypha. Our research is focused on unraveling the cellular machinery controlling hypha formation and developing new antifungal drugs that will inhibit this process.

Training Opportunities
In our ongoing studies to provide additional details of the cellular machinery regulating *C. albicans* hypha formation, we recently discovered that the gene encoding the key transcriptional repressor Nrg1p is itself subject to negative regulation via the induction of an antisense transcript.

We are attempting to ascertain whether additional anti-sense transcripts play a role in controlling hypha formation and which *C. albicans* proteins are involved in their production and turnover; to that end, we employ a combination of molecular biology techniques such as RNA-Seq, ChIP-Seq and quantitative PCR with more traditional methodologies such as novel strain construction and various forms of microscopy. Our other major research endeavor involves characterizing the mechanism of action of several compounds we have identified which inhibit hypha formation and represent potentially new antifungal drugs with novel mechanism(s) of action.

Selected Publications and Funding

Link to Publications
http://www.ncbi.nlm.nih.gov/pubmed/?term=Saville+SP

Active Projects
- Genetic Regulation of *Candida albicans* filamentation.
- Role of hypha formation in *Candida albicans* pathogenesis.
- Analyzing differences in the host response to the three major morphotypes (yeast, hyphae and pseudohyphae) of *Candida albicans*.
- Characterization and development of novel small molecule inhibitors of *Candida albicans* hypha formation as potential new antifungal drugs.

Current Graduate Students
- Dwayne Keith (M.S.)
- Justin Duran (M.S.)
Janakiram Seshu, Ph.D.
Professor

Research Focus
Our research focus is to study how pathogenic bacteria interact with their hosts leading to infectious diseases such as Lyme disease and Q fever. We have started studies on how antibiotic-resistant strains of bacteria influence physiological responses critical for healing of infected wounds. We determine the role of key players in regulatory pathways that facilitate bacterial pathogens to adapt to different environmental conditions and devise strategies to interfere with the lifestyles of bacteria to prevent their infectious capabilities.

We also focus on developing a variety of products such as vaccines, inhibitors of critical metabolic pathways and modulators of host response to prevent bacterial infections using a number of experimental models of infection in conjunction with state-of-the-art methods in genomics, proteomics and metabolomics of host-pathogen interactions.

Training Opportunities
We train undergraduate, graduate and postdoctoral students in areas of bacterial pathogenesis with an emphasis on vector-borne disease such as Lyme disease. Numerous training modules in 1) recombinant DNA/RNA methods; 2) protein purification and analysis of interactions; 3) genetic manipulation of infectious bacterial agents and 4) analysis of infectivity using rodent and tick models of infection are in place for students depending on their research experience. Students can also pursue studies on the stages of infection of an intracellular pathogen (using Coxiella burnetii Phase II - an avirulent strain as a model) exploiting state-of-the-art microscopy, transcriptomics and proteomics. An intense “boot-camp” with hand-on training on basic techniques in molecular microbiology is provided to all students and when the students gain confidence in executing these procedures, they will transition to independent projects.

Selected Publications and Funding


FUNDING: Department of Defense, NIH-NIAID, Link to Publications

Active Projects
- Regulation of gene expression in Borrelia burgdorferi
- Cell wall biogenesis in Borrelia burgdorferi
- Metabolic control of virulence potential of the agent of Lyme disease Pathogen-tick interactions
- Inhibitors of antibiotic resistant strains of ESKAPE Pathogens

Current Graduate Students
- Yue Chen (Ph.D.)
- Brian Moy (Ph.D.)
- Taylor MacMackin (Ph.D.)
- Jose Casillas (M.S.)
- Cassidy Graham (MS)
Research Focus

The Sunter laboratory explores aspects of host-pathogen interactions using geminiviruses. Geminiviruses are a significant threat to food security worldwide, and current control measures include limiting vector populations using pesticides, which is a significant health concern, as pesticides work by disrupting nervous system function. Our work has potential implications in the development of alternative ways to reduce the incidence of geminivirus disease.

Ongoing studies in the lab focus on 1) Analysis of the epigenetic state of viral chromatin state. Geminiviruses are single-stranded DNA viruses, which replicate through double-stranded DNA intermediates that associate with host histones to form viral mini-chromosomes. Regulation of viral transcription by host systems involved in DNA and histone methylation are of particular interest; 2) Given the small size of the geminivirus genome (~3kbp), the virus has to utilize/highjack host transcription factors to mediate the expression of viral genes; We have identified three factors to date and are currently characterizing their interactions with the viral genome; 3) Geminiviruses are subject to numerous host immune responses that act to reduce infection. My lab is studying two of these pathways, Transcriptional Gene RNA silencing (TGS) and autophagy, to understand how they target the virus and the mechanisms geminiviruses utilize to circumvent and/or avoid them; 4) Network discovery to increase understanding of plant immunity, and to identify key regulatory points that determine infection outcome.

Training Opportunities

The lab utilizes model plants, Arabidopsis and Tobacco, as well as agriculturally relevant crops (Tomato, Sugar Beet and Spinach), as genetic models to study host-pathogen interactions, such as transcriptional regulation, transcriptional and post-transcriptional gene silencing (RNAi) and host immunity.

We use multidisciplinary approaches that include cell and molecular biology, genomics, bioinformatics and computational analysis. Skills developed in the lab involve cell culture, DNA/RNA and protein purification, fluorescence and confocal microscopy, RNASeq, gene expression studies and mutational analysis. Trainees are introduced to the design and conduct of experiments and statistical approaches for data analysis.

Selected Publications and Funding


Link to Publications


Active Projects

- Developing tools and databases for network-based plant systems biology with applications to understanding plant-virus interactions.
- Determining the role of a host transcription factor (TCP) in regulating geminivirus promoter activity
- Characterizing the impact of a viral RNA silencing suppressor on autophagy
- Developing technology to improve the health of vulnerable plants by creating a rapid response to various conditions that can impact plant productivity, such as drought, disease and environmental stress.

Current Graduate Students

- Jacqueline Williams (Ph.D.)
Yufeng Wang, Ph.D.
Professor

**Research Focus**
Research in Dr. Wang’s lab focuses on the comparative genomics, molecular evolution, and systems biology of gene families. The lab uses genomic and related data, coupled with other biochemical and microbiological information, to identify new therapeutic targets and to further study the underlying evolutionary mechanisms in diseases such as malaria. Their research has a particular emphasis on the functional divergence of duplicated genes, which are believed to provide the raw material for functional novelty. They are also interested in the association between sequence evolution and gene network regulation.

**Training Opportunities**
Students in the Wang lab will be trained to the use of cutting-edge bioinformatic and genomic tools to statistical modeling and analysis of the omic data. Students will gain hands-on experience in bioinformatics and computational biology. Topics to be covered in student training include:
- Information and resources: PubMed, bioinformatic databases, molecular biology databases
- Next-generation sequencing: technology and data analysis
- Gene expression profiling
- Phylogenetic analysis and molecular evolution
- Gene regulatory networks and systems biology
- Population and statistical genetics
- Pathway analysis

**Selected Publications and Funding**

**Active Projects**
- Systems biology of infectious diseases
- Host-pathogen interactions
- Molecular evolution of protein families in vertebrates and infectious agents

**Link to Publications**
Research Focus
Dr. Zhang's research focuses on understanding the cellular and molecular mechanisms of protective immunity against aerosolized intracellular bacterial pathogens and developing novel approaches for discovery of safe, effective vaccines and immunotherapeutic strategies against aerosol-transmitted intracellular bacterial pathogens. To accomplish these broad goals, current projects in the lab are designed to understand the cellular and molecular mechanisms of protective immunity against Coxiella burnetii infection and to develop a safe and effective vaccine against human Q fever. Current studies include NIH funded and pending projects: 1) use of a humanized antibody against intracellular bacterial pathogen; 2) understanding the role of dendritic cells in regulating vaccine-induced protective immunity against Q fever; 3) use of mimetic peptides vaccines against aerosol-transmitted bacteria; and 4) understand the mechanisms of B cell-mediated protective immunity against Q fever.

Training Opportunities
Dr. Zhang's laboratory welcome undergraduate and graduate students to participate research projects. Our expertise in small animal models of infectious diseases, molecular and cellular immunology, host cell interaction with microbial pathogens and vaccine development will be available to students.

Selected Publications and Funding
- L. Buttrum, L. Ledbetter, R. Cherla, Y. Zhang, William J. Mitchell, and GQ. Zhang. Both MHC class I and class II molecules are required while MHC-I appears to play a critical role in host defense against primary Coxiella burnetii infection. 2018. Infect Immun. 86(4). PMID:29311245.


Visit to Publications

Active Projects

Current Graduate Students
- Shawkat Alam (Ph.D.)
Plant Molecular Biology and Biochemistry
Research Focus
Our research focuses on the role of so-called ‘green leaf volatiles’ (GLV), the common ‘green’ smell of plants, as mediators of plant stress responses. GLV are well known as compounds that prime stress responses, thereby effectively protecting plants without investing valuable metabolic resources. However, even after almost 20 years of research little is known about how GLV regulate these processes. We are therefore investigating the molecular mechanisms of GLV-induced priming and how these affect the physiology of the plant during stress responses.

Training Opportunities
We study the effects of GLV on plants under abiotic and biotic stress conditions. We use physiological, analytical, and molecular techniques to analyze these responses and to assess the effectivity of GLV-induced signaling. Students on all levels are welcomed to work in the lab on these topics.

Selected Publications and Funding

Link to Publications
https://www.ncbi.nlm.gov/pubmed/?term-Engelberth+j

Active Projects
- The role of GLV in priming plant stress responses.
- Free fatty acids and how they effect defense signaling.
- Herbivore-derived effectors of plant defense responses.

Current Graduate Students
- Loan Doan (M.S.)
Dr. Sponsel’s research focuses on the gibberellin class of plant hormones that regulates plant growth and development. Many different gibberellins have been identified in plants and in the fungus Gibberella fujikuroi. It was the original identification of these compounds in Gibberella that led to their unusual name. In plants, one class of hormone can control many different processes, for example, gibberellins regulate seed germination, stem growth, transition to flowering, and fruit development. In most instances, this regulation involves interaction of gibberellins with other hormones.

Currently, the lab is interested in cross-talk between gibberellins and two other types of plant hormones, auxin and jasmonic acid in the model plant Arabidopsis thaliana. Defining processes and mechanisms of how growth and development are regulated in Arabidopsis can provide information that can be useful to improve growth and productivity of crop plants.

Dr. Sponsel also has a long-standing interest in medicinal plants, and is currently collaborating with Dr. Francis Yoshimoto (Chemistry Department, UTSA) on a project to elucidate the final steps in biosynthesis of artemisinin in the plant Artemisia annua. Artemisinin is a potent drug for treating malaria.

Students in the lab use a variety of Arabidopsis mutants in which the biosynthesis, transport, signaling, or response of one hormone is perturbed to examine the effects of other hormones on the transcription of genes involved in hormone action. Plants are grown under sterile conditions and/or in environmental growth chambers prior to nucleic acid extraction and PCR. Expression of reporter genes is monitored histochemically, and by confocal microscopy.

Selected Publications and Funding

Link to Publications
https://scholar.google.com/s?user=Cu17BlcAAA&hl=en&oi=scholartitle

Active Projects
• Investigating the effect of jasmonic acid on gibberellin biosynthesis and signaling in wildtype plants and auxin mutants
• Effect of gibberellins on jasmonic acid biosynthesis and signaling. The metabolism of natural and unnatural precursors of artemisinin (with Dr. Frances Yoshimoto)
Research Focus
The goal of Dr. Apicella’s lab is to reveal the neural basis of perception. More specifically, he wants to understand exactly how cortical microcircuits process sensory information to drive behavior. To assess how populations of neurons concur to encode information, generate perceptions, and execute behavioral decisions requires working at both the cellular and system level. Towards this goal, by turning neurons “ON” and “OFF” using optogenetic and pharmacogenetic approaches, the lab can monitor and then manipulate specific subsets of neurons in awake behaving mice. This approach will allow the lab to quantitatively determine how specific subsets of neurons contribute to sensory processing and behavior. By complementing in vivo work with synaptic connectivity and network dynamics analysis in vitro, they are going to achieve a more complete understanding for how neural circuits in our brain support sensation, action, and cognition.

Training Opportunities
Optogenetics and whole-cell patch-clamp recordings to examine synaptic mechanisms in vitro, as well as in vivo. Optogenetics and Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) manipulation of relevant neural circuits in-vivo to modify behavior.

Selected Publications and Funding
• Hector Zurita, Crystal Rock, Jessica Perkins, Alfonso junior Apicella; A Layer-specific Corticofugal Input to the Mouse Superior Colliculus, Cerebral Cortex, Volume 28, Issue 8, 1 August 2018, Pages 2817–2833, https://doi.org/10.1093/cercor/bhx161
• Crystal Rock, Hector Zurita, Shannon Lebby, Charles J Wilson, Alfonso junior Apicella; Cortical Circuits of Callosal GABAergic Neurons, Cerebral Cortex, Volume 28, Issue 4, 1 April 2018, Pages 1154–1167, https://doi.org/10.1093/cercor/bhx025

Link to Publications
http://saci.uthscsa.edu/Active Projects
Cortical microcircuits process sensory information to drive behavior. Deciphering how populations of neurons encode information, generate perceptions, and execute behavioral decisions requires working at both the cellular and system levels.

Current Graduate Students
• Hector Zurita Apellaniz (Ph.D.)
Research Focus

My research interest focuses on investigating and applying the best teaching practices in STEM education. Pedagogy is defined as the method and practice of teaching. Unfortunately, many graduate programs in STEM (Science, Technology, Engineering, and Math) disciplines do not incorporate pedagogy in their training programs.

Scientific Teaching is a pedagogical method used in undergraduate science courses. The main idea of Scientific Teaching is to help scientists bring to teaching the critical thinking, rigor, creativity, and spirit of experimentation that defines research (Handelsman et al., 2007). Scientific Teaching involves three major components, Active learning, Assessment, and Inclusiveness.

Training Opportunities

I welcome students who are interested in investigating the impact of best teaching practices on student retention in STEM disciplines.

Selected Publications and Funding

All my funding is focused on student training programs. The goal is to increase underrepresented minorities in STEM.

- **Research Initiative for Scientific Enhancement (RISE)** is a developmental program that seeks to increase the number of students underrepresented in the biomedical sciences that complete Ph.D. degrees in these fields.
- **Maximizing Access to Research Careers (MARC) U*STAR** provides support for undergraduate students who are underrepresented in the biomedical sciences to improve their preparation for high-caliber graduate training at the Ph.D. level. Institutions with significant enrollments of college students from underrepresented groups may be eligible to apply.

Selected Publications, Conference Presentations and Funding

- **Student-Centered Teaching: Designing your course methods, assignments and assessments to optimize student’s opportunity to learn**, Institute on Teaching and Mentoring, November 2016.
- **Piloting a Pre-Research Program “Bootcamp” to Educate and Pre-Screen Undergraduate Students**. Gail Taylor, Danielle Gordon, J. Aaron Cassill & Edwin Barea-Rodriguez. 5th Annual Conference on Understanding Intervention that Broaden Participation in Research Careers, Baltimore, MD 5/10-12/12

Active Projects

- **Scientific Teaching as a pedagogical method to improve retention in STEM**
Research Focus
The main interest of my lab is to understand alterations on brain function by psychological stress. Using animal models, we use sophisticated tools to evaluate the evolution of stress-induced alterations in the activity of discrete neural populations and circuits. Particularly, we focus on limbic regions such as the amygdala and the medial prefrontal cortex, which are necessary for emotional learning, as well as their projections to key downstream regions that promote aversive and rewarding behavior, such as the periaqueductal gray and the nucleus accumbens, respectively. Ultimately, this research program will identify key neural elements that exhibit stress vulnerability, and reveal alterations on important neural mechanisms leading to emotional and behavioral deficits. In addition, molecular characterization of the neural populations exhibiting stress vulnerability may reveal key biomarkers that could be exploited to gather further insights.

Training Opportunities
Training future generations of influential neuroscientists is one of my top priorities. My lab provides a highly supportive and energetic atmosphere in which everyone collaborates and learn from each other while sharing rigorous scientific standards. My trainees learn sophisticated approaches such as neural recordings, optogenetics, chemogenetics, and neuropharmacology in behaving animals. These allow trainees to record the activity of discrete neural populations and circuits while turning them “ON” and “OFF” to evaluate their function during particular learning and behavioral tasks. Other approaches in my lab include immunohistochemistry, tissue imaging, and molecular profiling techniques. Trainees in my lab also have the opportunity to develop innovative behavioral assays, apply computational skills, and use machine learning algorithms to evaluate complex neural functions.

Selected Publications and Funding

Link to Publications
https://www.ncbi.nlm.nih.gov/pubmed/?term=burgos-robles+a

Active Projects
- Stress-induced perturbations on fear circuits.
- Stress-induced alterations on observational learning.
Research Focus
The long-term goal of my laboratory is to understand the mechanisms that regulate plasticity in living organisms. In its simplest definition, plasticity is the capacity of single- or multi-celled organisms to adapt to their environment. Using the mouse as a model organism, our research focuses on neural crest and preimplantation embryonic cells to study plasticity. Neural crest cells are multipotent progenitor stem cells that are unique to vertebrates. In addition to giving rise to most peripheral neurons and glial cells, neural crest cells give rise to an array of cell types that make up the head. Preimplantation embryonic cells are the ultimate in vertebrate cellular plasticity; they have the potential to differentiate into both embryonic and non-embryonic tissues, which includes the placenta. These broad categories of cell types thus provide us a solid platform to dissect the molecular basis of cellular plasticity in a mammalian model organism.

Training Opportunities
Training future generations of influential My laboratory is interested in understanding how epigenetic and chromatin remodeling proteins control cell fate in the mouse. One of our projects focuses on the contribution of neural crest cells on the postnatal growth of the skull. We’ve found that misregulation of the epigenetic landscape in neural crest cells during mid-gestation manifests in loss of multi-progenitor stem cells in the postnatal skull. This phenotype mimics the leading development disorder of the human skull. The other project explores mechanisms that prevent embryonic or adult somatic cells from de-differentiation or transforming into other cell types. The latter project is significant due to its broad implications from regenerative medicine and cancer to evolution.

Selected Publications and Funding

Funding
NSF-EAGER: Reprogramming to the Totipotent State

Link to Publications

Active Projects
- Epigenetic control of neural crest cells and postnatal growth of the skull
- Regulation of reprogramming and preimplantation development

Current Graduate Students
- Eric Cheng (Ph.D.)
Melanie Carless, Ph.D.
Associate Professor

Research Focus
My research focuses on identifying genetic and epigenetic factors associated with complex diseases, and in understanding how these might contribute to disease risk, and be leveraged as potential novel therapies. I am particularly interested in how epigenetic mechanisms such as DNA methylation, DNA hydroxymethylation and microRNAs contribute to gene regulation, and consequently risk for metabolic disorders (e.g., diabetes and obesity) and neurological and psychiatric diseases (e.g., Alzheimer’s disease, schizophrenia, bipolar disorder). To accomplish this, my laboratory employs a range of approaches, including cohort-based studies, post-mortem tissue analysis, animal models and cell-based systems, as well as cutting-edge technologies, including stem cells, organoids, next-generation sequencing and epigenetic editing using the CRISPR/dCas9 system.

Training Opportunities
I have several ongoing projects in my laboratory, including pilot projects in the early stages of development. As part of a collaborative study, we are investigating the role of DNA methylation in energy homeostasis and obesity in Hispanic children, we are incorporating next-generation sequencing and epigenetic editing of stem cell-derived human skeletal muscle cells to understand how DNA methylation might mediate energy-related phenotypes to increase risk for obesity. My laboratory is also using epigenetic editing to study how altered DNA methylation in stem cell-derived neurons might impact the production of amyloid beta in cell lines from patients with Alzheimer’s disease. Additionally, I am investigating how DNA hydroxymethylation changes during neurodevelopment, using cortical spheroids (organoids) as a proxy, and how this might be altered in cell lines derived from patients with bipolar disorder. Finally, my laboratory also focuses on developing and optimizing improved technologies for epigenetic editing and next-generation sequencing.

Selected Publications and Funding

Link to Publications

Active Projects
- Epigenetics of energy homeostasis, bioenergetics and obesity
- Establishing a miRNA biomarker signature for brain structural variation in a non-human primate model
- In vitro 3D modeling of neurodevelopment: the role of hydroxymethylation and its implications for bipolar disorder
- Epigenetic editing of neuronal cells as a treatment modality in Alzheimer’s disease
Research Focus

My lab studies the cellular and molecular mechanisms that control neural stem cells in the hippocampus ("adult neurogenesis") as well as a "disease-in-a-dish" approach, which uses patient stem cells to re-create human brain disorders in the lab. We were the first group to use a transgenic mouse to ablate adult-born granule neurons, and we showed this decreased seizure development later in life. Also, we use optogenetic and chemogenetic tools to define the critical period and circuit mechanism that govern the aberrant properties of adult-born granule neurons in the hippocampus circuitry. To translate our work to patients, we use human induced pluripotent stem cells to evaluate the role of genetic mutations in epilepsy and neurodegenerative disorders, ultimately for precision medicine. Our goal is to develop novel strategies to treat or prevent neurological disorders, such as acquired and genetic forms of epilepsy, or neurodegenerative disorders, such as Alzheimer's disease.

Training Opportunities

My lab is interested in using novel tools, such as human induced pluripotent stem cells, CRISPR/Cas9 gene editing, and chemical biology to elucidate the basic mechanisms of neurological disorders. We have an open human subject research protocol to collect blood and tissue samples from patients in order to make human induced pluripotent stem cells, and we use CRISPR/Cas9 gene editing technology and 3D human brain organoids to understand the causes of different neurological disorders. We also have an open, active animal research protocol in order to study epilepsy by using a mouse model.

Selected Publications and Funding

- R01NS113516 – “Precision models of ARX-associated neurodevelopmental disorders”. The goal of this project is to use human brain organoid models to understand pAla function in normal and abnormal brain development.
- R01NS093992 – “Targeting aberrant neurogenesis to prevent epilepsy and associated cognitive decline”. The goal of this project is to understand the role of adult-born neurons in epilepsy and memory using transgenic and conditional knockout mice.
- R01NS089770 – “Circuitry mechanisms underlying new neuron development in adult and epileptic brain”. The goal of this project is to determine the role of sphingolipid signaling in circuit regulation of adult-born neurons in normal and epileptic mice.

Link to Publications

https://www.utsa.edu/hsiehlab/
https://www.utsa.edu/bhc/index.html

Active Projects

- Cellular, molecular, and circuit mechanisms of adult-born granule neurons in epileptogenesis
- Role of genetic variants and environmental factors in brain disorders using human 3D organoids

Current Graduate Students

- Erin Hurley (Ph.D.)
- Courtney McMahon (Ph.D.)
- Karina (Kaisha) Meyer (Ph.D.)
- Raul Wilshire (Ph.D.)
- Grey De La Torre (M.S.)
- Florencia Salinas (M.S.)
Aaron Cassill, Ph.D.  
Professor  
Research Focus  
I am interested in issues that prevent students from successfully completing their education. I am especially interested in problems encountered by students from successfully completing their education.  

A second area of interest is how pain information is regulated by the dorsal root ganglion. The "gate theory" proposes that pain information is filtered within the spinal cord when the gates are open, pain messages flow freely and pain can be intense. When the gates are closed, pain messages are prevented from reaching the brain and may not even be experienced. As part of an international collaboration, we have found that the dorsal root ganglion (DRG) that lies before the spinal cord, can actively filter pain information. Because the DRG is part of the peripheral nervous system, and not the central nervous system, it presents an important target for the therapeutic control of pain.

Training Opportunities  
• The effects of stress on hippocampal function using a combination of in vitro and in vivo electrophysiological (whole cell recording and extracellular field recording, respectively), along with chemogenetic and imaging approaches.  
• How BK channels affect the excitability of dentate gyrus granule neurons are studied using electrophysiological analysis and biophysical computer modeling.

David B. Jaffe, Ph.D.  
Professor  
Selected Publications and Funding  
• Funding: National Science Foundation (1456862) “Understanding how BK Potassium channels enhance a neuron’s input/output function”  

Link to Publications  
• https://www.ncbi.nlm.nih.gov/pmc/ articies/PMC4247381/  
• http://jn.physiology.org/content/114/6/3140.long  
• https://www.ncbi.nlm.nih.gov/pmc/ articies/PMC4190997/  
• http://jn.physiology.org/content/116/2/456.long  

Current Graduate Students  
• Thomas Jordan (M.S.)
Research Focus
Dr. Lee’s research is focused mainly on the understanding of the pathological mechanism(s) underlying the selective neurodegeneration in Alzheimer disease (AD) and other neurodegenerative diseases. Multiple molecular mechanisms identified from previous research in the lab which would lead to the development of the effective therapy. Among these identified mechanisms, ongoing research in the lab is focused on following topics.

Cell cycle re-entry in neurodegeneration
Aberrant cell cycle activation in neurons is now emerging as a key pathogenic mechanism in many neurodegenerative diseases including AD. The lab has recently developed the transgenic mouse models to study the role of aberrant cell cycle re-entry in neurodegeneration and, with these animal models, the lab focuses on elucidating molecular and cellular mechanism how cell cycle re-entry causes neurodegeneration.

Insulin signaling in AD
Defects in glucose metabolism and insulin signaling in AD brain have also been suggested as an underlying cause of neurodegeneration in AD although its causal mechanism is elusive. Dr. Lee’s lab has been studied potential mechanisms causing dysregulation of neuronal insulin signaling and its pathological effect on AD. Several molecular targets have been identified in the lab and the lab is actively pursuing to reveal the molecular/cellular mechanism and its pathological role in AD.

Training Opportunities
1. Cell cycle re-entry in neurodegeneration. Aberrant cell cycle activation in neurons is now emerging as a key pathogenic mechanism in many neurodegenerative diseases including AD. We have recently developed the transgenic mice models to study the role of aberrant cell cycle re-entry in neurodegeneration and current research focus on how cell cycle re-entry causes neurodegeneration in these animal models.

2. Insulin signaling in AD. Defects in glucose metabolism and insulin signaling in AD brain tissues have been suggested as an underlying cause of neurodegeneration in AD although its causal mechanism is elusive. My lab has been studied potential mechanisms causing dysregulation of insulin signaling in neurons and its pathological effect on AD.

Selected Publications and Funding

Link to Publications

Active Projects
- Pathological role of cell cycle re-entry in neurodegeneration
- Insulin signaling in neurons and its pathological significance in neurodegeneration.
Aaron Cassill, Ph.D.
Professor
Research Focus
I am interested in issues that prevent students from successfully completing their education. I am especially interested in what extent stem and progenitor cells become cancer-initiating cells. Thus, our work has potential implications for basic stem cell and cancer biology as well as translational significance for treatment and prevention of diseases.

Training Opportunities
The approaches used in Lin's laboratory include animal models, genome editing, single cell and large-scale imaging, and proteogenomics. These innovative technologies can be implemented in any well-functioning laboratory, and several aspects are ideally suited for independent research for undergraduate and graduate students. The interdisciplinary nature of research activities in Lin's laboratory makes it an ideal program for research training at the interface of cancer research, neurobiology, stem cell biology, bioinformatics, and molecular biology.

Selected Publications and Funding
- **Bioinformatics, and molecular biology.**
  The ongoing projects seek to understand the role of stem and progenitor cells in cancer research, neurological diseases, and environmental impact.

- **The general theme of research in my lab is cell fate regulation in the human health and diseases with a focus on the intersection of stem cells and cancer biology.** The ongoing projects seek to understand the role of stem and progenitor cells in cancer research, neurological diseases, and environmental impact.

- **Epigenetic Regulation in Stem Cells and lineage specification**
  Cross-species Analyses Unravel the Complexity of H3K27me3 and H4K20me3 in the Context of Neural Stem Progenitor Cells. Neuroepigenetics 6, 10-25 (2016). PMID: 27429906; PMCID: PMC4944106

- **Protein-based Approach for Genome Editing**
  Cross-species Analyses Unravel the Complexity of H3K27me3 and H4K20me3 in the Context of Neural Stem Progenitor Cells. Neuroepigenetics 6, 10-25 (2016). PMID: 27429906; PMCID: PMC4944106

- **Biomarker and therapeutic intervention via big data and multi-omics**
  Cross-species Analyses Unravel the Complexity of H3K27me3 and H4K20me3 in the Context of Neural Stem Progenitor Cells. Neuroepigenetics 6, 10-25 (2016). PMID: 27429906; PMCID: PMC4944106

- **Epigenetic Regulation in Stem Cells and lineage specification**
  Cross-species Analyses Unravel the Complexity of H3K27me3 and H4K20me3 in the Context of Neural Stem Progenitor Cells. Neuroepigenetics 6, 10-25 (2016). PMID: 27429906; PMCID: PMC4944106

- **Protein-based Approach for Genome Editing and Therapeutics**
  Cross-species Analyses Unravel the Complexity of H3K27me3 and H4K20me3 in the Context of Neural Stem Progenitor Cells. Neuroepigenetics 6, 10-25 (2016). PMID: 27429906; PMCID: PMC4944106

Link to Publications

Active Projects
- Biomarker and therapeutic intervention via big data and multi-omics
- Environmental Impact in Development and Neurological Diseases
- Epigenetic Regulation in Stem Cells and lineage specification
- Protein-based Approach for Genome Editing and Therapeutics

Current Graduate Students
- Madeleine Moseley (M.S.)

Chin-Hsing Annie Lin, Ph.D.
Associate Professor
Aaron Cassill, Ph.D.
Professor

Research Focus
I am interested in issues that prevent students from successfully completing their education. I am especially interested in problems encountered by students from successfully completing their education. I am especially interested in the challenges faced by students from underrepresented backgrounds in pursuing STEM careers. My goals include identifying the barriers that prevent students from successfully completing their education and developing strategies to address these issues. I am particularly interested in advancing the following initiatives:

- NSF S-STEM Scholarships- "Retaining Students" PI Cassill, funding $1,392,192 from 9/1/13-8/31/18
- GEEMS Program to Prepare Highly Qualified Math and Science Teachers. Christine Moseley and Aaron Cassill, Zephyr Teachout, Breaux & Martin, 19/13-2015
- Association of Public and Land-Grant Institutions, Baltimore, MD 10/16-2015
- Breaux & Martin in Research Careers, Baltimore, MD 10/16-2015
- Emerging Alamo College Talent in STEM

Selected Publications and Funding

*Authors contributed equally

Link to Publications

Active Projects
- The wiring of taste at the periphery
- Chemosensation in the gut and the role of vagal ganglia neurons
- Reflex circuits in the NST (Nucleus of the Solitary Tract)

Current Graduate Students
- Bryan Fowler (Ph.D.)
- Sonya Djikeng (M.S.)

Lindsey Macpherson, Ph.D.
Assistant Professor

Research Focus
The Macpherson lab is interested in investigating the sense of taste and the molecules, cells, and circuits involved in chemosensation from the tongue and gut to the brain. Taste receptor cells on the tongue are specialized to be activated by only one of the five taste qualities, and signal that information to discrete populations of neurons in the gustatory ganglia through “labeled lines”. This hard-wired, labeled line connectivity pattern is essential for our ability to correctly detect and discriminate tastes. The lab is interested in understanding how this gustatory circuit is organized at the cellular and molecular level. Less well understood are chemosensory cells in the gut – which have many parallels to taste receptor cells – and may signal the presence of nutrients, toxins, and microbial metabolites to peripheral sensory neurons in the vagal ganglia. We aim to identify the cells and signaling mechanisms necessary for this gut-brain communication.

Training Opportunities
Our lab combines the power of mouse genetics with in vivo functional imaging of gustatory and vagal ganglia neurons. We use molecular cloning and BAC recombineering to engineer transgenic mouse lines for Cre-dependent expression of imaging and optogenetic toolkit genes (like GFP, GCaMP, and Channel Rhodopsin) within specific populations of cells. We also use CRISPR gene targeting to create knockout mouse models faster and easier than traditional methods. In addition to using circuit mapping techniques such as GFP Reconstitution Across Synaptic Partners (GRASP), we can manipulate these circuits with optogenetics, and assay the effect of their manipulation with behavioral assays. As a new lab (Fall 2017), we are looking forward to training PhD Students, Masters Students, and Undergraduates.
**Research Focus**

My lab is interested in understanding the molecular and physiological aspects of cellular dysfunction that occur in the brain with aging, injury, or disease. Using pluripotent stem cells induced from human patients (hiPS) with Alzheimer’s disease (AD), Frontotemporal Lobar Degeneration associated with Dementia (FTLD), or Amyotrophic Lateral Sclerosis (ALS), we apply several differentiation paradigms to generate and isolate distinct subgroups of fate-committed neurons and glia of the cortex.

These cells are then co-cultured with cells derived from transgenic mouse models to produce physiologically functional circuits, which are useful in determining the molecular interactions that render specific neural cell types susceptible or resistant to neurotoxicity at distinct, progressive stages of disease.

**Training Opportunities**

To study cellular dysfunction with neurodegeneration, the Maroof lab implements several novel and published models for AD, FTLD, or ALS. Through in vitro assays that use co-cultures of both primary neural cells isolated from transgenic mice and hiPS cells differentiated into forebrain-committed neurons and glia, several defined pathological stages of disease progression can be examined using biological and physiological techniques.

Upon discovery of the molecular determinants that lead to toxicity or resistance in distinct human neuronal subgroups, these in vitro assays would be applicable in high throughput screening (HTS) platforms enabling the identification of novel therapeutic targets at pre- and post-symptomatic stages.

Furthermore, several fundamental aspects of human cortical circuit maturation, from the formation of synaptic connections to the modulation of neuronal network behavior, will be studied using live cell fluorescence microscopy, multi-electrode array recordings, single cell characterization, and genome modification techniques.

**Selected Publications and Funding**


**Link to Publication**


**Active Projects**

The Role of Cortical Projection Neurons Susceptible to Progressive Degeneration with Age (K99/R00)

**Current Graduate Students**

- Zachary Jordan (Ph.D.)
- Kanaan Thangamani (Ph.D.)
- Charles Hutchinson (M.S.)
- Ahmed Khan (M.S.)
Research Focus
Dr. Muzzio’s research focuses on the variables that affect spatial navigation and episodic memory - events occurring in specific contexts at particular times. Her lab investigates how neurons in the hippocampus and other areas of the medial temporal lobe form representations of context that facilitate navigation and memory encoding. Specifically, she studies how these representations change when animals are lost, under conditions of stress and fear, and following sleep deprivation. Dr. Muzzio’s lab addresses these questions conducting long-term single cell recordings in freely moving mice in combination with pharmacological, genetic, behavioral, and computational tools.

Training Opportunities
Trainees in Dr. Muzzio lab learn sophisticated in vivo electrophysiological tools in combination with various pharmacological, and genetic approaches. Additionally, trainees learn to design and conduct complex behavioral experiments and use several computational and statistical approaches for data analysis.

Selected Publications and Funding

Active Projects
- Neural substrates of spatial reorientation: Oriented navigators use internal and external cues to keep track of their bearings. However, during disorientation, internal cues are disrupted, and navigators must rely on external cues to reorient. We study how these cues are used and represented in the brain combining in vivo recordings and computational tools.
- Role of the ventral hippocampus in emotional learning: While the role of the dorsal hippocampus in spatial processing is well established, the function of the ventral region remains unclear. We investigate the function of this area combining single unit recordings, optogenetic, cell-specific chemogenetic silencing, and pharmacological tools.
- Sleep patterns and aging. In aged animals sleep patterns become more fragmented. We investigate if sleep fragmentation contributes to the cognitive decline observed in aging conducting in vivo recordings and biochemical assays.

Current Graduate Students
- Celia Gagliardi (Ph.D.)
- Matthew Lopez (Ph.D.)

Link to publications
Carlos Paladini, Ph.D.  
Professor

Research Focus
Activity patterns in the brain establish the manner by which sensory information is perceived, salience is assigned, and motor output is performed. Transient, activity-dependent release of dopamine is critical for natural processing in the brain. Disruptions of dopamine activity result in many of the symptoms of a wide range of psychiatric diseases, drug addiction, and in the extreme case of the degeneration of these cells, to Parkinson’s Disease.

In vitro studies have determined that ion channel proteins drive the activity patterns of dopamine neurons. The multitude of physiological consequences of their opening and closing makes ion channels and their associated receptors highly compelling as important therapeutic targets for treating many of the symptoms of mental illnesses and neurological disorders.

Training Opportunities
We investigate the cellular, synaptic, and circuit mechanisms by which inputs to dopamine neurons influence their activity, and how they are changed in various disease states. These inputs include not only other neurons in the brain, but also a type of glia cells called astrocytes. To achieve this, we use selective in vitro and in vivo manipulation of identified inputs following prior viral infection with light-sensitive opsins. This strategy gives us a unique opportunity to dissect and individually examine all the components necessary for dopamine cell activity.

Our lab has developed methods to individually manipulate identified neuronal inputs and astrocytes. We also have developed methods to record the electrical activity of dopamine neurons in vivo. Training is provided not only in these technical advances but also in experimental design, publication and funding strategies, and scientific advancement.

Selected Publications and Funding
- Quraishi S.A., Paladini CA.; A Central Move for CB2 Receptors. Neuron. 2016 http://dx.doi.org/10.1016/j.neuron.2016.05.012

Link to Publications

Active Projects
- "Ion Channels of Reward Related Behavior." This study is an investigation of the specific cellular channels and receptors that drive dopamine neuron firing pattern during reward related behavior.
- "Cellular Mechanisms of Dopamine Neuron Bursting." This study is an investigation of the cellular mechanisms that enable dopamine neurons to fire at high frequencies.
- "Mechanisms of cocaine hypersensitivity following chronic DBH inhibition." This study will address the effects of chronic reduction of the norepinephrine precursor enzyme, dopamine beta hydroxylase, on the responses of striatal spiny projections neurons to exposure to dopamine.
- "The Synaptic Origin of Reward Prediction Error Signal in Dopamine Neurons." This study is an investigation of the neuronal and astrocytic components that are capable of driving dopamine neurons to burst or pause, and how drugs of abuse change the influence of each input.

Current Graduate Students
- Jorge Gomez (Ph.D.)
- Jessica Perkins (Ph.D.)
Dr. Perry’s studies are focused on the mechanism of formation and physiological consequences of the cytopathology of Alzheimer disease. The lab has shown that oxidative damage is the initial cytopathology in Alzheimer disease. They are working to determine the sequence of events leading to neuronal oxidative damage and the source of the increased oxygen radicals. Current studies focus on:
1. role of redox active metals in mediating prooxidant and antioxidant properties
2. mechanism of phosphorylation control of oxidative damage to neurofilament proteins
3. Mass spectrometry analysis of protein metal binding and crosslinking

Selected Publications and Funding

Active Projects
- Mass spectrometry of disease related structures
- Metal catalyzed redox chemistry
- Mitochondria dynamics
- Stem cell models of disease

Link to Publications
http://scholar.google.com/?user=ySklo5EAAAAJ&hl=en&oi=ao
https://www.ncbi.nlm.nih.gov/pubmed/?term=Perry%20%5BAuthor%5D&cauthor=true&cauthor_uid=29111606
Fidel Santamaria, Ph.D.
Professor

Research Focus
I am a computational neuroscientist with two main lines of work. The first one is to understand how the cerebellum processes and stores information. In particular I study a really beautiful neuron called the Purkinje cell. My second line of research is very theoretical. Here my interest is to understand how the engram, the physical foundation of memory, is implemented by the interaction of processes spanning multiple scales of biological organization, from molecules to neuronal networks. For this I use fractional order differential equations, a branch of mathematics that is the natural language to describe complex systems.

My long term objective is to combine theory, modeling, and experiments to understand how the cerebellum computes information; develop closed-loop systems for neuronal control, particularly those associated with deep brain stimulation; and neuromorphic devices for the solution of real-time complex signal analysis for brain machine interfaces.

Training Opportunities
In my laboratory people can be trained in modeling, electrophysiology, and imaging. Our modeling uses all available resources, from ready to use software to our own algorithms. We run our simulations in local servers, computer clusters, super-computers, and even the cloud.

The experimental work that my lab performs requires performing intracellular recordings in live neurons in vitro. These recordings can be done also using fluorescent markers to then be visualized in a two- photon microscope. With this approach we can control and monitor the electrical activity of the neuron while also visualizing biochemical signals in its complex dendrites. Ideally, all students in the lab should combine modeling and experimentation for their work.

Selected Publications and Funding

Link to Publications
- http://www.utsa.edu/SantamariaLab/
- https://scholar.google.com/citations?user=7zf6DMEAAAAJ&hl=da
- https://www.researchgate.net/profile/Fidel_Santamaria

Active Projects
- NSF-DBI: BRAIN EAGER: Analyzing and modeling power-law behaviors in neuroscience

Current Graduate Students
- Chenling Fang (Ph.D.)
Research Focus
Senseman’s Genome Lab is currently in the process of refocusing its research efforts from neurophysiological studies of cortical processing towards the study of the genetic basis of mammalian behavior. Much of the advanced computational and visualization techniques that were developed for high-speed imaging of cortical behavior are now being reapplied to the analysis of genomic data. Of particular interest is the remarkable behavioral repertoire of the dog, Canis familiaris. There are currently more than 350 distinct breeds that have been selected largely based on morphological and/or behavioral traits. Because of selective breeding over many generations, many of these behavioral phenotypes are either fixed or close to fixation in large number of populations. This high level of fixation provides a unique and very powerful tool for identifying specific gene regions associated with breed-specific behaviors. To fully exploit these advantages, a large compute server (called “Great Dane”) was constructed in the lab for genomic analysis.

Training Opportunities
Opportunities exists for students to learn how to use Linux workstations for genomic analysis using the R software language in combination with the RStudio integrated software development environment (IDE).

Selected Publications and Funding
- UMB-Institutional, Preparing Computational Biologists by Encouraging an Academic Minor Collaborative grant to enhance quantitative skills in biology undergraduates and biological skills in mathematics and statistics undergraduates through mentored research in computational biology, 9/1/06-8/31/11
Research Focus
I am interested in issues that prevent students from successfully completing their education. I am especially interested in problems encountered by students transferring from community college to four-year institutions and increasing the number of underrepresented students entering research careers.

Selected Publications and Funding
• Piloting a Pre-Research Program “Bootcamp” to Educate and Pre-Screen Undergraduate Students. Gail Taylor, Danielle Gordon, J. Aaron Cassill & Edwin Barea-Rodriguez 5th Annual Conference on Understanding Intervention that Broaden Participation in Research Careers, Baltimore, MD 5/10-12/12
• GEEMS Program to Prepare Highly Qualified Math and Science Teachers. Christine Moseley and Aaron Cassill, Science and Math Teacher Imperative, Association of Public and Land-Grant Institutions, Alexandria, VA 6/6-8/12

Funding
• NSF Noyce Scholarships - “Scholarship Support for Community College Transfer Students” PI Cassill, $1,392,192 9/1/13-8/31/18
• NSF S-STEM Scholarships - “Retaining Emerging Alamo College Talent in STEM (REACT-STEM)” PI Cassill, $637,188 8/1/15-7/31/20

Link to Publications
https://www.ncbi.nlm.gov/sites/myncbi/1dsM8isSv3_A7/bibliography/48011320/public//sort=date&direction-ascending
**Research Focus**

Research in the Troyer lab focuses on the question of how neural activity is coordinated within neural circuits to produce behavior. One set of research questions centers on studies of vocal communication in songbirds. Songbirds are an excellent model system for understanding how the brain orchestrates activity on multiple timescales to produce a complex sequence of actions.

A second line of research employs theoretical and modeling techniques to gain fundamental insights into how noise and variability influence computations in neural circuits. Particular questions include neural resonance and synchronization within cells and circuits, and the emergence of power law behavior.

**Training Opportunities**

Research in the Troyer lab combines theoretical and computer modeling techniques with detailed analysis of vocal behavior. Students receive training in a broad range of techniques in computational neuroscience. More theoretical research is based on a solid grounding in mathematical approaches to studying and modeling nonlinear dynamical system, including the use of phase response curves and stochastic differential equations.

Students investigating vocal behavior will learn a range of modern signal processing techniques. All students receive extensive training in computer programming and gain familiarity with modern statistical and machine learning approaches to data analysis.

**Selected Publications**


**Active Projects**

- Investigations of sequence representations in Bengalese Finches
- Power law behavior and fractional differential equation modeling of cortical circuits
- Modeling of neural oscillators in the Basal Ganglia

**Link to Publications**

www.ncbi.nlm.nih.gov/myncbi/browse/on/47557703/?sort=date&direction=descending
Research Focus
Our research focuses on the neural circuits that control reward-seeking actions (positive reinforcement) as well as the avoidance of aversive outcomes (negative reinforcement). We are particularly interested in how the mesolimbic dopamine system governs actions in a regionally and temporally defined manner. Our goal is to identify and reverse neural adaptations underlying aberrant motivational processes in models of psychiatric disorders.

Training Opportunities
Training opportunities are available for undergraduate students, graduate students, and postdoctoral fellows. The lab employs a diverse array of experimental techniques, including fast-scan cyclic voltammetry, optogenetics, chemogenetics, and fiber photometry.

Selected Publications and Funding

Active Projects
- Elucidating the regional specificity of dopamine’s control over cue-elicited behaviors
- The acute and long-term effects of stress on dopamine release and behavior
- Neural circuits mediating changes in subjective preference
- Delineating astrocyte-neuron interactions within the ventral midbrain

Current Graduate Students
- Merridee Lefner (Ph.D.)


Link to Publications
- www.wanatlab.org
Research Focus
Our research focuses on understanding how the brain processes language in real time using both behavioral and brain imaging techniques. The lab has three primary areas of research that encompass our work:
I. Neural time course of language comprehension
II. Cognitive neuroscience of bilingual language and cognition
III. Interface between language and other cognitive processes (e.g., math)

Training Opportunities
Inquire about possible training opportunities for undergraduate, graduate and postdoctoral researchers.

Selected Publications & Funding

Funding:
• R21HD098878-National Institute of Child Health and Human Development. Localizing arithmetic in the developing bilingual brain
• R21HD079884-National Institute of Child Health and Human Development. Brain and behavior of multiplication fact retrieval in bilingual children
• DBI1451032 (Santamaria, F. PI)- National Science Foundation. BRAIN EAGER: Analyzing and modeling power-law behaviors in neuroscience

Link to Publication

Active Projects
• Arithmetic in the developing bilingual brain
• Neurobiology of bilingual language comprehension
• http://www.utsa.edu/biology/faculty/WichaLab/

Current Graduate Students
• Vanessa Cerda (Ph.D.)
• Amandine Grenier (Ph.D.)
• Matthew Wood (Ph.D.)
• Tara Flaugher (M.S.)
Research Focus
We study the circuitry and neurons of the basal ganglia, with the goal of understanding the computational function of these structures at the cellular level, and their dysfunction in diseases, especially Parkinson’s Disease. Our experiments are focused on the ionic mechanisms that endow each cell type with its characteristic responses to synaptic input, the patterns of connectivity that deliver specific inputs to each cell, and the dynamics that arise from the combination of these.

Our experiments are focused on the ionic mechanisms that endow each cell type with its characteristic responses to synaptic input, the patterns of connectivity that deliver specific inputs to each cell, and the dynamics that arise from the combination of these.

Training Opportunities
We use intracellular recording, fluorescence microscopy and computer simulations to study the intrinsic properties of basal ganglia neurons, their connectivity and their network dynamics.

Selected Publications & Funding
Funded by NIH/NINDS R35NS097185

Link to Publication

Active Projects
- Oscillations and Resonance in the Basal Ganglia

Current Graduate Students
- Juan Morales (Ph.D.)