



FOUNDATION FOR ANESTHESIA EDUCATION AND RESEARCH

Medical Student Anesthesia Research Fellowship 2009 Host Departments and Projects

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Section B. Detailed Project Listings**Children's Hospital of Philadelphia**

Research Topic:	Intubation characteristics of the Storz Video laryngoscope, Glidescope and direct laryngoscopy in children less than two years of age.
Mentor(s):	John Fiadjoe, MD
Student Role:	Assisting with patient recruitment, data collection, and assisting manuscript preparation.
Research Topic:	Prospective randomized multicenter comparison of the Intubating laryngeal airway (Air Q) and the laryngeal mask airway in infants.
Mentor(s):	John Fiadjoe, MD
Student Role:	Assisting with patient recruitment, data collection, and assisting manuscript preparation.
Research Topic:	Retrospective Review of Perianesthetic Events in Patients with Noonan Syndrome
Mentor(s):	Ari Weintraub, MD
Student Role:	Data extraction and collection from computerized database, data analysis.
Research Topic:	Postoperative problems in tonsillectomy patients under 3 years of age.
Mentor(s):	David Cohen, MD
Student Role:	Data extraction and collection from computerized database, data analysis.
Research Topic:	Pharmacogenomics of Morphine Sulfate in Pediatric Day Surgery Patients.
Mentor(s):	Scott Cook-Sather, MD
Student Role:	Patient recruitment, data collection, manuscript preparation.
Research Topic:	Investigations into the putative neurotoxicity of potent inhalational anesthetics using a neonatal rat pup model.
Mentor(s):	Lynnae Schwartz, MD
Student Role:	Cell culture, immunocytochemistry, fluorescence microscopy and volumetric image analysis, phenotypic response to challenge with inflammatory substances, analysis of protein and gene expression for substances and receptors of interest.
Research Topic:	Effects of the tachykinin Substance P on neural progenitor and astroglial differentiation and function.
Mentor(s):	Lynnae Schwartz, MD
Student Role:	Cell culture, immunocytochemistry, fluorescence microscopy and volumetric image analysis, phenotypic response to challenge with inflammatory substances, analysis of protein and gene expression for substances and receptors of interest.
Research Topic:	Quantitative analysis of neural progenitor expression in archival brain from HIV-1 infected infants and children.
Mentor(s):	Lynnae Schwartz, MD
Student Role:	Cell culture, immunocytochemistry, fluorescence microscopy and volumetric image analysis, phenotypic response to challenge with inflammatory substances, analysis of protein and gene expression for substances and receptors of interest.
Research Topic:	Role of immune system in pain and analgesia during early development
Mentor(s):	Gordon Barr, PhD
Student Role:	Behavioral testing of animals; preparation and assay of brain and spinal cord of rats for quantitative measurement of mRNA and protein of cytokines and other immune markers. Cell counting under microscope. Sectioning of tissue etc.

Children's Memorial Hospital - Chicago

Research Topic:	4% Lidocaine Spray to the Vocal Cords: Can this decrease Adverse Airway Reactions in Children with Upper Respiratory Tract Infections.
Mentor(s):	Santhanam Suresh, MD
Student Role:	Active Participation in the Study

Research Topic:	Postoperative Pain Control in Children Undergoing Laparoscopic Appendectomy: Comparison of Peripheral Nerve Blocks to Local Anesthetic Infiltration
Mentor(s):	Santhanam Suresh, MD
Student Role:	Active Participation in the Study

Research Topic:	Ultrasound Guidance for Localization of the Bifurcation of the Sciatic Nerve in Children: Validation of a Mathematical Formula
Mentor(s):	Santhanam Suresh, MD
Student Role:	Active Participation in the Study

Research Topic:	Pharmacodynamics of Bupivacaine in Infants and Children Undergoing Caudal Blockade for Penile Surgery in Children: A Mathematical Modeling for Optimal Dosing
Mentor(s):	Santhanam Suresh, MD
Student Role:	Active Participation in the Study

Cleveland Clinic

Research Topic:	Regional analgesia and recurrence of breast cancer after potentially curative surgery
Mentor(s):	Daniel Sessler, MD
Student Role:	Patient enrollment, measurements, data analysis

Research Topic:	Evaluation of a new non-invasive thermometer
Mentor(s):	Andrea Kurz, MD
Student Role:	Patient enrollment, measurements, data analysis

Research Topic:	Dexmedetomidine and postoperative delirium
Mentor(s):	Leif Saager, MD
Student Role:	Patient enrollment, measurements, data analysis

Columbia University College of Physicians & Surgeons

Research Topic:	Airway GABAA receptors and reactive airway diseases (basic)
Mentor(s):	Charles Emala, MD
Student Role:	Assist with measuring airway smooth muscle contraction in vitro

Research Topic:	Neurokinin and GABA _B receptor signaling (basic)
Mentor(s):	Charles Emala, MD
Student Role:	Assist with in vitro cell signaling experiments

Research Topic:	Nicotinic Agonists as analgesic drugs (basic and clinical)
Mentor(s):	Pamela Flood, MD
Student Role:	Assist with cellular biochemistry (basic) or patient recruitment (clinical)

Research Topic:	Determinants of post-operative cognitive dysfunction (clinical)
Mentor(s):	Eric Heyer, MD, PhD
Student Role:	Assist with patient recruitment and administration of neurocognitive tests

Research Topic:	Cellular signaling regulating airway smooth muscle contraction (basic)
Mentor(s):	Carol Hirshman, MD
Student Role:	Assist with in vitro cell signaling experiments

Research Topic:	Acute kidney injury after liver IR (basic)
Mentor(s):	HT Lee, MD, PhD
Student Role:	Assist with in vitro cell signaling experiments

Research Topic:	Volatile anesthetic and lipid kinases (basic)
Mentor(s):	HT Lee, MD, PhD
Student Role:	Assist with in vitro cell signaling experiments

Research Topic:	Dexmetomidine and radiocontrast nephropathy (basic)
Mentor(s):	HT Lee, MD, PhD
Student Role:	Assist with in vitro cell signaling and mice experiments

Research Topic:	Epidemiology of anesthesia-related morbidity and mortality (epidemiological)
Mentor(s):	Guohua Li, MD, PhD
Student Role:	Assist with literature review, research design, data collection, and manuscript development

Research Topic:	Anesthesia Safety Indicators
Mentor(s):	Guohua Li, MD, PhD
Student Role:	Pursuing an independent study under the supervision of established investigators and within ongoing research projects

Research Topic:	Beta-adrenergic receptor genotype and premature labor (clinical)
Mentor(s):	Richard Smiley, PhD, MD
Student Role:	Assist with patient recruitment and laboratory genotyping

Research Topic:	Post-anesthesia emergence agitation and delirium in children (clinical)
Mentor(s):	Lena Sun, MD
Student Role:	Assess children in PACU using validated emergence agitation scale

Research Topic:	Pediatric Anesthesia Neurodevelopment Assessment Project
Mentor(s):	Lena Sun, MD
Student Role:	Review medical records to identify eligible study subjects; develop and implement survey of pediatric anesthesia practice in participating children's hospital study site; participate in all other relevant aspects of project

Research Topic:	Anesthesia and Alzheimer's Disease Biomarkers in Humans (clinical)
Mentor(s):	Robert Whittington, MD
Student Role:	Assist with cellular biochemistry in mice

Research Topic:	Anesthesia and Neuropathogenic Pathways Associated with Alzheimer's disease (basic)
Mentor(s):	Robert Whittington, MD
Student Role:	Assist with patient recruitment and administration of neurocognitive tests

Research Topic:	A Functional MRI Study of the Neural Bases of Placebo (clinical)
Mentor(s):	Robert Whittington, MD
Student Role:	Assist with patient recruitment and administration of neurocognitive tests

Research Topic:	Diabetic peripheral neuropathy and hyperglycemia-induced signaling (basic)
Mentor(s):	Jay Yang, PhD, MD
Student Role:	Assist with in vitro cell signaling experiments

Research Topic:	Lymphocyte Kv1.3 potassium channel and immune response in sepsis (basic)
Mentor(s):	Jay Yang, PhD, MD
Student Role:	Assist with in vitro cell signaling and mice experiments

Research Topic:	Leptin transport and neuroendocrine signaling in pregnancy
Mentor(s):	Richard Smiley, PhD, MD
Student Role:	Assist with patient recruitment and laboratory assay for neuropeptides

Research Topic:	Research in Neuroscience: Various Projects
Mentor(s):	Neil Harrison, MD, PhD
Student Role:	Electrophysiology and molecular biology of GABA _A channels

Dartmouth-Hitchcock Medical Center

Research Topic:	Minimally Invasive Hemodynamic Monitoring Pilot Study
Mentor(s):	Matthew Koff, MD
Student Role:	Assist with data acquisition, analysis, and patient data/chart abstracting for pilot study that will gather data for larger multi-center trial if successful. This is an operating room study looking at general surgery patients undergoing surgery with potential large blood loss.

Research Topic:	Development of a Central Venous Access Training intervention, based upon video analysis of the procedure in a cardiac OR
Mentor(s):	George T. Blike, MD
Student Role:	Student will use data from previous summer student and assets in the Patient Safety Training Center to create a multimodal training intervention to support development in competency with ultrasound guided central access. This training intervention will be validated in simulation and in situ with video analysis of observed performance.

Research Topic:	The Effect of Sedation on Outcomes of Voiding Cystourethrograms in Children.
Mentor(s):	Joseph Cravero, MD
Student Role:	We are investigating how the application of sedation affects the physical and psychosocial outcomes of voiding cystourethrograms in children. We investigate the anxiety and emotional/behavioral state of parents and children before during and remotely after these procedures - and compare these outcomes with an institution where no sedation is given. In addition, we will look at the outcome of the VCUG's themselves (Radiographically) to see if there is any discernable outcome change in this aspect as well.

Research Topic:	Stress Cortisol: Effects on Circulating and Transmigrated Human Monocytes
Mentor(s):	Mark P. Yeager, MD
Student Role:	The student will conduct a research study to test the effect of a short intravenous infusion of cortisol on peripheral blood leukocyte activation and functional responses. This will involve both in vivo and in vitro work. Leukocytes will be taken from subjects' peripheral blood and following their transmigration from peripheral blood into experimentally induced skin blisters. Leukocytes will then be examined for both phenotypic and functional responsiveness to ex vivo stimulation with bacterial endotoxin.

Duke University Medical Center

Research Topic:	Improving Patient Safety during Moderate Sedation Procedures through Point of Care Simulation Training (PoCST) of Physician-Nurse Teams
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Mentor(s):	Jonathan Mark, MD, Rebecca Schroeder, Atilio Barbeito, MD, Jeffrey Taekman, MD, Melanie Wright, PhD, and Noa Segall, PhD
Student Role:	Assist with implementation of simulation training, operation of high-fidelity patient simulator, scoring and analysis of simulation training events

Research Topic:	Does Pre-Operative Cognitive Status Affect Post-Operative Outcomes?
Mentor(s):	Terri G. Monk, MD, MS
Student Role:	The student will be trained in the administration of neuropsychological tests by a neuropsychologist and will be responsible for test administration prior to and after surgery. Additional student tasks will include patient recruitment and data collection as well as data entry and participation in data analyses

Research Topic:	Translational Genetics of Persistent Pain after Surgery
Mentor(s):	Andrew Shaw, MB
Student Role:	Work with the mentor on a transgenic mouse model of post thoracotomy allodynia and hyperalgesia.

Emory University School of Medicine

Research Topic:	Effect of Neuropathic Pain on Neurogenesis
Mentor(s):	Wei, Ling (MD),
Student Role:	The student will learn and be in charge of literature research, behavior and immunohistochemical tests; he/she will participate in experimental design, data collection and analysis.

Research Topic:	A Regulatory Role of the NR3 Subunit of NMDA Receptors in Neuropathic Pain
Mentor(s):	Shan Ping Yu, MD, PhD
Student Role:	Perform behavior and morphological experiments, learn to carry out daily research activities, work with small animals and summarize experimental data.

Research Topic:	The Molecular Mechanisms of General Anesthetics
Mentor(s):	Andrew Jenkins, PhD
Student Role:	Learn the techniques of whole cell patch clamp electrophysiology, site directed mutagenesis and numerical modeling. Using these methods, measure the effect of general anesthetic drugs on the function of mutant GABA(A) receptors.

Research Topic:	Retrospective Review of Hemostatic Management in Cardiac Surgical Patients.
Mentor(s):	Kenichi Tanaka, MD, MSc
Student Role:	Data collection from medical records, basic analysis, and modeling if person has advanced skills in biochemistry or statistics.

Research Topic:	Anti PF4 antibody formation and clinical significance in heparin induced thrombocytopenia (HIT).
Mentor(s):	Jerrold Levy, MD
Student Role:	Retrospective and prospective evaluation of laboratory data and follow-ups on patients with thrombocytopenia and HIT assays. Round in ICU to evaluate patients with thrombocytopenia, and evaluate serum to determine novel tests of hypercoagulability including thromboelastometry and thrombin generation.

Research Topic:	Alzheimer's disease and mild cognitive impairment: A role for anesthesia-induced neurodegeneration?
Mentor(s):	Chantal Kerssens, PhD

Student Role:	Query one of the nations most comprehensive databases (at Emory) in order to determine effects of anesthesia and surgery on long-term patient cognitive (dys)function. Student will collect, discuss, analyze and report data in close collaboration with mentor.
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Massachusetts General Hospital

Research Topic:	Role of inhaled Nitric Oxide Role of cGMP pathway and other mediators in acute ischemia and vasomotor activity
Mentor(s):	Warren M. Zapol, MD
Student Role:	To study awake animal models (sheep and mice) to test the use of “artificial blood” (hemoglobin-based oxygen carriers) in combination with inhaled nitric oxide to provide oxygen delivery to ischemic heart and brain, and for emergency transfusion in hemorrhagic shock.

Research Topic:	My research focuses on elucidating the molecular mechanisms by which general anesthetics cause anesthesia and side effects. We locate anesthetic binding sites on ligand-gated ion channels such as the acetylcholine and GABA-A receptors, and on protein kinase C, using agents that are both general anesthetics and photoaffinity labels. These covalently insert into their sites of action when exposed to light.
Mentor(s):	Keith W. Miller, PhD
Student Role:	Students will focus on a single problem. They will employ biochemical techniques, such as proteolysis and HPLC, to characterize which region of the receptor binds particular anesthetics such as propofol and etomidate. Mass spectrometry is used to sequence these fragments.

Research Topic:	Gain and loss of function studies on the molecular mechanisms responsible for pain.
Mentor(s):	Clifford Woolf, MD, PhD
Student Role:	Examine the phenotype of mice with either a null mutation or conditional knock out of pain-related genes and of transgenic mice that overexpress defined genes in neurons, for changes in behavior in experimental inflammatory and neuropathic pain models.

Research Topic:	<ol style="list-style-type: none"> 1. Studies of the role of nitric oxide and soluble guanylate cyclase in the molecular mechanisms regulating the changes in cardiac shape and function in response to hemodynamic challenge. 2. Studies of the role of bone morphogenetic proteins in cardiac development and the pathogenesis of pulmonary arterial hypertension.
Mentor(s):	Kenneth D. Bloch, MD
Student Role:	Students participate in an intensive and focused research experience in cardiovascular biology and pathophysiology using genetically-modified mice and cutting-edge technologies ranging from echocardiography and physiology to molecular and cellular biochemistry.

Research Topic:	How and where do general anesthetics act on human GABA-A receptors? We study the actions of both intravenous (etomidate) and volatile anesthetics on the dominant type of GABA-A receptors in mammalian brain. We combine functional studies on heterologously expressed receptors using whole cell and patch electrophysiology with structural studies that utilize chimeric and mutated receptor subunits. Other projects focus on characterizing the pharmacological actions of novel photoreactive anesthetics, in the context of a collaborative program project grant.
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Mentor(s):	Stuart A. Forman, MD, PhD
Student Role:	Students will work with the PI and postdocs on characterizing the function of new chimeric and mutant GABA-A receptors as well as their sensitivity to intravenous and volatile anesthetics. Students will learn basic laboratory skills and methods for receptor expression and functional studies in <i>Xenopus</i> oocytes. Student will also read background literature related to the lab's research and participate in laboratory group journal clubs.

Research Topic:	<ol style="list-style-type: none"> 1. Neural and molecular mechanisms of pain and opioid analgesia (preclinical studies) 2. Clinical neurobiology of pathological pain, opioid tolerance, dependence and addiction (clinical studies).
Mentor(s):	Jianren Mao, MD, PhD
Student Role:	To learn state-of-the-art neuroscience research methodologies including molecular biology (e.g., real-time PCR, Western blotting), pharmacology, electrophysiology (e.g., patch clamping), autoradiography (e.g., receptor binding assay), ELISA, protein kinase assay, animal behavioral testing and to learn basic clinical research skills including study design, data analysis, and regulatory issues.

Research Topic:	My research focuses on understanding how general anesthetics work and using that information to develop new anesthetic agents. This research project focuses on characterizing the pharmacological actions of an interesting, new I.V general anesthetic that we have developed in our laboratory. Such characterization includes measuring its anesthetic potency in animals, defining its actions on GABAA receptors using oocyte electrophysiology, defining its rate of metabolism using an in-vitro assay and in animals, and studying its affect on blood pressure and breathing
Mentor(s):	Douglas E. Raines, MD
Student Role:	Depending on the student's interest and experience, he/she will learn anesthetic pharmacology and the laboratory techniques needed to characterize this new compound in an enjoyable and productive setting.

Research Topic:	<ol style="list-style-type: none"> 1. To test the hypothesis that immobilization-induced muscle wasting results from decreased anabolic effects of insulin (insulin resistance). 2. To test the hypothesis that simple immobilization leads to inflammation and increased $\alpha 7$ acetylcholine receptor ($\alpha 7$AChR) expression and that $\alpha 7$AChR agonist will attenuate the inflammation and muscle wasting associated with immobilization.
Mentor(s):	Jeevendra Martyn, MD
Student Role:	The student will participate in intensive and focused research experience in neuromuscular physiology and pharmacology. The projects will use signal transduction, biochemical pharmacology, in vivo muscle physiology and transgenic mouse models to test these hypotheses.

Medical College of Georgia

Research Topic:	Mechanisms of Anesthetic Effect. Annually 25 – 30 million patients are anesthetized in the United States; however, our understanding of how inhaled anesthetics achieve their desired (and adverse) effects is incomplete. To address this question, we decided to use a genetic approach to identify novel regulators of volatile anesthetic function in the model organism, <i>Caenorhabditis elegans</i> . We are currently screening ~ 17,000 genes of the <i>C. elegans</i> genome, employing state-of-the-art gene silencing methodology by RNA interference. Heretofore undiscovered genes are studied for their role in anesthetic effect by function and structure analysis. Methods applied include a feeding screen in <i>C. elegans</i> with ~17,000 <i>E. coli</i> /RNAi clones, computer-assisted mutant phenotype analysis, de-novo protein synthesis for novel genes, tissue expression studies by whole-mount immunohistochemistry and/or in vivo GFP-transgene imaging, construction of transgenic
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	animals with dominant-negative and constitutively active gene constructs, classic genetics, focused gene arrays, proteomics, and others.
Mentor(s):	Steffen E. Meiler, MD
Student Role:	The student will be directly involved in many of the daily, practical tasks of this project, which according to interest and background will range from growing nematode populations, assisting in the RNAi feeding screen, conducting anesthetic assays and other pharmacological studies, participating in the quantification of mutant phenotypes, and more. Additionally, the student will acquire a general knowledge of current models of how different inhaled and intravenously administered anesthetic drugs are thought to achieve their effects. This theoretical background in combination with the research activities will be of tremendous value to the student in trying to develop an appreciation for the intended effects and short-comings of modern anesthetics during the clinical component of this fellowship.

Research Topic:	Immunological Mechanisms of Postoperative Infections. The immune response to infection is intended to eliminate invading pathogens without harming the host. Though numerous genetic examples exist to demonstrate that immunity is highly vulnerable to dysregulation, the impact of chronic inflammatory diseases on the immune response to acute infections is less well understood. Using a mouse model of sickle cell disease (SCD) as an example of a severe, chronic inflammatory condition, we were able to demonstrate that macrophages involved in the repair of sickle cell-mediated, ischemic tissue infarcts mounted a profoundly amplified immune response to low-dose LPS resulting in the death of the host. We are currently identifying the molecular and cellular mechanisms responsible for this reprogramming step and believe that these findings will have important applications beyond SCD.
Mentor(s):	Steffen E. Meiler, MD
Student Role:	The student will become familiar with the effects of surgery and anesthesia on the immune system, the immunological mechanisms of some of the prevalent chronic diseases, and how the two conditions may interact to modify the outcome of postoperative infections. Research-related activities will include working with different mouse models of inflammatory diseases, learning cell culture systems, and a variety of immunological methods to study function of macrophages, dendritic cells, and T-cells.

Research Topic:	Role of nitric oxide in sickle cell disease. Sickle Cell Disease (SCD) is a common genetic disorder of the hemoglobin molecule, which affects ~ 80,000 patients in the U.S. alone. Sickle hemoglobin has a strong propensity to form long, fiber-like polymers under hypoxic conditions, resulting in deformed, rigid, and pro-adhesive red blood cells. The biophysical behavior of sickle hemoglobin and its down-stream effects are capable of initiating a cascade of life-threatening vascular complications, including acute painful crisis, hepatic crisis, or acute chest syndrome. Our in vitro observations that binding of the biological gas nitric oxide (NO) to sickle hemoglobin (HbSS) is capable of diminishing and/or breaking down HbSS polymer has resulted in a series of on-going investigations in our laboratory. These studies aim to delineate the spectrum and mechanisms of NO's therapeutic effects in SCD.
Mentor(s):	C. Alvin Head, MD, Steffen E. Meiler, MD
Student Role:	The student will acquire in-depth knowledge of the genetic basis and pathophysiology of sickle cell disease, and learn of the special challenges that surgery and anesthesia poses to these patients. Additionally, the student will have the opportunity to participate in a myriad of experimental approaches ranging from physiology-based assays (such as intravital microscopy in genetic animal models) to assisting in advanced cell biology, molecular, and biophysical methods.

Medical College of Wisconsin

Research Topic:	Anesthetic-Induced Cardioprotection
Mentor(s):	Zeljko J. Bosnjak, PhD
Student Role:	<p>Our laboratory has focused on the role of mitochondria in normal myocardial functions as well as in pathologies. One of the hypotheses is that a short exposure to volatile anesthetics provides protection for the heart against ischemic damage by preserving mitochondrial structure and function. This hypothesis is investigated in an interdisciplinary approach. We are using physiological, pharmacological and molecular techniques as well as proteomics to demonstrate that there are quantifiable alterations in protein expression, channel function and mitochondrial bioenergetics after their exposure to inhalational anesthetics. Here are some specific methodologies pertaining to the mitochondrial isolation and functional (bioenergetics) studies using isolated mitochondria:</p> <p>Measurements of ATP synthesis: The rate of mitochondrial ATP synthesis is calculated and expressed as $\mu\text{mol ATP} \cdot \text{min}^{-1} \cdot \text{mg mitochondrial protein}^{-1}$ ATP concentration is expressed as $\text{nmol ATP} \cdot \text{mg mitochondrial protein}^{-1}$.</p> <p>Measurements of membrane potential: Mitochondrial membrane potential is determined spectrofluorometrically utilizing the dye Rhodamine 123. The maximal depolarization capacity of mitochondria can be determined after a challenge with carbonylcyanide-p-trifluoro-methoxyphenol hydrazone and Antimycin A, a combination of mitochondrial uncouplers.</p> <p>Measurements of oxygen consumption: Oxygen consumption is measured polarographically with a Clark-type oxygen electrode in a water-jacketed chamber. The electron transport chain is examined using different site-specific substrates. All respiration rates are expressed as $\mu\text{mol of oxygen consumed mg protein} \cdot \text{L}^{-1} \cdot \text{min}^{-1}$.</p> <p>Detection of reactive oxygen species: Mitochondrial reactive oxygen species are monitored with a fluorescent probe, dichlorohydro-fluorescein diacetate, which is oxidized in the presence of hydrogen peroxide to dichlorohydro-fluorescein.</p>

Research Topic:	Diabetes, Hyperglycemia and Cardioprotection
Mentor(s):	Judy R. Kersten, MD
Student Role:	<p>The student will be involved in all aspects of the project exploring the mechanisms whereby diabetes and hyperglycemia increase cardiovascular risk. Specifically, the student will be involved in: experimental design; conduct of <i>in vivo</i> experiments; conduct of <i>in vitro</i> experiments using western blotting, immunoprecipitation, immunohistochemistry, real time PCR, and other techniques; analysis of data; scientific writing; oral presentation of results; interacting with scientists in other disciplines; and participation in journal club. The student will also have experience in the operating room observing patients with cardiovascular disease undergoing anesthesia and surgery, and will discuss the potential implications for translational research.</p>

Research Topic:	K_{ATP} channels in Normal and Injured Sensory Transduction
Mentor(s):	Constantine D. Sarantopoulos, MD, PhD
Student Role:	<p>Student(s) participating in the project will be given the opportunity to get familiar, assist and become involved in several aspects pertinent to the project. These include:</p> <ul style="list-style-type: none"> • Understand the basic concepts of pain transduction and pathophysiology of neuropathic pain • Assist in surgical techniques aiming at producing experimental neuropathic pain in rats; understand relevance to pain in humans • Assist or independently conduct behavioral-sensory testing to confirm the presence of neuropathic pain in rats • Train in techniques of dorsal root ganglia harvesting, neuronal dissociation, plating, and neuronal culturing • Prepare special solutions for culturing neurons, as well as for identifying special

	membrane ionic currents <ul style="list-style-type: none"> • Training and assisting in electrophysiological experiments using the patch-clamp technique • Training and assisting in immunohistochemistry and molecular (RT-PCR) techniques • Literature search, readings, and assist in paper writing and/or abstract presentation
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Research Topic:	Role of Mitochondrial Function in Genetically Determined Resistance against Cardiac Ischemia-Reperfusion Injury
Mentor(s):	Matthias Riess, MD, PhD
Student Role:	Student(s) participating in the project will be given the opportunity for training and the participation in the planning, conducting, analyzing and presenting isolated-heart experiments pertinent to the above topic

Research Topic:	Anesthetic Breakdown, Physics of Anesthesia, Transplant Anesthesia, Pharmacotherapeutics
Mentor(s):	Harvey Woehlk, MD
Student Role:	Student(s) participating in the project will be given the opportunity to work on short experiments related to oxone in the breathing circuits, compounds chemically bound to absorbents and further elucidating the reactions that occur. The focus will be on organic and acid-based chemistry.

Research Topic:	Can Effective Screening for OSA Influence Perioperative Outcomes?
Mentor(s):	Thomas J. Ebert, MD, PhD
Student Role:	Screen for patients, administer screening tests, follow/monitor postoperative course.

Research Topic:	Cardioprotection by Volatile Anesthetics
Mentor(s):	David C. Warltier, MD, PhD
Student Role:	Students in the laboratory participate actively in ongoing research programs investigating the mechanisms of anesthetic cardioprotection that are conducted using cell culture and animal models of ischemia and reperfusion injury. The student will acquire skills in animal handling, small animal surgical techniques, vascular and cardiac physiological monitoring, and tissue and cell preparation for molecular and biochemical analyses. Students will participate actively in weekly laboratory meetings by giving periodic presentations of their work. Students are instructed on accurate record keeping and are mentored in scientific technical writing skills. Students interact on a daily basis with technical staff, visiting scientists, post-doctoral fellows and junior faculty. The Anesthesiology Department annually hosts several world-renowned speakers for invited seminars for which all students and faculty are encouraged to attend.

Research Topic:	Mitochondrial Cation Exchangers: Modeling Experimental Data
Mentor(s):	David F. Stowe, MD, PhD
Student Role:	Conduct experiments in isolated cardiac mitochondria using specific cation dye spectrophotofluorimetry, assess changes in cation flux and the effect of cation exchange inhibitors, and help develop models of cation exchange that underlie mitochondrial bioenergetics.

Research Topic:	Role of Calcium in the Cellular Mechanisms of Pain Following Nerve Injury
Mentor(s):	Thomas A. Stekiel, MD
Student Role:	The student will have responsibility for planning protocols, generation of data, analysis and presentation of findings in a project involving measurement of rat pain behavior, rat surgery, cell dissociation, and recording of cellular events in sensory neurons, under my supervision and the fellow's (Geza Gemes)

Research Topic:	Factors that affect intraocular pressure and exophthalmometry in spine surgery patients
Mentor(s):	Kathryn K. Lauer, MD
Student Role:	The student would assist in data collection, learning to obtain intraocular pressure recordings and measuring exophthalmos in patients who need spine surgery. This is a study with anesthetized patients in both the prone and supine position, and the student will participate in assessing factors that might impede ocular perfusion.

Research Topic:	Database evaluation of neurologic events related to hypotension
Mentor(s):	Kathryn K. Lauer, MD
Student Role:	Our department has constructed a database that began in 2004 that captures data on the approximately 18,000 anesthetics that we provide at our institution per year. This database collects summary data on patient's preoperative pre-existing medical problems, the anesthetic events and postoperative events. In this study, working with the Outcomes Center of CHOW Statisticians, we would identify the patients at risk for neurologic worsening and identify from chart review the validity of the hypothesis that those patients at risk for cerebral hypoperfusion would have a higher incidence of neurologic events based on intraoperative hypotension.

Research Topic:	Role of Calcium in the cellular mechanisms of pain following nerve injury
Mentor(s):	Quinn Hogan, MD
Student Role:	The student will have responsibility for planning protocols, generation of data, analysis, and presentation of findings in a project involving measurement of rat pain behavior, cell dissociation, and recording of cellular events in sensory neurons, under my supervision and the fellow's (Geza Gemes).

Medical University of South Carolina

Research Topic:	Quality and Safety Research Groups Locating Errors through Networked Surveillance (LENS): The Society of Cardiovascular Anesthesiologists Foundation FOCUS Initiative
Mentor(s):	Jake Abernathy, MD, MPH
Student Role:	Data collection and data analysis and clinical participation in the anesthesia care team for these patients.

Research Topic:	Modulation of Proteolytic Pathways in Cardiac Ischemia-Reperfusion: Investigating Myocardial Protection in Ischemia-Reperfusion (multiple ongoing basic science protocols under Program Project Grant)
Mentor(s):	Francis Spinale, MD, PhD, Scott Reeves, MD
Student Role:	Equipment setup and operation, anesthesia and surgical assistance (animal), data collection, and data analysis, abstract and oral presentation preparation

Research Topic:	Randomized, Placebo-controlled Trial of the Effects of Dexmedetomidine and Gabapentin on PONV and acute pain in Bariatric Laparoscopic Surgical Patients (N=150)
Mentor(s):	Matthew D. McEvoy, MD
Student Role:	Data collection and data analysis and clinical participation in the anesthesia care team for these patients.

Research Topic:	Validation of a Simulation and Team Training Debriefing Tool for High-Fidelity Crisis Resource Management Events
Mentor(s):	John Schaefer, III, MD, Matthew D. McEvoy, MD
Student Role:	Assist in data collection and statistical analysis of simulation event debriefing with a novel database tool

Research Topic:	Validation of a Central Venous Line Placement Simulator
Mentor(s):	John Schaefer, III, MD
Student Role:	Assist in data collection and statistical analysis of simulation technology in central line placement

Research Topic:	Prefrontal Transcranial Magnetic Stimulation Effects in Chronic Pain Patients (N=100)
Mentor(s):	Scott Reeves, MD
Student Role:	Equipment setup and operation, data collection, and data analysis

Research Topic:	Effect of Low-Dose Vasopressin on Need for Additional Pressors and On Urine Output in Cardiac Surgical Patients Undergoing Cardiopulmonary Bypass (N=50)
Mentor(s):	Jake Abernathy, MD, MPH
Student Role:	Equipment setup and operation, data collection, and data analysis and participation in the anesthesia care team

Research Topic:	A Multi-center Survey of Anesthesiologists Attitudes and Abilities in Difficult Airway Management using Simulation-based Performance Evaluation
Mentor(s):	John Schaefer, III, MD
Student Role:	Assist in data collection and statistical analysis of simulation technology in difficult airway management

Research Topic:	Difficult Airway Management Performance Tool Simulation and Validation
Mentor(s):	John Schaefer, III, MD, Matthew D. McEvoy, MD
Student Role:	Be involved in designing difficult airway scenarios for evaluation as well as assisting in data collection and statistical analysis of simulation technology in difficult airway management

Research Topic:	Transcranial Magnetic Stimulation Effects on Pain in Gastric Bypass Patients (N=150)
Mentor(s):	Scott Reeves, MD
Student Role:	Equipment setup and operation, data collection, and data analysis

Mount Sinai School of Medicine

Research Topic:	Geriatric Cognition. There are a number of studies in progress. Perioperative Cognitive Protection -Dexmedetomidine and Cognitive Reserve "The Dexlirium Study" is a multi-center NIA funded trial including extensive cognitive and delirium testing. Similar studies are evaluating the role of perioperative hypertension.
Mentor(s):	J.H. Silverstein, MD, S. Deiner, MD
Student Role:	Student will be introduced to neurocognitive testing and delirium assessment. Student will participate in steering committee meetings.

Research Topic:	Studies in Neuropathic Pain
Mentor(s):	Marco Pappagallo, MD
Student Role:	Student will participate in clinical trials and data review projects regarding chronic neuropathic pain.

Research Topic:	Three dimensional Echocardiography and studies in cardiac anesthesia
Mentor(s):	Gregory Fischer, MD
Student Role:	Students will participate in the quantitative assessment of 3D echocardiograms or participate in clinical studies of cardiac anesthesia.

Research Topic:	Studies in Perioperative Medical Informatics
Mentor(s):	M. Krol, PhD, D. Wax, D. Reich, MD;
Student Role:	Students will engage in research involving over 300,000 digital anesthesia records, focused on methods of analyzing large datasets.

Research Topic:	Clinical Effectiveness in Obstetric Anesthesia
Mentor(s):	Y Beilin, MD, H. Bernstein, MD, J. Zahn, MD
Student Role:	Students will participate in studies of clinical obstetric anesthesia.

Research Topic:	Evaluation of modern airway interventions
Mentor(s):	I. Osborn, MD
Student Role:	Students will participate in studies of modern airway management devices

Research Topic:	Studies of Adolescent Anesthesia.
Mentor(s):	C. Scher, MD
Student Role:	Student will participate in survey protocols of adolescent patients undergoing anesthesia.

Northwestern University

Research Topic:	The Effects of Perioperative Inflammation on Surgical Morbidity and Mortality
Mentor(s):	Dhanesh K. Gupta, MD, Saadia Sherwani, MD
Student Role:	Data Collection, Data Analysis, and Preparation of Abstracts and Manuscripts

Research Topic:	The Prognostic Value of Somatosensory and Motor Evoked Potentials in Intracranial and Spine Surgery
Mentor(s):	Dhanesh K. Gupta, MD, Antoun Koht, MD
Student Role:	Data Collection, Data Analysis, and Preparation of Abstracts and Manuscripts

Research Topic:	The effect of neuraxial analgesia on maternal breast feeding
Mentor(s):	Cynthia A. Wong, MD
Student Role:	Collection, Data Analysis, and Preparation of Abstracts and Manuscripts

Research Topic:	Barriers to Labor Analgesia in Ethnically and Socio-economically disadvantaged populations
Mentor(s):	Cynthia A. Wong, MD
Student Role:	Collection, Data Analysis, and Preparation of Abstracts and Manuscripts

Oregon Health & Science University

Research Topic:	Soluble Epoxide Hydrolase as a Novel Therapeutic Target for Stroke
Mentor(s):	Nabil J. Alkayed, MD, PhD
Student Role:	Arachidonic acid epoxides, or EETs, are protective against stroke injury, but their efficacy is limited by breakdown via soluble epoxide hydrolase (sEH). The project will evaluate newly developed pharmacological inhibitors as novel therapeutic agents against stroke. The student will process brain samples for EETs measurements, sEH measurement using Western blot, blood flow and infarct size image analysis.

Research Topic:	Regulation of soluble epoxide hydrolase (sEH) expression and translocation in cultured neurons
Mentor(s):	Nabil J. Alkayed, MD, PhD
Student Role:	Ischemia induces the translocation of soluble epoxide hydrolase (sEH) from the cytosol, to the peroxisomes. The project will examine the molecular mechanism and functional significance of this translocation. The project will examine the effect of oxygen-glucose deprivation (OGD) on the translocation of fluorescently tagged recombinant sEH in

	cultured cortical neurons. The student will prepare and maintain neuronal cultures, prepare GFP-sEH fusion protein, perform cell death assay and sEH expression and activity assays.
Research Topic:	Role of CART in Estrogen-Mediated Neuroprotection
Mentor(s):	Nabil J. Alkayed, MD, PhD
Student Role:	CART is a novel gene product that is regulated in brain by estrogen and plays an important role in protection from stroke injury. However, the mechanism of neuroprotection by CART is unknown. The student will determine the effect of CART on extracellular regulated kinase (ERK)/MAPK signaling pathway and its effect on oxygen free radical formation by mitochondria.
Research Topic:	Role of STAT3 in Estrogen-Mediated Neuroprotection
Mentor(s):	Nabil J. Alkayed, MD, PhD
Student Role:	STAT3 is activated by estrogen in ischemic brain, and its activation is protective against ischemic cell death, presumably due to upregulation of neuroprotective genes. The student will use real-time quantitative PCR and chromatin immunoprecipitation (ChIP) to determine which genes are induced by estrogen through STAT3 pathway.
Research Topic:	Sleep-wake disturbances in adolescents with chronic pain
Mentor(s):	Tonya Palermo, PhD
Student Role:	The aim of this study is to characterize the type of sleep disturbances experienced by adolescents with chronic pain compared to healthy adolescents and to assess the impact of sleep disturbances on adolescent daily functioning and emotional status. Sleep is assessed using subjective survey measures and actigraphy. The student would enroll study participants, score and analyze sleep data.
Research Topic:	Web-based cognitive-behavioral treatment of chronic pain in children
Mentor(s):	Tonya Palermo, PhD
Student Role:	The goal of this project is to develop and test the feasibility and efficacy of a web-based cognitive-behavioral treatment program for children and adolescents with chronic pain. This is a randomized controlled trial of an 8-week web-based treatment program in 72 children and adolescents with chronic pain (ages 11-17 years) who will either receive the web-based treatment or serve as no-treatment controls. The student would assist with beta testing of web site, and enroll study participants
Research Topic:	Role of microglia in ischemic neuronal death in-vitro
Mentor(s):	Ines Koerner, MD, PhD
Student Role:	Microglia are the brain's resident immune cells. They are activated after ischemic brain injury and likely contribute to ischemic injury and neuronal death. The project will use a system of primary cell cultures to examine the effect of activated microglia on neuronal injury after oxygen-glucose deprivation, which is an in-vitro model of ischemia. Specifically, we will investigate the role of the enzyme soluble epoxide hydrolase (sEH) for microglia-induced cell death. The student will prepare and maintain microglia and neuronal cultures, perform oxygen-glucose deprivation and cell death assays, and perform immunofluorescence staining and immunoblotting to analyze protein expression.
Research Topic:	Pain catastrophizing and markers of inflammation
Mentor(s):	Beth Darnall, PhD
Student Role:	Pain catastrophizing is a powerful predictor of pain outcome: it is associated with worsening pain, increased use of opioids and decreased response to treatment; it has also been linked to the development of chronic pain. The current study builds on previous work on cytokine response to an in-vivo pain catastrophizing induction. In this proposal we hone our focus on women, employ a randomized controlled design, extend our

	examination to include the role of pro- and anti-inflammatory <i>cytokine balance</i> in predicting risk for inflammation following pain catastrophizing, and we link inflammatory responses to clinical pain status and function.
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Research Topic:	A multi-centered review of Glidescope intubations: predictors of failure, success rate, and rescue success rate.
Mentor(s):	Michael Aziz, MD
Student Role:	Retrospectively review electronic medical records to determine utility of a video laryngoscope in operative airway management, and assist in statistical analysis and abstract preparation.

Research Topic:	Genetically Engineered Mouse Colonies
Mentor(s):	Stephanie J. Murphy, VMD, PhD
Student Role:	Project would involve managing and genotyping mice within the breeding colonies in the APOM department mouse breeding colonies. Our research program requires the use of transgenic and knockout mice to test our research hypotheses. Many of these animals are difficult to breed or require special care and have to be genotyped. The student will be trained to perform basic mouse health checks, mouse reproductive management and husbandry, mouse anesthesia, database entry, and tail tattooing and tail sampling for genotyping. The student will also be heavily involved with genotyping of several knockout mouse breeding colonies. This involved preparing DNA from tail samples, performing PCR with specific primers, and interpreting results in order to properly characterize mice born in our colonies and distribute them for use in various research projects.

Research Topic:	Rodent Surgeries
Mentor(s):	Stephanie J. Murphy, VMD, PhD
Student Role:	Student will learn how to handle mice and rats, perform rat anesthesia and minor surgeries such as gonadectomies and hormone implantations, and carry out peri-operative monitoring and care. Rodent surgeries can present unique challenges primarily due to their small size and provides excellent training for microsurgical manipulations. In addition to providing basic rat surgical support to our staff, fellows, and faculty, the student will be given a chance to perform sterile, survival surgery in mice as well as learn an experimental model of focal stroke in the rat involving occlusion of the middle cerebral artery. These are technically demanding studies requiring the use of a surgical microscope with the mice as well as placement of arterial and venous catheters and surgical preparation of cerebrovascular vessels in order to expose these rats to cerebral ischemia.

Research Topic:	Complications Associated with Ketamine Premedication for Measurement of Intraocular Pressure in Children: A Case-Control Study
Mentor(s):	Kirk Lalwani, MD, FRCA
Student Role:	Ketamine premedication is commonly requested for measurement of intraocular pressure (IOP) prior to induction of anesthesia to minimize anesthesia-related effects on IOP that could adversely influence the decision to perform definitive glaucoma surgery. Following implementation of such a protocol, reports of an increased incidence of postoperative respiratory complications following surgery in these children surfaced. In order to determine if these reports are valid, a retrospective case-control study is proposed in order to compare these children to a matched control group that did not receive ketamine premedication for IOP measurement. The student will participate in chart review, data collection and entry, data analysis, abstract and manuscript preparation.

Research Topic:	What Happens to the Leak Around Uncuffed Pediatric Endotracheal Tubes Over Time?
Mentor(s):	Kirk Lalwani, MD, FRCA
Student Role:	An uncuffed endotracheal tube (ETT) is commonly used to secure the airway during pediatric anesthesia. One school of thought is that the leak increases over time as the ETT warms to body temperature and becomes more compliant; others believe the leak decreases over time due to laryngotracheal mucosal edema induced by the tube. This study will recruit children undergoing surgery requiring intubation (with some exclusions), and measure the leak around the endotracheal tube immediately following placement and over a predetermined time course to assess changes in the leak pressure. The student will participate in IRB preparation, statistical consultation, patient recruitment, data collection and entry, data analysis, abstract and manuscript preparation.

Research Topic:	Determination of an Optimal Anesthetic Regimen for Children Scheduled for Intraocular Pressure Measurement
Mentor(s):	Kirk Lalwani, MD, FRCA
Student Role:	Ketamine premedication is commonly requested for measurement of intraocular pressure (IOP) prior to induction of anesthesia to minimize anesthesia-related effects on IOP that could adversely influence the decision to perform definitive glaucoma surgery. Following implementation of such a protocol, reports of an increased incidence of postoperative respiratory complications following surgery in these children surfaced. This study will prospectively compare two techniques for induction and maintenance of anesthesia following ketamine premedication (inhalational versus intravenous) in order to compare the incidence of respiratory complications between the two groups. The student will participate in IRB preparation, statistical consultation, patient recruitment, data collection and entry, data analysis, abstract and manuscript preparation.

Pennsylvania State University

Research Topic:	Perioperative Genomics: Focus on Discovery of PONV Genomic Markers
Mentor(s):	Piotr K. Janicki, MD, PhD
Student Role:	Interviewing patients, collecting clinical data and samples, analysis of results.

Research Topic:	Coupling Mechanisms of NOP Receptors and Calcium Channels
Mentor(s):	Victor-Ruiz-Velasco, PhD
Student Role:	Learning electrophysiological techniques and performing experiments in the basic science laboratory.

Research Topic:	Assessment of Acute Postoperative Pain in Infants
Mentor(s):	Priti Dalal, MD, FRCA
Student Role:	Interviewing patients, obtaining clinical data, analysis of results.

Research Topic:	Use of Advanced Airway Devices for the Difficult Airway Management
Mentor(s):	Leonard Pott, MD
Student Role:	Interviewing patients, learning techniques and collecting clinical data, analysis of results.

Research Topic:	Techniques to Reduce Errors in the Administration of Intravenous Medications-A Human Factors Evaluation
Mentor(s):	Elizabeth Sinz, MD
Student Role:	Interviewing patients, collecting of clinical data, analysis of results.

Stanford University

Research Topic:	Molecular Cardiac Physiology
Mentor(s):	Andrew J. Patterson, MD, PhD
Student Role:	The research in my laboratory focuses on how specific receptors regulate heart and blood vessel function. In addition to disease states like congestive heart failure (whose primary impact is upon the heart), we are interested in the mechanisms by which sepsis impairs cardiac function. The goal of the summer student project is to evaluate how inhibition of sympathetic nervous system outflow and/or adrenergic receptor signaling impacts gene expression in the heart during sepsis. Students will conduct experiments that involve induced sepsis in genetically engineered mice. They will learn to extract RNA from mouse hearts and conduct microarray studies using the Affymetrix platform as well as GeneSpring and Ingenuity Pathway Analysis software. Students will work with a research associate and two critical care medicine fellows.

Research Topic:	Sympathetic neuron α_2 adrenoceptor structure/function
Mentor(s):	Timothy Angelotti, MD, PhD
Student Role:	<p>My research efforts are focused on investigating the pharmacological and physiological interface of the autonomic nervous system with effector organs. Utilizing molecular, cellular, and electrophysiological techniques, the student and I will examine the function of α_2 adrenergic receptors in sympathetic neurons cultured alone, or in the presence of other neurons, cardiac myocytes, or smooth muscle cells. Sympathetic neurons are isolated from various transgenic knock-out and knock-in mice, which have been designed to express altered adrenergic receptor subtypes (e.g. α_2A/C, b1, b2). Using recombinant adenovirus constructs encoding additional wild-type, mutant, or chimeric adrenergic receptors, we are able to further modify the pharmacology and physiology of this system. Receptor binding, immunocytochemistry, single- cell analysis of neurotransmitter release, and standard molecular biology are the techniques that are employed to characterize this dynamic system. Development of this in vitro model of the sympathetic nervous system will allow us to better understand its role in sympathetically- mediated pain and in the stress response to surgery and critical illness.</p> <p>My second project, in which there are opportunities for a MSARF student, is a clinical study where we hope to determine if it is possible to measure sympathetic nerve activity in ICU patients using non- or minimally invasive methods. Previous research by others has suggested that activation of the sympathetic nervous system by critical illness may lead to a higher rate of mortality. Currently, we do not monitor SNS activity in patients and we hope to determine if such monitoring can be both predictive of recovery, mortality/morbidity or both.</p>

Research Topic:	Surviving Cerebral Ischemia
Mentor(s):	Rona Giffard, MD, PhD
Student Role:	We study stroke in both surgical animal models and using brain cells. Students can participate in collecting data to characterize gene expression in brain with recovery after stroke, and help analyze the interaction of different brain cell types in response to stroke at the level of gene expression. Individual cell types are isolated from the brains of animals following stroke to understand their interactions. This will allow us to target therapies to individual cell types to protect the brain and reduce damaging effects. A second project a student could work on is understanding the contribution of inflammation and oxidative stress to stroke injury. Both astrocytes and microglia respond rapidly to injury and can have proinflammatory phenotypes. We need to study activation of these cell types through staining brain sections at different intervals following stroke, and then manipulate these phenotypes by altering gene expression in these cells. For the first project a student could learn to isolate RNA from the brain and learn about gene chip analysis. For the second

	project a student could learn immunohistochemical staining and techniques for changing gene expression in the brain. In both cases they could contribute to the development of a new potential treatment for stroke.
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Research Topic:	Obstetric Anesthesia
Mentor(s):	Brendan Carvalho, MD
Student Role:	The obstetric anesthesia group conducts clinical and translational research into various aspects of cesarean anesthesia and labor analgesia. We have completed a number of studies examining the role of extended-release epidural morphine and certain oral adjuvants including NSAIDs and COX-2 inhibitors for post-cesarean analgesia. We have determined ED50 and ED95 dosing requirements of local anesthetic for cesarean delivery and have conducted a number of studies investigating the efficacy of PCEA for labor analgesia. In addition we have demonstrated increased pain tolerance in pregnant patients compared to non-pregnant controls using quantitative sensory pain models. We have done research on the economics of obstetric anesthesia, patient perception of risk prior to cesarean delivery, coagulation changes following fluid loading and shivering during cesarean delivery. We have helped develop loss of resistance epidural syringe as well as a CSF and epidural pressure measurement device. We have many ongoing studies and a number of studies being developed. We are currently examining the role of cytokines in the development and maintenance of pain following cesarean delivery as well as determining the role of pharmacogenetics on labor pain and the response to opioids. We are also involved in simulator training and offer a number of research opportunities in this area. A number of our faculty as well as two obstetric anesthesia fellows conduct the clinical and translational research. We have successfully helped undergraduate students, medical students, and residents complete research projects. Our past residents and fellows have gone on to academic careers or been very successful in private practice. One of the strengths of our group is our ability to collaborate with a variety of people in the institution. We have conducted projects in the past with Drs. Alex Macario (economics), Yasser El Sayed (fetal-maternal medicine), David Drover (pharmacokinetics and statistics), and Martin Angst (experimental pain).

Research Topic:	Experimental clinical science to study (1) mechanisms of pain and inflammation in injured tissue, and (2) the pharmacology of opioids in pain and inflammation.
Mentor(s):	Martin Angst, MD
Student Role:	The role will be identified on an individual basis and depends on a student's particular interest and current on-going research efforts.

Research Topic:	Mechanisms of pain
Mentor(s):	David Clark, MD, PhD
Student Role:	Current projects being pursued in the Clark lab can generally be placed in one of two categories. One group of projects involves the investigation of the roles of cytokines, complement split products and other inflammatory mediators in incisional wounds. The laboratory has identified a number of novel inflammation-related molecules in the recent past. We are now attempting to determine which of these is related to inflammation in general versus nociception specifically. The interactions between analgesics and the inflammation-related molecules is of particular interest. The second group of projects involves the mechanistic exploration of opioid-induced hyperalgesia. Experiments from our lab have to this point demonstrated thermal hyperalgesia and mechanical allodynia in mice and rats after the cessation of opioid administration. This hyperalgesia has been partially characterized pharmacologically. Ongoing studies seek to further elucidate the mechanism of this form of hyperalgesia as well as test methods for preventing or limiting its manifestation. We are currently using genetic, behavioral, immunohistochemical and biochemical methods.

Research Topic:	Development of molecular approaches for the treatment of chronic pain.
Mentor(s):	David Yeomans, PhD
Student Role:	Our main research focus is on the development of gene therapy methods for the treatment of chronic pain. Two of the primary problems in gene therapy have been the targeting of the right cells, and the duration of the desired effect. We have used a highly modified herpes simplex virus (the kind that causes cold sores) to carry analgesic genes into the pain-sensing neurons. Because herpes viruses stay naturally in these cells for the life of the host, we should obtain very long lasting analgesic effects using these treatments. Thus, we are making use of the natural proclivity of herpes for entering and staying in the very cells we are interested in. In this way, we target pain treatment to painful areas, and only painful areas. These new approaches to therapy could revolutionize the treatment of chronic pain. Students can directly participate in the laboratory in learning behavioral testing in rodent models for pain, as well as microscopy, histochemistry, virology, immunoassays, and other techniques.

Research Topic:	Mechanisms of action of central nervous system drugs
Mentor(s):	Bruce MacIver, PhD
Student Role:	The long-term goal of our research is to provide the physiological background information required for the rational design of safer and more effective anesthetics and analgesics. Synaptic Physiology Research: We investigate the cellular, synaptic and molecular mechanisms of action of central nervous system drugs; especially barbiturates, opiates, anesthetics, abused inhalants and other CNS depressants. Electrophysiological recording techniques and selective pharmacological probes are used to investigate the sites and mechanisms of action for CNS depressants. Most of our studies focus on the CA 1 area in rat hippocampal brain slices. Neurons in this brain area are depressed by anesthetics through a combination of pre- and postsynaptic actions on glutamate and GABA mediated neurotransmission. EEG Research The effects of pharmacological agents on EEG waves generated by the neocortex are being examined. EEG theta activity (4 to 12 Hz) is one of many rhythms, like alpha and delta (slow wave sleep) rhythms that are altered by CNS active drugs. Patch clamp and electrophysiological recording techniques are used to look at the effects of anesthetics on carbachol and bicuculline induced theta activity in neocortical brain slices. Anesthetic effects on brain slice micro-EEG activity are correlated to EEG effects seen in animals and humans during anesthesia. Effects on micro-EEG theta activity appear to involve actions at GABA and glutamate synapses, as well as effects on neuronal excitability. Theta activity can be recorded from specific regions of cortex in rat brain slices. Comparison of micro-EEG signals and intracellular recordings (whole cell) reveal that the low frequency theta waves (~ 8 Hz) were generated by synchronous synaptic potentials and discharge activity of cortical neurons. The discharge of each cortical neuron appears to contribute ~ 1.0 μ V to the micro-EEG signal, so theta activity requires synchronous activity in ~ 100 neurons in each cortical location. Theta activity is known to be important for spatial mapping and may provide a 'binding' mechanism that contributes to the formation of memory in general. When selective populations of neurons are synchronously active they can interact in a 'Hebbian' manner to change the strength of synaptic inputs that are timed at the theta frequency. Theta activity is also known to be particularly sensitive to anesthetic agents at concentrations which block memory formation. Preliminary studies in our laboratory indicate that brain slice theta activity is also depressed by anesthetics and that this depression occurs with a profile similar to in vivo responses. Students would be directly involved in collecting and analyzing electrophysiology data from rodent brain slice models.

Research Topic:	Pharmacokinetics and Pharmacodynamics
Mentor(s):	David Drover, MD
Student Role:	My research interest is in clinical research on the pharmacokinetics and pharmacodynamics of drugs. Medications studied are those commonly used for anesthesia and analgesia.

	<p>Additionally, other drugs are studied if they have unique characteristics that require intensive or specialized monitoring. Particular effort is used to obtain quality real-time data from intensive pharmacokinetic/pharmacodynamic studies to enable mathematical modeling of drug effect on the human body. Mathematical modeling of data is mainly performed with NONMEM. Where possible, research projects use the electroencephalogram to quantitate pharmacodynamic effect and develop mathematical models to relate pharmacokinetics to pharmacodynamic response. The main interest of my research projects is to develop novel ways to model and describe clinical pharmacology relationships.</p>
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Research Topic:	Pain Neuroimaging, Systems Neuroscience, Clinical Pain Trials
Mentor(s):	Sean Mackey, MD, PhD
Student Role:	<p>Dr. Mackey's lab (Stanford Systems Neuroscience and Pain Lab) is focused on using advanced imaging and psychophysical techniques to better understand the processing of pain in the brain and spinal cord. Dr. Mackey has pioneered novel techniques to perform neuroimaging of the human spinal cord and its response to acute and chronic pain. He has also developed innovative methods to permit subjects to directly view and control their own brain activity in real time using fMRI feedback. He is conducting multiple neuroimaging projects which would allow the interested student to participate at all phases of data collection, analysis and presentation. Additionally, he is conducting studies assessing outcomes in chronic pain utilizing validated outcomes measurements. These studies would be ideal for the student interested in epidemiology or statistics. Finally, there are several pharmacologic studies investigating novel therapies for chronic neuropathic pain that would allow the student interested in clinical trials experience in study design, patient recruitment, study execution and data analysis. For more information on these projects, go to http://snapl.stanford.edu and http://paincenter.stanford.edu</p>

Research Topic:	Medical Acupuncture
Mentor(s):	Brenda Golianu, MD
Student Role:	<p>Research interests in the division of medical acupuncture involve the application of acupuncture techniques to medical problems that are inadequately addressed by current medical practice. Currently, that includes the use of acupuncture as an adjuvant in the treatment of cancer and the use of acupuncture in surgical patients. Additional projects include the use of acupuncture in decreasing opioid requirements in neonates after surgery, speeding recovery from surgery of critically ill infants electrical acupoint stimulation to decrease pain from heelstick, and use of acupuncture in improving outcomes in <i>in vitro</i> fertilization in adults. An interdisciplinary component to our program involves collaboration with physicians and researchers in other disciplines, including oncology, surgery, obstetrics and gynecology. Perioperative studies will compare nausea, vomiting, pain, antiemetic use, opiate use, and clinical outcomes in patients receiving acupuncture vs. control. Interested students may either join an existing project or construct a project of their own.</p>

Research Topic:	Experimental pulmonary hypertension
Mentor(s):	Ronald Pearl, MD, PhD
Student Role:	<p>My research examines mechanisms and therapy of experimental pulmonary hypertension. We use the combination of pneumonectomy and monocrotaline administration to produce proliferative pulmonary hypertension in mice and rats. We have examined the changes at a transcriptional and cellular level which result in pulmonary hypertension and the ability of vasodilator, immunosuppressive, and anti-proliferative therapies to prevent and/or reverse the pulmonary hypertension. Ongoing research is investigating the effects of specific genes on the development and reversal of pulmonary hypertension.</p>

Research Topic:	Pediatric Cardiac Anesthesia
Mentor(s):	Chandra Ramamoorthy, MBBS, FRCA
Student Role:	<p>Cerebral oximetry in children using near infrared spectroscopy (NIRS) has been shown to help in reducing adverse neurological outcomes after heart surgery. Using the same technology researchers have evaluated the oxygen saturation to the other body tissues such as kidney, gut. This 2 site NIRS approach could be useful in managing children after heart surgery in the Intensive care unit (ICU) and preliminary data exists showing this might be helpful. At Stanford cerebral and somatic oximetry is routinely monitored during open heart surgery. We propose to study a group of infants in the ICU following open heart surgery, where 2 site NIRS will be monitored for 12 hours following arrival in the ICU. In addition to routine hemodynamic measurements, 2 site NIRS data will be collected as will serial plasma lactates which is currently the gold standard for measuring tissue ischemia. Using Bland Altman analysis and ROC curves we will show that a) decreases in cerebral and somatic oximetry are not reflected in peripheral arterial saturation b) changes in somatic oximetry will have a linear correlation with plasma lactate levels. In a previous observational study on children with heart disease undergoing cardiac catheterization, we had shown that decreases in cerebral saturation (rsO₂%) measured using NIRS did not correlate with decreases in peripheral arterial saturation (SpO₂%) in infants with cyanotic heart disease. As a follow-up to that study, we propose this interventional study in infants with cyanotic heart disease during cardiac catheterization. Cerebral desaturation, defined as a 20% decrease in baseline lasting at least one minute, will be continuously collected along with hemodynamic data and SpO₂%. Interventions that result in restoring cerebral saturation to baseline and their effectiveness will be evaluated.</p>

Research Topic:	Factors causing prolonged post-surgical pain and prolonged opioid use.
Mentor(s):	Ian Carroll, MD, MS
Student Role:	<p>Chronic post-surgical pain as a result of nerve injury is a major complication of surgery. In short, virtually every surgery has a definite incidence of chronic neuropathic pain postoperatively. Following elective inguinal hernia repair 24% of patients experience pain 1 year postoperatively. 11% of patients experience moderate to severe pain. Similar numbers exist for other surgeries including: 13% of patients have chronic pain following knee replacement, 6% following cesarean section, 30-60% following thoracotomy, and as many as 50% following breast cancer surgery. We are collaborating with the thoracic, breast, general and orthopedic surgery divisions to measure the duration of post surgical pain. We hope to define for the first time a survival curve that describes the natural history of postsurgical pain. By changing our focus from elements influencing pain intensity to those influencing pain duration we hope to gain insight into factors influencing the incidence of delayed pain resolution, and chronic pain. We hope this work will allow us to identify those patients at highest risk of postoperative chronic pain so that they can be targeted in the future for early intervention and treatment. Data collection is currently ongoing in the pilot stage, and this project has provided opportunities for undergraduate students, medical students, and residents to contribute meaningfully in collecting data from patients, and analyzing results. This work is exciting because little focus has been given to pain using duration as the primary endpoint. However, it is the chronicity of pain that results on its burden to society, We have excellent means of dealing with pain in the acute setting, but have much worse outcomes in the chronic setting. By focusing on pain duration, we hope to develop new insights into this problem. Ultimately, this research may help to answer the overriding question in pain medicine: Why following identical injuries is pain of short duration for most people but of extended or infinite duration for others?</p>

SUNY Downstate Medical Center - Brooklyn

Research Topic:	Anesthesia residents training in fiberoptic technique: a) Double fiberoptic technique for intubations; b) Retrograde-assisted fiberoptic intubation through tube exchanger used as spacer; c) Using video feedback to train anesthesiology residents in fiberoptic intubation; d) Retromolar fiberoptic intubation technique for double lumen tube
Mentor(s):	Alexandru Apostol, MD
Student Role:	Assist with protocol development and implementation, including IRB approval process; data collection and analysis

Research Topic:	a) Cerebral oximeter in transplant patients; b) Cerebral oximeter during Cesarean section; Cerebral oximeter in pre-eclamptic patients treated with magnesium sulfate
Mentor(s):	Alexandru Apostol, MD
Student Role:	Assist with protocol development and implementation including IRB process, patient recruitment, data collection and analysis

Research Topic:	Intracerebral hemodynamic monitoring in pregnant patients during Cesarean section under spinal-epidural anesthesia
Mentor(s):	Alexandru Apostol, MD
Student Role:	Assist with protocol development and implementation including IRB approval process, patient recruitment, data collection and analysis

Research Topic:	Magnesium + Obstetric Patients: a). Brain bioavailability of peripherally-administered magnesium sulfate in Preeclamptic patients; b) association between the length of prenatal exposure of preterm newborns to Magnesium sulfate and neural development outcome during the first year of life
Mentor(s):	Alexandru Apostol, MD
Student Role:	Assist with study implementation, including data collection and analysis

Research Topic:	Case Series: a) Effect of dexmedetomidine on postop pain in patients undergoing spine surgery; b) Effect of dexmedetomidine intravenous infusion during MAC cases for spinal cord stimulation in drug dependent patients.
Mentor(s):	Audree Bendo, MD, MS
Student Role:	Assist with study implementation, including patient recruitment, data collection and analysis

Research Topic:	Correlation of complement activation and factors with delayed cerebral vasospasm and delayed ischemic neurological deficits in aneurysmal subarachnoid hemorrhage patients
Mentor(s):	Audree Bendo, MD, Ming Zhang, MD, PhD
Student Role:	Assist with protocol implementation, data collection and analysis

Research Topic:	A randomized, controlled, phase 3 study of gentamicin-collagen sponge (Collatamp G) in general surgical subjects at higher risk for surgical wound infection (Innocoll Company)
Mentor(s):	Jean Charchaflied, MD, MPH, Ming Zhang, MD, PhD
Student Role:	Assist with study implementation, data collection and analysis

Research Topic:	Efficacy and safety of drotrecogin alfa/xigris (activated) in adult patients with septic shock (Eli Lilly & Co)
Mentor(s):	Jean Charchaflied, MD, MPH, Ming Zhang, MD, PhD
Student Role:	Assist with study implementation, data collection and analysis

Research Topic:	Temporal alterations in complement expression profiles are associated with increased mortality in septic shock
Mentor(s):	Jean Charchaflied, MD, MPH, Ming Zhang, MD, PhD
Student Role:	Assist with study implementation, data collection and analysis

Research Topic:	Modulating postoperative cognitive dysfunction and disability: the role of anesthetic depth and perioperative intervention
Mentor(s):	James E Cottrell, MD, Rebecca S. Twersky, MD
Student Role:	Assist with protocol development and implementation, including IRB approval process, patient recruitment, data collection and analysis.

Research Topic:	Development of novel amnesic agents using a strategy of blocking PKM activity
Mentor(s):	James E Cottrell, MD, Todd Sacktor, MD, Ira Kass, PhD,
Student Role:	Assist with study implementation, data collection and analysis.

Research Topic:	The effect of periarticular injection of bupivacaine-ketorolac-epinephrine-morphine admixture, in addition to continuous femoral nerve block, on rehabilitation and postoperative pain in patients undergoing total <u>knee</u> replacement
Mentor(s):	Dennis Dimaculangan, MD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis

Research Topic:	Study comparing the effects of PCEA vs. periarticular single-shot injection (SSI) vs. continuous periarticular infiltration (CPI) of local anesthetic, on top of a standard multimodal postop pain management strategy, on pain and rehabilitation outcomes in patients undergoing total <u>hip</u> replacement surgery.
Mentor(s):	Dennis Dimaculangan, MD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis

Research Topic:	Is there an increased benefit for ease of access during performance of neuraxial anesthesia amongst the variety of patient positioning?
Mentor(s):	Dennis Dimaculangan, MD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis

Research Topic:	Learning curves for the utilization of ultra-sound during regional anesthesia: learning curve for brachial plexus ultrasound imaging by anesthesia residents using the Cusum method
Mentor(s):	Dennis Dimaculangan, MD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis

Research Topic:	Effect of midazolam on focal cerebral ischemia
Mentor(s):	Ira Kass, PhD, James E Cottrell, MD
Student Role:	Assist with study implementation, data collection and analysis.

Research Topic:	Mechanisms of ischemic and hypoxic brain injury; effects of anesthetics and other agents on the mechanisms of neuronal damage
Mentor(s):	Ira Kass, PhD, James E Cottrell, MD
Student Role:	Assist with the design of the experiments and to carry them out

Research Topic:	Video glasses for use during inhalation induction in children
Mentor(s):	Beklen Kerimoglu, MD
Student Role:	Assist with protocol development and study implementation including IRB approval process, patient recruitment, data collection and analysis.

Research Topic:	1) Effects of anesthetics on acid-sensing ion channels (ASICs) in collaboration with Legacy Research Lab- Portland, Oregon; 2) Effects of tetracaine-induced spinal anesthesia on pial microcirculation in rats
Mentor(s):	Jun Lin, MD, PhD
Student Role:	Assist with conducting experiments, data collection and analysis

Research Topic:	Innate immunity responses to ischemic changes during cardiac surgery
Mentor(s):	Ketan Shevde, MD, Ming Zhang, MD, MPH
Student Role:	Assist with study implementation including IRB approval process, patient recruitment, data collection and analysis.

Research Topic:	Preservation of neurological and cognitive function utilizing high-dose midazolam in cardiac surgery patients
Mentor(s):	Ketan Shevde, MD, John Hartung, PhD
Student Role:	Assist with study implementation including IRB approval process, patient recruitment, data collection and analysis.

Research Topic:	The role of natural IgM in human myocardial infarction
Mentor(s):	Ketan Shevde, MD, Ming Zhang, MD, PhD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis.

Research Topic:	The effect of mannitol on the tissue reperfusion injuries after cardiopulmonary bypass surgery
Mentor(s):	Marina Svyatets, MD
Student Role:	Assist with study implementation including data collection and analysis.

Research Topic:	Should ambulatory and same-day admission patients discontinue their angiotensin ace inhibitors medications preoperatively?
Mentor(s):	Rebecca S. Twersky, MD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis.

Research Topic:	Smoking cessation in the perioperative period
Mentor(s):	Rebecca S. Twersky, MD
Student Role:	Assist with study implementation including patient recruitment, data collection and analysis

Research Topic:	Animal model of ischemia: to examine the innate immune responses to ischemia in genetically modified animals
Mentor(s):	Ming Zhang, MD, PhD
Student Role:	Assist with conducting of experiments, data collection and analysis

Research Topic:	Animal model of sepsis: to examine the innate immune responses during sepsis using genetically modified animals
Mentor(s):	Ming Zhang, MD, PhD, Jean Charchaflied, MD, MPH
Student Role:	Assist with conducting of experiments, data collection and analysis

Research Topic:	Overexpression of antioxidant enzyme CuZn SOD improves survival in a septic shock model
Mentor(s):	Ming Zhang, MD, PhD, Jean Charchaflied, MD, MPH
Student Role:	Assist with study implementation, data collection and analysis.

Research Topic:	Mechanism of the initial inflammatory response in a heart transplantation model
Mentor(s):	Ruimin Zhang, MD, PhD, Ming Zhang, MD, MPH
Student Role:	Assist with conducting of experiments, data collection and analysis

SUNY/Stony Brook

Research Topic:	Can Epidural analgesia effectively continue the gestation in preterm labor
Mentor(s):	Rishi S.N. Adsumelli MBBS, FFARCS
Student Role:	Student role involves in data collection, chart reviews, data entry.

Research Topic:	The Preemptive Use of the Nicotine Patch for Post-Operative Pain Relief After Open Abdominal Surgery
Mentor(s):	Ursula N. Landman DO
Student Role:	Students will be actively involved with the study, i.e., from start-recruitment, placement of patch vs placebo, and follow up of data for probably more than 15% clinical time since this is a clinical study.

Research Topic:	Efficacy of Perioperative Interventions in Smoking Cessation
Mentor(s):	Peggy A. Seidman MD
Student Role:	Patient screening and evaluation in preadmission testing, enrollment of patients in to study, application of nicotine patches preoperatively, PACU follow up with nicotine replacement therapy, assistance in enrollment in smoking cessation support groups, phone contacts postop, data collection and analysis, beginning abstract/ peer reviewed paper writing.

Research Topic:	Use of Dexmedetomidine in Adolescent Posterior Spinal Fusions
Mentor(s):	Peggy A. Seidman MD
Student Role:	Enroll patients in the study, monitor compliance with protocol anesthetic for operative case, assess patient for 24h following case, assist in data analysis and possible abstract/peer reviewed paper writing.

Research Topic:	Development of a tool to assess quality of life following Ambulatory surgery
Mentor(s):	Peter S.A. Glass MB ChB
Student Role:	The student would be involved in the development of the instrument, reviewing literature related to QOL instruments, testing the instrument in patients, helping with data analysis and possibly creating an abstract from the work.

Research Topic:	Effects of local anesthetics on cerebral blood volume, tissue oxygenation and intracellular calcium in vivo brain using optical imaging
Mentor(s):	Congwu Du, PhD
Student Role:	Involvement in preclinical studies, assistance in handling experimental animal surgery (rats), measuring the physiologic changes of animal during the experiment and assistance in data analysis and possible abstract/peer reviewed paper writing.

Research Topic:	Cognitive dysfunction following thoracic surgery using fMRI, and resonance spectroscopy: the role of stem cells
Mentor(s):	Peter S.A. Glass MB ChB, Helene Benveniste, MD, PhD
Student Role:	Recruiting and consenting subjects, performing neurocognitive testing

Research Topic:	Computer simulation of synaptic transmission
Mentor(s):	James P. Dilqer PhD
Student Role:	Use a Monte-Carlo simulation program to determine the time course of neuromuscular transmission in the presence of muscle relaxants

Research Topic:	Effects of anesthetics and alcohols on glycine receptors
Mentor(s):	James P. Dilqer PhD
Student Role:	Perform electrophysiological experiments to measure currents from human alpha1 glycine receptors. Determine the kinetics of drug action on these channels

Research Topic:	Molecular mechanisms of opiate tolerance
Mentor(s):	Mario J. Rebecchi PhD
Student Role:	The student will culture cells, treat with interfering RNA and assess the knockdown of the target gene by quantitative RT-PCR. Opiate tolerance will be measured by assay of second messenger production.

Research Topic:	Effect of intravenous anesthetics on smooth muscle
Mentor(s):	Srinivas Pentyla PhD
Student Role:	The student will be involved in biochemical, cell biological, physiological and biophysical studies pertaining to cell, tissues and organ systems, evaluating the effects of IV anesthetics on calcium regulated events.

Research Topic:	Development of a new monitor of depth of anesthesia
Mentor(s):	Ira J. Rampil, MS, MD
Student Role:	The fellow will assist in recruitment, consent and physiologic monitoring of patients as well as data reduction and correlation with physiologic signs of autonomic stress

Research Topic:	Age-associated changes in cardiac gene expression following anesthetic preconditioning
Mentor(s):	Lixin Liu MD, PhD
Student Role:	Extract tissue protein and run Western blot, Extract tissue RNA, perform RT-PCR with analysis, preparation of abstracts/manuscripts

Clinical Experience for Lab based FAER Research Students

As per the grant requirements, all students are expected to have 15% clinical exposure. SUNY/SB Department of Anesthesiology will fulfill that requirement as follows:

1) Depending on when the student is at Stony Brook, they will be able to participate in our Clinical Extern Program. Our clinical extern program is designed for students between their first and second year of medical school to gain clinical anesthesia experience. This program includes exposure to all subspecialties in anesthesia, as well as simulations designed specifically for this education level student held in our SIM center. Our FAER student would function as an extern 1 day/week with a specific clinical assignment with the intent to expose the student to all specialties in anesthesia, as well as participate in the planned simulations in our SIM lab.

2) If the FAER student is not concurrent with our SUNY/SB externs, we would use the extern format for clinical OR assignment 1 day/week with an attempt to allow some time in the SIM center using the simulations developed for our externs.

Thomas Jefferson University

Research Topic:	Observational Study of Recurrent Hypoglycemia in Hospitalized Patients using a Continuous Glucose Monitoring System
Mentor(s):	Jeffrey I Joseph, DO
Student Role:	As Key Personnel, the student will assist with literature review, subject recruitment, glucose sensor insertion, data collection, data analysis, and manuscript preparation.

Research Topic:	Correlation Between Hyperglycemia and Glycosuria in Surgical Patients
Mentor(s):	Jeffrey I Joseph, DO
Student Role:	As Key Personnel, the student will assist with literature review, subject recruitment, glucose sensor insertion, data collection, specimen testing, data analysis, and manuscript preparation.

Research Topic:	Continuous Glucose Monitoring During Anesthesia, Surgery, and ICU Care
Mentor(s):	Jeffrey I Joseph, DO
Student Role:	As Key Personnel, the student will assist with literature review, subject recruitment, glucose sensor insertion, data collection, specimen testing, data analysis, and manuscript preparation.

Research Topic:	Cost Analysis of Mild, Moderate, and Severe Hypoglycemia in a University Hospital
Mentor(s):	Jeffrey I Joseph, DO
Student Role:	As Key Personnel, the student will assist with literature review, subject recruitment, glucose sensor insertion, data collection, specimen testing, data analysis, and manuscript preparation

Research Topic:	An Observational Study using Continuous Glucose Monitoring to Correlate Changes in Blood Glucose Level with Coagulation and Ultrasound Evidence of Deep Vein Thrombosis in Patients Undergoing Neurosurgery
Mentor(s):	Boris Mraovic MD
Student Role:	As Key Personnel, the student will assist with literature review, subject recruitment, glucose sensor insertion, data collection, specimen testing, data analysis, and manuscript preparation

Research Topic:	Computer Models for Glucose and Insulin Dynamics in the Framework of Functional Data Analysis
Mentor(s):	Brian Hipszler PhD
Student Role:	As Key Personnel, the student will assist Dr. Hipszler with computer simulations and modeling of human physiology, including the effects of surgical stress, catecholamines, and steroids on glucose metabolism.

University of Alabama at Birmingham

Research Topic:	Relative Prevalence and severity of autonomic nervous system dysfunction in diabetic patients for retinal surgery
Mentor(s):	Gwendolyn L. Boyd, MD
Student Role:	Perform ANS function testing, data collection, database management, statistical analysis, abstract and poster preparation

Research Topic:	Functional Imaging of Pain
Mentor(s):	Michael Froelich, MD
Student Role:	Research Assistant

Research Topic:	Delineation of the mechanisms of nitrosothiol formation from nitric oxide (NO) in cells
Mentor(s):	Jack Lancaster, PhD
Student Role:	Student Assistant

Research Topic:	Chlorine induced lung injury: Understanding the mechanisms and developing countermeasures
Mentor(s):	Sadis Matalon, PhD
Student Role:	Become familiar with the literature and perform experiments under supervision and of course analyze data and prepare a poster. May also perform experiments independently

Research Topic:	Influenza: Understanding how it damages the ability of lungs to clear fluid
Mentor(s):	Sadis Matalon, PhD
Student Role:	Become familiar with the literature and perform experiments under supervision and of course analyze data and prepare a poster. May also perform experiments independently.

Research Topic:	Nitric oxide as a therapeutic agent for cystic fibrosis
Mentor(s):	Sadis Matalon, PhD
Student Role:	Become familiar with the literature and perform experiments under supervision and of course analyze data and prepare a poster. May also perform experiments independently.

Research Topic:	Developing new treatments for respiratory syncytial virus
Mentor(s):	Sadis Matalon, PhD
Student Role:	Become familiar with the literature and perform experiments under supervision and of course analyze data and prepare a poster. May also perform experiments independently.

Research Topic:	Role of HDL mimetics in liver transplantation
Mentor(s):	Dale Parks, PhD, Professor
Student Role:	This is a translational research project that involves human subjects, animals and cell culture. This project will attempt to define the mechanism(s) by which a peptide that mimics a component of HDL attenuates liver tissue associated with the reduction of blood flow (ischemia) such as occurs during liver transplantation. A high percentage of the patients undergoing liver transplantation also present with acute lung injury post-surgery. This project will also investigate the mechanisms associated with the remote pulmonary damage associated with ischemia/reperfusion. These studies are highly relevant to critical care and integrate clinical and basic science concepts.

Research Topic:	Reactivation of labor epidurals for post partum tubal ligation- success, efficiency and predictors
Mentor(s):	Yasser Sakawi, MD
Student Role:	Patient recruitment and data collection

Research Topic:	Clinical research studies in patients with interstitial cystitis (a bladder pain syndrome)
Mentor(s):	Ursula Wesselmann, MD, PhD
Student Role:	Students participate in patient interviews, clinical examinations, database management, statistical analysis, as well as IRB protocol writing

Research Topic:	Vulvodynia (a vaginal pain syndrome)
Mentor(s):	Ursula Wesselmann, MD, PhD
Student Role:	Students participate in patient interviews, clinical examinations, database management, statistical analysis, as well as IRB protocol writing

University of California, Irvine

Research Topic:	Gas Kinetics and Metabolism in Anesthesia During Non Steady State
Mentor(s):	Peter H. Breen, MD, FRCPC, Abraham Rosenbaum, MD
Student Role:	Actively participating in designing, collecting data, analyzing and developing specific sections in our study.

Research Topic:	Molecular mechanisms of chronic pain.
Mentor(s):	Zhigang David Luo, MD, PhD
Student Role:	Explore the cellular mechanisms of chronic pain and publish findings as a professional meeting abstract or peer-reviewed publication.

Research Topic:	The role of the amygdala in anesthetic-induced amnesia
Mentor(s):	Michael T. Alkire, MD
Student Role:	Students will participate in all aspects of hypothesis driven in vivo small animal research. The students will learn small animal handling techniques, surgical techniques, behavioral assessment of memory techniques and histology methods.

Research Topic:	Center for Perioperative Research
Mentor(s):	Zeev Kain, MD
Student Role:	Participate in one or more of a wide spectrum of related studies such as the impact of parenteral presence in the O.R. and means to reduce perioperative stress.

University of California, San Diego

Research Topic:	Role of macrophage infiltration in Neuropathic pain. Macrophage infiltration in the injured nerve directly relates to the degree of neuropathic pain, and we have shown that MMP inhibition through the use of pharmacologic therapy and genetic knockouts control macrophage recruitment to the injury, and thus, onset of hyperalgesia into the nerve after injury. A co-culture system of primary peritoneal macrophages with sciatic nerve explants would be used to study this interaction
Mentor(s):	Veronica Shuybayev, PhD
Student Role:	Student will be involved in preparing the co cultures and running the experiments.

Research Topic:	Effect of chronic swim stress on pain thresholds and glial activation in mice. Stress has been shown to affect pain perception in humans and animals. While mostly inducing stress-induced analgesia (SIA), particularly in immediate response to acute stress, there is also strong evidence of stress inducing a hyperalgesic state (stress induced hyperalgesia, SIH) under certain conditions. The stress response system interacts with the immune system, which in turn can alter pain perception and could induce a central sensitized state. There are known increased central levels of cytokines like IL-6 shown for stress related painful diseases including Fibromyalgia, irritable bowel syndrome and PTSD, all of which show altered pain perception and evidence of increased central sensitization. If the stress response alters the pain response via the immune activation and therefore presents a novel target for treatment is not known. We want to develop a chronic swim stress protocol in mice and test for development of hyperalgesia. We further want to test for spinal immune activation (glial activation) We will test 3 groups of mice: one swim stressed group, one sham swim control and one cage control group.
Mentor(s):	Hemal Patel, PhD, Tobias Moeller-Bertram, MD

Student Role:	The student will be actively involved in all of the above-described procedures. She/he will get the necessary training in animal handling and testing from the current lab members. The student will have assigned research technicians that will oversee their work and will be continuously available for questions and feedback. The student will assist in performing the experiment, collect tissue, prepare histologic samples and immunochemistry, behavioral data gathering, collection and analysis. She/he will be encouraged to participate in preparation of a presentation of the findings of this study as a poster, paper or talk.
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Research Topic:	Role of calcium permeable AMPA sites in pain processing. AMPA channels lacking a GluR-2 subunit serve as calcium ionophores. We have shown that intrathecal Ca ²⁺ -permeable non-NMDA receptor antagonists block hyperalgesia. The student will examine the signal transduction cascade downstream of this calcium ionophore receptor subtype using clinically relevant models of pain.
Mentor(s):	Linda Sorkin, PhD
Student Role:	Student will undertake behavioral and western blotting studies to define the nature of these cascades.

Research Topic:	Promoting recovery of function after spinal injury. Spinal injury induces paralysis and dysesthetic sensory states. Using our model of thoracic aortic occlusion with a 2 F Fogarty catheter passed from the femoral artery of the rat, such ischemic deficits are seen to be the result of a selective degeneration of small inhibitory GABAergic and glycinergic neurons localized in lumbosacral segments. A trainee will have the opportunity to be directly engaged in the development of implant approaches and cellular replacement examining the role of GABA and glycine phenotype expressing cells in sprouting, synaptogenesis and changes in pain behavior.
Mentor(s):	Martin Marsala, PhD
Student Role:	Student will undertake immunohistochemistry to investigate the sprouting of microinjected progenitor cells in spinal cord.

Research Topic:	Mechanisms of spinal toxicity. Intrathecal delivery of certain products such as local anesthetics and opiates is a widely used clinical procedure. Studies have shown that many molecules with diverse structures can produce toxicity. A hypothesis for these effects is that the agents at high concentrations form micelles which have a detergent action. We wish to assess the physicochemical characteristics of these agents to determine if they do form micelles and if they have membrane lytic effects using the disruption of an <i>ex vivo</i> cell system to assess their impact.
Mentor(s):	Tony L. Yaksh, PhD
Student Role:	Student will be responsible for the preparation of the cell systems and undertaking the lysis experiments.

University of California, San Francisco

Research Topic:	Evaluation of anesthetic sensitivity of two-pore potassium channel (K2P) knockout mice.
Mentor(s):	C. Spencer Yost, MD, Marta Sabbadini
Student Role:	We have created one strain of mice in which the gene for the K2P channel TRESK has been inactivated and have obtained other strains in which other K2P channel genes are inactive. We are determining the effect of knockout on these mice. The student would learn to determine the sensitivity of homozygous knockouts as well as wildtype and heterozygous littermates to volatile anesthetics in the standard MAC immobility test. Additional characterization studies include tests of pain sensitivity (thermal tail flick and paw withdrawal). Hands-on whole animal testing and tissue harvesting for <i>in vitro</i> tests such as quantitative RT-PCR will be the primary skills learned.

Research Topic:	Effect of anesthesia on brain development in rats
Mentor(s):	Greg Stratmann, MD, Jeffrey Sall, MD, PhD
Student Role:	In vitro stem cell culture work, In vivo work (immunohistochemistry, fluorescent microscopy), Data analysis, Presentation at FAER student research session ASA 2010.

Research Topic:	Does pediatric anesthesia cause hippocampal dysfunction?
Mentor(s):	Greg Stratmann, MD, Jeffrey Sall, MD, PhD
Student Role:	Patient recruitment, administration of neurocognitive test Battery to children, data entry, presentation at FAER student research session ASA 2010

Research Topic:	Role of innate immune pathways in sepsis-induced coagulation disturbances. My laboratory investigates the basic mechanisms by which interactions between microorganisms and the host innate immune system ultimately lead to shock and organ dysfunction in sepsis. We are currently investigating the underlying mechanisms and functional significance of Toll-like receptor 2 (TLR2) activation in sepsis <i>in vivo</i> using infection and toxicity models, and <i>in vitro</i> using endothelial cells and macrophages. We are focused on the effects of TLR2 pathways on coagulopathy, on the microvascular circulation, and on the lung.
Mentor(s):	Judith Hellman, MD
Student Role:	Participate in studies on the effects of Toll-like receptor activation on endothelial and white blood cell functions, including effects on coagulation, inflammation, and endothelial permeability. The student will gain experience in basic methods, including, but not limited to cell culture, antibody assays for measuring expression of proteins involved in inflammation and coagulation, and quantitative real time PCR for quantifying expression of mRNA of mediators of inflammation and coagulation.

Research Topic:	The control and regulation of the capsaicin receptor gene –TRPV1
Mentor(s):	Mark Schumacher, MD, PhD
Student Role:	Learn to conduct mammalian cell culture experiments, transfect reporter genes into cell lines and complete luciferase transcriptional assays. Prepare primary cultures of sensory neurons from rat. Apply anti-sense, siRNA technologies for knockdown of targeted transcription factors.

Research Topic:	Identification of Genetic Polymorphism in Pain Related Genes
Mentor(s):	Mark Schumacher, MD, PhD
Student Role:	Learn computer-based genomic analysis, map promoter regions of the TRP family of ion channels <i>in silico</i> , Test computer based genomic mapping with PCR based genotyping of pain related genes.

Research Topic:	The effect of nerve growth factor in inflammatory pain
Mentor(s):	Mark Schumacher, MD, PhD
Student Role:	Testing noxious heat induced paw-withdrawal response of rats, isolation of rat sensory ganglia, cryosection for immunofluorescent studies, microscopic analysis of gene expression using fluorescent markers.

Research Topic:	Identifying human antibodies targeting tumor stem cells
Mentor(s):	Bin Liu, PhD
Student Role:	The student is expected to select phage antibody display libraries to identify tumor stem cell-targeting human antibodies, and to develop targeted therapeutics against tumor stem cells utilizing selected human antibodies. The student will also join efforts to characterize antibody-defined tumor subpopulations with regard to properties commonly associated with tumor stem cells, including innate drug resistance and tumor initiation <i>in vivo</i> .

Research Topic:	Postdischarge nausea and vomiting (PDNV). Clinical study aims to determine independent predictors for PDNV and to develop a simplified risk model for PDNV based on US patients. The results will allow clinicians to identify patients who would benefit from prophylactic antiemetic strategies.
Mentor(s):	Christian Apfel, MD, PhD
Student Role:	The general goal is to expose the student to the fundamentals of biostatistics in clinical research. The student will work with established PDNV database and learn the basics of database management and data analysis using statistical software. He/she will also learn how to interpret the results and prepare a manuscript. Co-authorship on a publication resulting from the student's activities during the fellowship period is highly encouraged.

Research Topic:	Quantitative systematic review: Meta-analysis on a clinically relevant topic such as potential interventions used to decrease perceived injection pain during propofol induction.
Mentor(s):	Christian Apfel, MD, PhD
Student Role:	The student will learn the skills needed to conduct a systematic review from inception to publication. The student may use an idea of her/his own or one from our research group. The student will research the topic of interest using electronic databases, evaluate the selected journals, and assess the quality of published articles. Other work will involve data management, meta-analysis, and interpretation of the results. If possible, all projects will involve manuscript preparation and national conference presentation.

Research Topic:	Efficacy of non-surgical spinal decompression treatment:. A prospective, non-randomized clinical study to evaluate the efficacy and safety of non-surgical spinal decompression therapies as a treatment option for patients with chronic musculoskeletal or mechanical lower back pain (LBP). Results from this study will potentially be used to help designing future studies involving chronic LBP therapies and aid clinicians to choose the optimal treatments for chronic LBP.
Mentor(s):	Christian Apfel, MD, PhD
Student Role:	The general goal is to provide the student with a broad exposure to conduct clinical research trials with an emphasis on non-surgical spinal decompression therapies. Student's role may include research study design, protocol development, practical implementation of a study protocol, research database design, patient recruitment and follow up, data collection, data management, data analysis, literature review, and possible manuscript preparation. Co-author on a publication resulting from the student's activities during the fellowship period is possible.

Research Topic:	The occurrence of QT prolongations during and after general anesthesia. The aim of the study is to identify risk factors associated with QT prolongation and to establish a predictive model for QT prolongations associated with general anesthesia.
Mentor(s):	Kerstin Kolodzie, MD
Student Role:	The general goal is to provide the student with a broad exposure to conduct clinical research with an emphasis on understanding the physiology behind QT prolongation after general anesthesia. The student will be involved in all aspects of this project, including patient recruitment, data collection at ICU and through the electronic record system, data management, literature review, and possible manuscript preparation.

Research Topic:	Our primary interest is to study the pathophysiology of intracranial and aortic aneurysms using novel animal models. Our goals are to identify the mechanisms for growth and rupture of aneurysms and to develop pharmacological therapies to prevent aneurysmal rupture. Our research projects are funded by the National Institutes of Health and American Heart Association.
Mentor(s):	Tomoki Hashimoto, MD

Student Role:	A student is expected to complete a small project that is a subset of a larger project in our lab. The student will conduct experiments on animals and tissues harvested from animals. Techniques will include animal surgery, tissue staining, and molecular biological assays.
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Research Topic:	Cerebrovascular physiology and vascular biology
Mentor(s):	William L. Young, MD, Chanhung Lee, MD PhD, Helen Kim, PhD, Ludmilla Pawlikowska, PhD, Hua Su, MD
Student Role:	Human studies include clinical studies of brain hemorrhage, including arteriovenous malformations and intracranial aneurysms. A major emphasis is on using genomic techniques to identify risk of poor outcome as well as disease susceptibility. Laboratory studies include modeling of intracranial vascular malformations that include models of disease formation and progression, including use of growth factor stimulation to simulate human disease. There is emphasis on the contribution of vascular inflammation and various kinds of progenitor cells in mounting abnormal vascular remodeling. Other studies include use of cell and viral therapy to protect or resuscitate the brain from ischemic injury. The student would be expected to pick a project that is fairly well defined by ongoing studies and shepherd it through the fellowship period. The general goal is a broad exposure to clinical and translational neuroscience with an emphasis on cerebrovascular disease research in a multidisciplinary setting. A goal is to be a co-author on a publication resulting from the student's activities during the fellowship period.

University of Cincinnati College of Medicine

Research Topic:	Sympathetic sprouting in neuropathic pain
Mentor(s):	Jun-Ming Zhang, MD
Student Role:	Making animal model of neuropathic pain, immunohistochemical staining of sympathetic fibers, imaging analysis.

Research Topic:	Neural and chemical basis of pathological pain
Mentor(s):	Jun-Ming Zhang, MD
Student Role:	Participate in making animal model of low back pain, animal behavioral testing, data analysis, PCR, western blotting.

Research Topic:	Sphingosine 1-phosphate receptors and sensitization of sensory neurons
Mentor(s):	Jun-Ming Zhang, MD
Student Role:	Participate in surgical procedures, behavioral testing, immunohistochemistry, data analysis.

Research Topic:	Maturation of spinal nociceptive circuits
Mentor(s):	Mark Baccei, PhD
Student Role:	Making animal model of pain, animal behavioral testing, data collection/analysis.

Research Topic:	Analysis of blood and fluid use in the or and subsequent transfusion requirements in the sicu
Mentor(s):	Leonard Lind, MD, FCCM
Student Role:	Review chart, data collection, data analyses, data preparation for publication.

Research Topic:	Difficult airway registry
Mentor(s):	Leonard Lind, MD, FCCM
Student Role:	Data collection, data entry, data analysis, data preparation for presentation and publication

Research Topic:	Catheter related infections in pediatric burn population
Mentor(s):	Steven Lisco, MD, Lindsey Nelson, MD
Student Role:	Participate in data collection and analysis; prepare data for publication.

Research Topic:	Throat pain and dyphonia following tracheal intubation
Mentor(s):	Steven Lisco, MD, Lindsey Nelson, MD
Student Role:	Participate in data collection and analysis; prepare data for publication.

Research Topic:	Surgical conditions during laproscopic tubal ligation with and without muscle relaxants
Mentor(s):	Steven Lisco, MD, Lindsey Nelson, MD
Student Role:	Participate in data collection and analysis; prepare data for publication.

University of Colorado, Denver

Research Topic:	Preeclampsia and Uteroplacental vascular remodeling: What is the role of vascular smooth muscle and endothelium?
Mentor(s):	Martha Tissot van Patot, PhD
Student Role:	The overall goal of the research is to determine the role of uterine artery smooth muscle and endothelial cells during normotensive and preeclamptic pregnancies. Hypoxia is used to induced changes in similar to those seen during preeclampsia. Students will learn some or all of the following: PCR, western blotting, immunohistochemistry, to work with transgenic animals and will be trained in data collection, analyses, interpretation, writing and presentation.

Research Topic:	The effect of ischemia/ reperfusion on cell metabolism and protein patterns in the heart during bypass surgery.
Mentor(s):	Tamas Seres, MD
Student Role:	The student will process samples, will run proteomic (2D gels, LC-MS) and metabolic profiling analyses (¹ H-NMR, LC-MS/TOF), will analyze data and assist in statistical analysis

Research Topic:	Induction of heat shock proteins by glutamine.
Mentor(s):	Paul Wischmeyer, MD
Student Role:	The student will assist in planning animal studies, will assist in experiments, will collect and analyze samples (Western blot, PCR, ¹ H NMR), and will analyze and manage data.

Research Topic:	Development of an LC-MS/MS assay for profiling of endothelial dysfunction markers.
Mentor(s):	Jelena Klawitter, PhD
Student Role:	This project involves as systematic review of the available literature, a systematic training program in modern mass spectrometry technologies, project planning, hands-on development and validation of LC-MS assays following current FDA guidances, analysis of the results and writing a report summarizing the results in preparation of a publication.

Research Topic:	Anesthesia and the developing brain
Mentor(s):	Lisa Wise-Faberowski, MD, Natalie Serkova, PhD
Student Role:	Experiments and data collection using organotypic hippocampals slices prepared from rat pups of differing ages. These experiments identify the role of GABA receptor development in the responses of BDNF and NKCC1/KCC2 to anesthetic induced neurodegeneration. This project is sponsored by FAER.

Research Topic:	Anesthesia and oxygen in a rat pup model of the developing cyanotic brain
Mentor(s):	Lisa Wise-Faberowski, MD
Student Role:	Experiments and data collection using organotypic hippocampals slices prepared from cyanotic rat pups of differing ages as an indirect measure to evaluate the effects of cardiopulmonary bypass (ischemia, hyperoxia) and anesthesia on the developing brain. The project specifically evaluates NMDA receptor modification, via oxygen concentration and anesthesia, and its effects on CREB phosphorylation and BDNF. Sponsored by an AHA National Scientist Development Grant.

Research Topic:	The use of NMRS as prediction tool for neurologic outcome in neonates undergoing surgical repair for congenital heart disease.
Mentor(s):	Lisa Wise-Faberowski, MD, Natalie Serkova, PhD
Student Role:	A clinical investigation evaluating the effect of two different anesthetic (intravenous versus inhalational) regimens on neurologic outcome in infants undergoing surgical repair for congenital heart disease. The project uses changes in metabolic parameters of blood and urine to evaluate the response to intravenous opposed to inhalational anesthetics as a primary outcome measure. Secondary measures include postoperative EEG monitoring for seizures and neurologic examinations at 6 and 12 months after surgery. This research is supported by the IARS Clinical Scholars Award.

Research Topic:	The effect of statin lactones on skeletal muscle cells.
Mentor(s):	Uwe Christians, MD, PhD
Student Role:	This project will be part of an NIH sponsored project (NIH RO1 HL071805-03). The goal is to set up an in vitro muscle toxicity model. This model will be based on human cells in combination of state of the art proteomics and biochemical profiling technologies. This model will be set up using statins (HMG-CoA reductase inhibitors) as model drugs. The goal is (A) to evaluate which biochemical pathways in the muscle cells are affected by statins using an unbiased 'shotgun' approach and (B) to assess as to whether the statin acids or the more lipophilic statin lactones are more potent. The student will learn (A) how to plan complex project, (B) technologies such as cell culture, metabolic profiling (GC-MS, LC-MS) and proteomics (2D gels, LC-MS/iontrap and data base searches), (C) data and analysis and presentation of data in our Department's research seminar.

Research Topic:	Drug metabolism and pharmacokinetics of the opioid sinomenine.
Mentor(s):	Uwe Christians, MD, PhD
Student Role:	Sinomenine is an opioid with anti-inflammatory and anti-pain activities that has been used in Southeast Asia in the treatment of rheumatic arthritis for 4000 years. Our recent work found that sinomenine is a prodrug and its main metabolite, nor-sinomenine, is ten-fold more potent than the parent drug. The student will establish an HPLC-MS assay to quantify sinomenine and its active metabolite, will study the enzyme kinetics of sinomenine metabolism using isolated human liver microsomes and will identify the cytochrome P450 enzymes involved in sinomenine metabolism using individually expressed and isolated cytochrome P450 enzymes, specific antibodies and specific chemical inhibitors.

Research Topic:	The effects of sirolimus derivative eluted from coronary stents on smooth coronary muscle cells.
Mentor(s):	Uwe Christians, MD, PhD
Student Role:	After initial enthusiasm due to significantly decreased coronary restenosis rates compared with bare metal stents, it has now been realized that drug eluting stents have an increased risk for sometimes fatal late coronary thrombosis. It is the hypothesis of this project that drug doses currently coated on stents are toxic to the coronary muscle cells and instead of selectively inhibiting growth via mTOR, the mammalian target of rapamycin, lead to cell death. The student will be trained in the LC-MS analysis of sirolimus and its metabolites, in cell culture techniques as well as in standard proteomics and metabolomics methodologies. The student will evaluate the dose dependent effect of sirolimus and its metabolites on the metabolism and protein expression of human coronary muscle cells in culture.

Research Topic:	The role of the biliary transporter c-MOAT (<i>ABCC2</i>) in the elimination of metabolites of the immunosuppressant cyclosporine.
Mentor(s):	Uwe Christians, MD, PhD

Student Role:	Cyclosporine has been the cornerstone of immunosuppressant drug regimens in solid organ transplantation for more than 2 decades. Cyclosporine is a substrate of cytochrome P4503A and is known to cause and to be the target of a multitude of pharmacokinetic drug-drug interactions. Interestingly, the role of active transporters in the elimination of cyclosporine is still poorly understood. There is evidence that active biliary transporters are the site of several cyclosporine drug-drug interactions. One of the most important transporters that seem to be involved in cyclosporine drug-drug interactions is c-MOAT. Interestingly, c-MOAT as an organic anion transporter has a preference for acids. The major metabolite of cyclosporine, AM1A, is a carboxylic acid and therefore may be involved. We will systematically study the effect of c-MOAT in a pharmacokinetic study using wild-type and c-MOAT-deficient rats. The student will carry out the study, will be involved in sample collection and will analyze the concentrations of cyclosporine and its metabolites in blood, urine, bile and hepatic tissue using HPLC/MS, will analyze the data using pharmacokinetics software (WinNonlin) and will prepare a presentation/ publication.
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Research Topic:	The effect of statin treatment on rat skeletal muscle mitochondria.
Mentor(s):	Karen Jonscher, PhD
Student Role:	This project will use 2D gels and shotgun proteomics to evaluate the effect of statin treatment on muscle myopathy. We will compare the mitochondrial proteome between control, statin-treated, and myopathic rats. Protein spots of interest will be analyzed by nano LC/MS/MS mass spectrometry and identified using database searching. We will also identify proteins that change phosphorylation and oxidation status in response to statin insult. The student will learn (A) how to plan a complex project, (B) proteomics technologies such as 2D gels, LC-MS/iontrap and data base searches, (C) advanced sample preparation strategies for isolating modified proteins, and (D) data analysis/presentation in our Department's research seminar.

Research Topic:	Protection from renal ischemia: Role of extracellular adenosine signaling
Mentor(s):	Almut Grenz, MD, PhD
Student Role:	Several studies implicate an important role of extracellular adenosine in tissue protection during conditions of limited oxygen availability. Therefore, the goal of these studies is to identify and functionally characterize mechanisms of A2BAR-dependent tissue protection of the kidneys during ischemia. Furthermore we will define the tissue-specific localization of the renal A2BAR and its expressional responses to ischemia in vivo. Based on these studies, we will utilize in vitro models of renal hypoxia and preconditioning to understand A2BAR-dependent mechanisms of tissue protection during preconditioning. Finally, we will define strategies to target the A2BAR during renal ischemia in vivo. These experiments will facilitate significant progress on several fronts, including a more basic understanding of innate mechanisms of renal adaptation to ischemia/hypoxia. In addition, novel pharmacological approaches to diseases precipitated by renal ischemia/hypoxia would be made, a medical problem contributing to morbidity and mortality of critically ill patients from different fields of medicine and surgery. The student will learn (i) to investigate renal function by inulin-clearance, (ii) to perform renal ischemia with or without ischemic preconditioning by the hanging weight system, (iii) to measure electrolytes, (iv), to perform metabolic cage investigations, (v) to perform RT-PCR and Western Plot analysis and (vi) immunohistochemistry. (Grenz A, Zhang H, Hermes M, Eckle T, Klingel K, Huang DY, Müller CE, Robson SC, Osswald H, Eltzschig HK. Contribution of E-NTPDase1 (CD39) to renal protection from ischemia-reperfusion injury. FASEB J 21 (11): 2863-2873, 2007.)

Research Topic:	Adenosine transporters during renal ischemia
Mentor(s):	Almut Grenz, MD, PhD
Student Role:	Once generated into the extracellular milieu, adenosine is rapidly cleared through passive uptake by nucleoside transporters, termed equilibrative nucleoside transporters (ENT). As

	<p>previous studies implicated extracellular adenosine in endogenous attenuation of intestinal inflammation following ischemia, we hypothesized adenosine transport in dampening inflammatory hypoxia of the kidney. The goal of these studies is to investigate kidney damage due to hypoxia in gene targeted mice for the ENT1 and ENT2. Furthermore we will localize these channels in renal epithelial cells and study adenosine uptake in <i>in vivo</i> studies. Moreover we will study the role of the ENT location in renal cells versus hematopoietic cells in chimeric mice. The student will learn (i) to plan a complex project, (ii) to investigate renal function (inulin-clearance, metabolic cage investigation) in <i>in vivo</i> studies, (iii) to perform renal ischemia, (iv) to measure adenosine re-uptake in cell cultures including siRNA studies in <i>in vitro</i>, (v) how to generate generic mice. (Grenz A, Osswald H, Eckle T, Yang D, Zhang H, Tran ZV, Klingel K, Ravid K, Eltzschig HK. The reno-vascular A2B adenosine receptor protects the kidney from ischemia. PLoS Medicine 24 (5): 968-986, 2008)</p>
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Research Topic:	Neuronal Guidance Molecule Netrin-1 in Diabetic Nephropathy
Mentor(s):	Almut Grenz, MD, PhD
Student Role:	<p>Despite optimal glucose management, up to 40% of patients with long standing type I or type II diabetes develop diabetic nephropathy. In fact, diabetic nephropathy is among the leading causes of morbidity and mortality in diabetic patients. Therefore, novel therapeutic approaches to attenuate diabetic nephropathy are an area of intense investigation. The goal of this study is to investigate the role of the neuronal guidance molecule netrin-1 in modulating renal inflammation during diabetic nephropathy. Previous studies demonstrated that netrin-1 is accumulated in the urine and urinary netrin-1 levels correlated with the degree of diabetic nephropathy. Other studies from our laboratory indicated that the treatment with endogenous netrin-1 attenuates renal inflammation and improves kidney function from diabetes, while gene-targeted mice for netrin-1 experience a more severe phenotype during diabetic nephropathy. Based on these studies, it is our hypothesis that Netrin-1 protects the kidneys from renal inflammation and dysfunction during diabetic nephropathy. The student will learn (i) to induce streptozotocin-induced diabetes mellitus, (ii) metabolic cage investigations in diabetic mice, (iii) renal function tests in diabetic mice, (iv) to investigate high glucose levels on cell function regarding ischemia and the role of adenosine in <i>in vitro</i> experiments, (v) RT-PCR, Western, Immunohistochemistry of netrin in the kidney and netrin determination in blood and urine. (Grenz A, Eckle T, Faigle M, Laucher S, Thompson LF and Eltzschig HK. A2B adenosine receptor dampens hypoxia-induced vascular leak. Blood 111 (4): 2024-2035, 2008.)</p>

Research Topic:	Hypoxia inducible factor in acute lung injury
Mentor(s):	Ana Fernandez Bustamante, MD PhD
Student Role:	<p>This research program will study the consequences of cyclic mechanical stretch <i>in vitro</i> and mechanical ventilation <i>in vivo</i> on gene transcription. Here, preliminary data indicate that the transcription factor hypoxia inducible factor is stabilized during conditions of cyclic mechanical stretch. Further studies will be aimed to elucidate functional consequences of HIF stabilization. This work will be performed using different models of acute lung injury (see for example Eckle et al. Journal of Clin. Invest. 2008). The student will be working with real-time reverse transcriptase PCR techniques to define changes in gene expression with cyclic mechanical stretch. In addition, changes in transcript level of specific genes will be confirmed on a protein level using Western blot analysis. <i>In vivo</i> relevance of these findings will be studied using <i>in vivo</i> models of acute lung injury (e.g. induced by mechanical ventilation or by LPS inhalation).</p>

Research Topic:	Extracellular adenosine signaling in myocardial ischemia
Mentor(s):	Tobias Eckle, MD PhD
Student Role:	Preliminary data indicate that extracellular adenosine signaling protects the heart from ischemia (Eckle et al. Circulation 2007 and 2008). Here, we will attempt to define the role

	of one of the four known adenosine receptors in cardioprotection. The student will help to expose wildtype mice or gene-targeted mice for individual adenosine receptors to myocardial ischemia. Additional studies will be performed using bone-marrow chimeric mice to study the contribution of myeloid versus cardiac tissues ...
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Research Topic:	Period-1 in cardioprotection
Mentor(s):	Tobias Eckle, MD PhD
Student Role:	Previous studies suggest a role of metabolic adaptation in cardioprotection from ischemia (see for example Eckle et al. Circulation 2008). Here, we will pursue the role of period-1, a protein important in regulation of metabolic adaptation. The student will use genetic and pharmacological approaches to address the role of period-1 in mouse models of myocardial ischemia and cardioprotection.

Research Topic:	Extracellular adenosine in lung protection
Mentor(s):	Tobias Eckle, MD PhD
Student Role:	Preliminary data from our laboratory indicate that during mechanical ventilation extracellular adenosine levels are enhanced and protect the lungs from acute injury (see Eckle et al. Journal of Clin. Invest. 2008, Eckle et al. Journal of Immunology 2007). The student will learn how to induce acute lung injury in mice, using inhalation of LPS or mechanical ventilation. Using adenosine receptor “knockout” mice, the student will then identify the role of individual adenosine receptors in lung protection from ischemia.

Research Topic:	Novel approaches to prevent hepatic ischemia reperfusion injury
Mentor(s):	Holger K. Eltzschig, MD PhD
Student Role:	Studies from our laboratory indicate that extracellular adenosine generation via the ectonucleotidase CD73 (an enzyme located on the outside of the cell membrane that converts AMP to adenosine) is important in liver protection from ischemia (see Hart et al. Gastroenterology 2008). The student will learn how to induce hepatic ischemia in mice. This will be followed by studies of acute hepatic ischemia in gene-targeted mice for individual adenosine receptors to identify the contribution of extracellular adenosine signaling in liver protection from ischemia.

Research Topic:	Neuronal guidance molecule netrin-1 as endogenous activator of adenosine receptors
Mentor(s):	Holger K. Eltzschig, MD PhD, Carol Aherne, PhD
Student Role:	We recently identified the neuronal guidance molecule netrin-1 as hypoxia responsive gene (see Rosenberger et al. Nature Immunology 2008). Additional studies in different models indicate that netrin-1 attenuates inflammatory hypoxia via enhancing adenosine-dependent signaling pathways. The student will help with further characterizing the interaction of netrin-1 with the A2B adenosine receptor. Such studies will include in vitro assays of A2BAR activation through adenosine, e.g. my measurements of intracellular cyclic AMP (cAMP).

University of Florida

Research Topic:	Reperfusion Injury Following Liver Transplantation
Mentor(s):	Nikolaus Gravenstein, MD, Mark Rice, MD
Student Role:	Data collection and compilation of data with respect to adverse physiological changes during liver transplantation (i.e., reperfusion syndrome) as assessed by blood potassium concentration changes, cardiac function via echocardiography, and temperature deviations as determined by invasive temperature monitoring of the graft and host, and forward looking infrared imaging of the graft surface.

Research Topic:	Personality Assessment of Resident Applicants for Patient Safety Improvement
Mentor(s):	Alexander S. Matveevskii, MD, PhD
Student Role:	Development and execution of personality inventory testing with creation of an electronic database of quality assurance data for anesthetized patients at Shands Hospital at the University of Florida.

Research Topic:	Maternal-fetal monitoring - electrohysterography using optimal linear filtering
Mentor(s):	Tammy Euliano, MD
Student Role:	Patient enrollment, application of monitoring device, data entry, monitoring during labor

Research Topic:	GABAA/Glycine Receptor-mediated Excitatory Adverse Effects of Sevoflurane (NINDS 1R21NS060862-01A1)
Mentor(s):	Anatoly E. Martynyuk, PhD, ; Christoph N. Seubert, PhD, MD
Student Role:	Provision of sevoflurane-anesthesia for rat pups with acquisition and analysis of electroencephalography

Research Topic:	Emergence of Glucose in Exhaled Breath
Mentor(s):	Timothy E. Morey, MD, Scott Wasdo, PhD, Donn M. Dennis, MD, FAHA
Student Role:	Collection of breath and blood specimens from human subjects after informed consent; data analysis of ion chromatograms; comparison of values using Bland Altman and Clark Error analysis

Research Topic:	A Breath-based Medication Adherence Monitoring System for HIV/AIDS Therapies (NIMH 1R43MH081767-01)
Mentor(s):	Richard Melker, PhD, MD, Donn M. Dennis, MD, FAHA
Student Role:	Collection of human breath samples with measurement using a mini-gas chromatogram; analysis of data and comparison with directly observed therapy (DOT) values.

Research Topic:	Retrospective Analysis of Intrathecal Morphine Administration in Patients Undergoing Ascending Aortic Arch Repair under Deep Hypothermic Circulatory Arrest.
Mentor(s):	Rama S. Kulkarni, MD
Student Role:	Collection of data and organization of database, analysis, and compilation of results

Research Topic:	Analysis of NIS (National inpatient sample) database on the occurrence of acute kidney injury among patients with subarachnoid hemorrhage (SAH).
Mentor(s):	Azra Bihorac, MD, Joseph Layon, MD
Student Role:	Students will be involved in learning basics of SAS programming and analysis of large administrative database. Students will work with Drs. Bihorac and Scholds, a statistician, on learning how to manipulate data from NIS and how to perform analysis.

Research Topic:	Assessment of microcirculatory changes in the patients with subarachnoid hemorrhage (SAH) admitted to NICU.
Mentor(s):	Azra Bihorac, MD, Joseph Layon, MD
Student Role:	Students will learn to implement technique of bedside assessment of microcirculation with video microscopy and will be involved also in the clinical data collection. Some basics of the video imaging interpretation will be useful.

Research Topic:	Nonvolatile Exhaled-Breath Biomarkers for Clinical Diagnostics.
Mentor(s):	Alexander V Glushakov, PhD, Timothy E. Morey, MD
Student Role:	Collection of breath and blood specimens from human subjects after informed consent; quantitative detection of biomarkers using analytical spectroscopy techniques as well as biochemical and molecular biological methods; analysis of experimental data.

Research Topic:	Retrospective analysis of cerebral oximetric findings and outcomes from procedures involving deep hypothermic circulatory arrest.
Mentor(s):	Gregory Janelle, MD
Student Role:	Assist with collection of perioperative data and organization of database, analysis, and compilation of results

Research Topic:	Biochemical Markers of Traumatic Brain Injury (NINDS 5R01NS052831-03)
Mentor(s):	Steven Robicsek, PhD, MD
Student Role:	Assist in recruitment of patients suffering TBI, collection of specimens and data, compilation of databases and analysis.

Research Topic:	Surface Acoustic Wave Technology for Sensing Propofol in Exhaled Breath
Mentor(s):	Timothy E. Morey, MD, Donn M. Dennis, MD, FAHA, James Bailey, DVM, Alex Bukoski
Student Role:	Working veterinary anesthesiologists and engineers to field trial a portable, real time propofol sensor: collecting specimens, operating the instrument, compiling data, performing pharmacokinetic analysis, and other tasks.

University of Iowa

Research Topic:	Pain Mechanisms after Surgery
Mentor(s):	Timothy J. Brennan, MD, PhD
Student Role:	Pain management after surgery is one aspect of difficult to control acute pain for patients. We have developed experimental animal models of postoperative pain. Possible experiments include behavioral measures and pharmacologic treatments for incisional pain. For a summer project a student could learn surgical techniques like spinal catheterization and spinal drug administration. Novel analgesic treatments and their long term effects could be studied.

Research Topic:	Measurement of Inflammatory Response During One-Lung Ventilation
Mentor(s):	Javier Campos, MD
Student Role:	The medical student will: help screen patients in the anesthesia preoperative evaluation clinic, help obtain patient's consent along with the anesthesiologist involved in the study, and keep a log of patient enrollment. The student will directly participate with the anesthesia team in the operating room collecting data pertinent to the study and providing anesthesia care to the patient. Once the study is completed, the medical student will enter the data into Excel spreadsheet. The student will participate in regular research clinical thoracic anesthesia meetings and attend the cardiothoracic anesthesia journal club meetings. The student will have daily contact with the principal investigator. Participant will spend greater than 15% of their time in clinical anesthesia.

Research Topic:	Minimum Stimulating Threshold (MST) Current Intensity for Posterior Cord Brachial Plexus Block in Patients with Diabetes and / or End Stage Renal Disease
Mentor(s):	Anthony Han, MD, PhD, FAAFP
Student Role:	The study involves measuring MST current intensity during daily regional anesthesia practice, aiming at posterior cord of infraclavicular nerve. It requires about 10 minutes of observation and then follow-up once postoperatively to assess complications, quality of block and satisfaction level. The students will participate in the patients' identification and enrollment, but not in consenting procedure. They will be familiar with regional anesthesia such as ultrasound, peripheral nerve stimulator, local anesthetics, etc. They will collect patient demographics, lab results, and other necessary data and put these into the digital format. The participants will learn the basic statistical analysis in the clinical contexts.

Research Topic:	Ketamine for Procedural Sedation in Children with Major Burns: Rational Dosing Guidelines
Mentor(s):	Anthony Han, MD, PhD, FAAFP
Student Role:	Children suffering from severe burns require repetitive painful procedures, particularly for debridement and dressing changes. The dosing of sedatives and analgesics in such children is very difficult due to the injury and related physiologic changes. The study is aimed at improving the quality of care for the burned children in sedation and pain control. The students will be participating in preparation of documents and the patients' identification. They will collect patient demographics, lab results, other necessary data and put these into the digital format and also participate in the processing of samples. The participants will develop the advanced statistical skills in the clinical contexts.

Research Topic:	Thoracic Paravertebral Nerve Block Versus Local Anesthetic Instillation into the Surgical Drain after Mastectomy for Breast Cancer
Mentor(s):	John Laur, MD
Student Role:	Pain from surgery is important to control and perhaps more so in cases with a high incidence of chronic pain afterwards such as mastectomy. In an ambulatory surgery center setting, pain relief can be achieved by placing an advanced regional nerve block like a thoracic paravertebral block. As a possible alternative to nerve block, we plan to compare thoracic paravertebral block versus injecting local anesthetic through the surgical drain for pain control after breast surgery. We will also compare patient satisfaction. The student will learn about regional anesthesia and clinical postoperative pain research by assisting with and observing nerve block placement, data collection and data analysis.

Research Topic:	Obstructive Sleep Apnea and Postoperative Outcomes
Mentor(s):	Douglas Merrill, MD
Student Role:	Obstructive Sleep Apnea (OSA) is becoming more prevalent given the rise in obesity – a major risk factor. OSA has multiple co-morbidities including hypertension, cardiac arrhythmias, mental impairment, and increased risk of death. It is not known if perioperative outcomes improve in patients diagnosed and treated for OSA with Continuous Positive Airway Pressure (CPAP) compared to patients with OSA who are untreated. The student will participate in the planning, data collection, and data analysis comparing perioperative outcomes in treated and untreated OSA patients.

Research Topic:	Molecular Biology of Incisional Pain
Mentor(s):	Christina Spofford, MD, PhD, Timothy J. Brennan, MD, PhD
Student Role:	We will pursue the neuroscience and molecular biology of incisional pain. The opportunity to examine mRNA and protein expression in animal postoperative models. The project will define molecular changes and patterns of neurotrophic and other factors in incisions over the time course that we typically measure in postoperative pain patients. The goal of these studies is to better understand incisional pain mechanisms, clinical postoperative pain, and the transition from acute to chronic pain.

University of Medicine & Dentistry of New Jersey

Research Topic:	The Effect of Different Ventilator Strategies on Inflammation and Injury in Normal Lungs
Mentor(s):	Ellise Delphin, MD, MPH
Student Role:	The student will benefit from their participation in a structured research study. They will be exposed to Good Clinical Practice (GCP) which ensures the rights and safety of clinical trial subjects and the integrity of clinical data obtained during the conduct of a clinical trial. The student will have the opportunity to have a comprehensive review of the protocol, participate in subject-investigator interactions, ongoing and risk appropriate safety monitoring throughout the conduct of the study and assist in data collection, analysis and reporting.

	<p>Students will benefit from the experience of interviewing potential subjects and reviewing the medical history to assess the individual eligibility for inclusion into the study. This study takes place in the Operating Room and the student will benefit from the experience of spending time in the OR Suite and having the opportunity to witness a variety of surgical procedures and anesthetic techniques.</p> <p>The student will become familiar with respiratory physiology, the mechanical ventilator/anesthesia machine, invasive and noninvasive monitoring parameters, normal arterial blood gas values and cytokine markers. In addition some portion of the work may involve basic science laboratory techniques.</p>
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Research Topic:	The Association Between Peri-operative Hyperglycemia and Major Morbidity and Mortality
Mentor(s):	Ellise Delphin, MD, MPH
Student Role:	<p>The student will benefit from their participation in a structured research study. They will be exposed to Good Clinical Practice (GCP) which ensures the rights and safety of clinical trial subjects and the integrity of clinical data obtained during the conduct of a clinical trial. The student will have the opportunity to have a comprehensive review of the protocol, participate in subject-investigator interactions, ongoing and risk appropriate safety monitoring throughout the conduct of the study and assist in data collection, analysis and reporting.</p> <p>Students will benefit from the experience of interviewing potential study subjects and reviewing the medical history to assess the individual eligibility for inclusion into the study. This study takes place in the Operating Room and the student will benefit from the experience of spending time in the OR Suite and having the opportunity to witness a variety of surgical procedures and anesthetic techniques.</p> <p>The student will gain an understanding of the response of the endocrine system to the stress of surgery. The student will have hands on experience with several devices including a glucometer and Baxter infusion pump. He/she will be well versed in the signs and symptoms of hypoglycemia and will have the opportunity to conduct post operative follow up.</p>

Research Topic:	The Effect of Nitrous Oxide on Intraocular Pressure and Ocular Perfusion
Mentor(s):	Geordie P. Grant MD
Student Role:	<p>The student will benefit from their participation in a structured research study. They will be exposed to Good Clinical Practice (GCP) which ensures the rights and safety of clinical trial subjects and the integrity of clinical data obtained during the conduct of a clinical trial. The student will have the opportunity to have a comprehensive review of the protocol, participate in subject-investigator interactions, ongoing and risk appropriate safety monitoring throughout the conduct of the study and assist in data collection, analysis and reporting.</p> <p>Additional subjects will benefit from the experience of interviewing the subject's and reviewing the medical history to assess the individual eligibility for inclusion into the study. This study takes place in the Operating Room and the student will benefit from the experience of spending time in the OR Suite and having the opportunity to witness a variety of surgical procedures and anesthetic techniques.</p> <p>This is one of several studies Dr. Grant has initiated in an effort to determine why some patients have diminished eyesight following surgery. The student will become familiar with the anatomy and physiology of the eye. Students will become familiar with the</p>

	Tonopen-XL the device used to measure intraocular pressure. They will work closely with Dr. Grant as well as physicians from other disciplines (Ophthalmology and Orthopedics)
Research Topic:	MicroRNA in isoflurane-mediated myocardial protection
Mentor(s):	Chunxiang Zhang, MD, PhD
Student Role:	<p>The student will benefit from their participation in a structured research study. This is a Basic Science Study conducted in a state of the art laboratory setting. They will become familiar with Federal regulations regarding the design of procedures involving animals and the performance of same with consideration of their relevance to human health. The student will have the opportunity to have a comprehensive review of the protocol, participate in laboratory staff-investigator interactions, ongoing and risk appropriate safety monitoring throughout the conduct of the study and assist in data collection, analysis and reporting.</p> <p>MicroRNAs (miRNAs) comprise a novel class of endogenous, small, noncoding RNAs that negatively regulate gene expression via degradation or translational inhibition of their target mRNAs. Functionally, an individual miRNA is important as a transcription factor because it is able to regulate the expression of its multiple target gene. Recent studies suggest that isoflurane, an anesthetic gas, has myocardial protection effects through multiple gene regulation. The molecular mechanisms of its effects are unclear. Two studies are proposed to look at the role of microRNAs in isoflurane mediated rats and rat heart cells.</p>
Research Topic:	Determining the relationship between the cellular mechanism and the behavioral effects of anesthetics.
Mentor(s):	Jiang-Hong Ye, MD, PhD
Student Role:	<p>The student will benefit from their participation in a structured research study. This is a Basic Science Study conducted in a state of the art laboratory setting. They will become familiar with Federal regulations regarding the design of procedures involving animals and the performance of same with consideration of their relevance to human health. The student will have the opportunity to have a comprehensive review of the protocol, participate in laboratory staff-investigator interactions, ongoing and risk appropriate safety monitoring throughout the conduct of the study and assist in data collection, analysis and reporting.</p> <p>The goal of this study is to determine the relationship between the cellular mechanisms and the behavioral effects of the widely used drug propofol. In this project, the investigators will perform experiments using rats comparing the loss of righting reflex (LORR) induced by propofol in the absence and presence of strychnine and the γ aminobutyric acid A receptor antagonist GABA_A. In addition, we will evaluate the effects of propofol on the currents induced by glycine (I Gly) and by γ-aminobutyric acid (I GABA), as well as the effects of strychnine and GABA_A on the I PRO in neurons isolated from the posterior hypothalamus, which is a pivotal area in the sleep pathway.</p>
Research Topic:	Can Blood Glucose Levels During the Perioperative Period Identify a population at Risk for Hyperglycemia?
Mentor(s):	Vasanti Tilak, MD
Student Role:	The student will benefit from their participation in a structured research study. They will be exposed to Good Clinical Practice (GCP) which ensures the rights and safety of clinical trial subjects and the integrity of clinical data obtained during the conduct of a clinical trial. The student will have the opportunity to have a comprehensive review of the protocol, participate in subject-investigator interactions, ongoing and risk appropriate safety monitoring throughout the conduct of the study and assist in data collection, analysis and reporting.

	<p>Students will benefit from the experience of interviewing potential study subjects and reviewing the medical history to assess the individual eligibility for inclusion into the study. This study takes place in the Operating Room and the student will benefit from the experience of spending time in the OR Suite and having the opportunity to witness a variety of surgical procedures and anesthetic techniques.</p> <p>The student will gain an understanding of the response of the endocrine system to the stress of surgery. The student will have hands on experience with several devices including a glucometer and a HbA1C apparatus. He/she will have the opportunity to conduct post operative follow up.</p>
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University of Miami Miller School of Medicine

Research Topic:	Our laboratory is studying risk factors underlying susceptibility to tobacco related diseases including: cardiovascular disease, chronic kidney disease, metabolic syndrome, and lung disease. Adequate treatment for tobacco related disease remains a major unmet need. We are using genetic models of tobacco smoke susceptibility to identify the genes and biologic pathways responsible for end-organ pathology. We are working closely with the Division of Pulmonary and Critical Care Medicine, Department of Surgery, Vascular Biology Institute, and the Miami Institute for Human Genomics in this multidisciplinary program.
Mentor(s):	Roy C. Levitt, MD
Student Role:	Students will assist with <i>in vitro</i> and <i>in vivo</i> genetics studies, including the genome-wide mapping of susceptibility genes, and the evaluation of the role of specific candidate genes. Students will become familiar with translational research methods including genomic methods applicable to common complex clinical problems.

Research Topic:	Our laboratory is studying gene-environment interactions important in the pathogenesis of addiction. Adequate treatment for addiction remains a major unmet need and little is understood about genetic susceptibility. We are testing the hypothesis that tobacco smoke exposures will impact ethanol consumption and that heritable factors underlying ethanol preference will also be shared with susceptibility to tobacco. These translational studies include mechanistic studies, behavioral and safety assessments, and bioanalysis of genes impacting addiction and withdrawal to tobacco and alcohol.
Mentor(s):	Roy C. Levitt, MD
Student Role:	Students will assist with planning and implementation of <i>in vitro</i> and <i>in vivo</i> mechanistic studies, safety assessments and behavioral assessments, data analyses including the evaluating the role of specific candidate genes and genomic methods applicable to common complex clinical problems

Research Topic:	The purpose of this trial is to test 2 standards of care with the hypothesis that in multi-system traumatic injury, initial resuscitation with Hextend will stabilize hemodynamics better than an equivalent volume of standard of care crystalloid fluids. With Hextend vs crystalloid, overall fluid requirements will be reduced, extravasation will be reduced, and outcome will be improved.
Mentor(s):	Kenneth G. Proctor, PhD
Student Role:	The student will enroll and consent patients, and assist trauma/critical care attending physicians and fellows administer test fluids.

Research Topic:	The purpose of this study is to determine whether Arginine vasopressin (AVP) is safe and effective to maintain cerebral perfusion pressure (CPP) = 60 mm Hg in patients with traumatic brain injury (TBI). We have already defined risks and benefits of AVP therapy, relative to PE, in four different clinically relevant laboratory model. We now plan to evaluate this new therapy relative to the current evidence-based guideline for CPP management in TBI patients. The working hypothesis is that the risk/benefit profile for
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	AVP is equal, or superior to, PE at equi-effective doses for the management of CPP following TBI. A corollary is that a higher CPP can be safely tolerated with AVP vs PE.
Mentor(s):	Kenneth G. Proctor, PhD
Student Role:	The student will enroll and consent patients, and assist trauma/critical care attending physicians and fellows care for patients with TBI.

Research Topic:	The purpose of this study is to critically evaluate three issues related to the treatment of blast injury, we aim: 1: To comprehensively evaluate the structural and functional consequences in a LD50 animal model that simulates blast-induced neuro- and poly-trauma followed by resuscitation with crystalloid (according to standard civilian practice) or Hextend (HEX, 6% hetastarch solution in lactated buffer: according to current military doctrine). 2: To evaluate the causes, and effectiveness of a potential treatment, for trauma-induced coagulopathy 3: To evaluate prophylaxis against intracranial hypertension 4: To evaluate three of the most commonly used alternative anesthetic regimens on structural and functional changes in the cerebral circulation
Mentor(s):	Kenneth G. Proctor, PhD
Student Role:	The student will assist a research fellow to design experimental protocols, collect data, analyze and interpret results.

Research Topic:	A multi-disciplinary program is underway to evaluate the mechanism of susceptibility to Chronic Pain Syndromes (CPS). Our aim is to identify specific gene-environment interactions important in the pathogenesis of CPS in order to develop better diagnostics and treatments. Adequate treatment for CPS remains a major unmet need. We are using genetic models of susceptibility to peripheral nerve injury to identify the genes and biologic pathways responsible for CPS.
Mentor(s):	Eugene Fu, MD, Salahhadin Abdi, MD, Keith Candiotti, MD, Roy C. Levitt, MD
Student Role:	Students will assist with <i>in vitro</i> and <i>in vivo</i> genetics studies of susceptibility to CPS, including the use of transgenic systems in evaluating the role of specific candidate genes in CPS. Students should become familiar with translational research methods including genomic methods applicable to common complex clinical problems.

Research Topic:	Participate in an ongoing project to study the role of a free radical scavenger; in attenuating chemotherapy induced peripheral neuropathic pain in rats.
Mentor(s):	Salahadin Abdi, MD
Student Role:	The student will learn to the methods and techniques used in behavioral pain research. 1. Proper care, use, and humane treatment of animals used in research. 2. To use different types of behavior instruments and techniques to investigate the effect of the above scavenger in reducing pain in rats. 3. How to collect basic behavioral data, how to analyze it and present it as a poster presentation

Research Topic:	The Effects of Genomic Polymorphisms on Acute Pain. The focus of this study is to evaluate the effects of genetic polymorphisms on the pain behavior in patients after surgery-typically nephrectomies. The project has both clinical and basic science elements. Evaluations of markers such as IL-1, IL-6 and CYP2D6, and their polymorphisms, will be evaluated for their effects on pain scores and morphine consumption.
Mentor(s):	Keith Candiotti, MD
Student Role:	Students can be involved in this project on different levels. Students will be able to follow patients clinically, assisting with enrollment and the collecting of blood and fluid samples for analysis. Additionally, students can participate in the laboratory section of the study by assisting with the preparation of samples and running of different genomic assays.

University of Michigan

Research Topic:	<p>Incidence and Predictors of Inadequate Intraoperative Cerebral Perfusion Pressure</p> <p>Neurological outcome and survival of patients after traumatic brain injury (TBI)¹ or subarachnoid hemorrhage (SAH)² is affected by the occurrence of the secondary acquired brain damage. These newly acquired injuries are mainly caused by ischemia secondary to prolonged periods of decreased cerebral perfusion³. The aggressive maintenance of a CPP above 65 – 70 mmHg has been previously reported to improve neurological outcome and patient survival^{1,4}. While there is extensive literature regarding the course and management of intracranial hypertension and CPP in the neuro intensive care unit, there are no detailed studies investigating the intraoperative setting. The majority of studies considering intraoperative changes in intracranial pressure (ICP) or CPP are based on the observation of brain bulk or dural tension by the surgical attending, or subdural ICP monitoring placed after craniotomy is completed and removed prior to closure. Both of these subsets generally test the effect of a single therapeutic maneuver (e.g. hyperventilation or drug effect) on patients undergoing elective craniotomy. Other modalities have been used in attempt to quantify intraoperative CPP including transcranial Doppler and brain tissue oxygen tension. However, these techniques may be inaccurate in their estimation of CPP^{5, 6} and also may be impractical during craniotomy. Direct measurement of mean arterial pressure (MAP) and ICP remain the gold standard for determining CPP. As inadequate CPP is associated with poor neurological outcome and increase mortality, identifying factors associated with low intraoperative CPP would be helpful in the management of patients at risk of developing secondary ischemic brain injuries. Using Centricity, it is possible to assess the intraoperative CPP in a large population of patients with pre-existing ICP monitoring devices retrospectively. We assume that the presence of pre-operative ICP monitoring devices in the majority of our patients suggests preoperative pathology. The cerebrovascular reactivity and the ability of the brain to autoregulate may be compromised in pathologic conditions such as TBI⁶, SAH, and large brain tumors. Therefore, choosing a level of “adequate” CPP to prevent the occurrence of secondary acquired brain injury in patients with these conditions is problematic. We propose to delineate pre-morbid conditions and intra- and postoperative factors associated with potentially inadequate CPP. Since “adequate” CPP is poorly defined, we plan to categorize measured CPP’s into four groups; inadequate CPP (< 60 mmHg), low adequate CPP (60-80 mmHg), high adequate (80-100 mmHg), super adequate (>100 mmHg). Subsequently, we will analyze data based on these groups.</p>
Mentor(s):	George A. Mashour, MD PhD
Student Role:	The student’s primary responsibilities will be the review of relevant literature, organization of an extensive database on intraoperative cerebral perfusion pressure, correlation of post-operative outcomes, and assistance in the statistical analysis.

University of Pennsylvania

Research Topic:	Anesthetic-induced apoptosis and endoplasmic reticulum calcium
Mentor(s):	Huafeng Wei, MD, PhD
Student Role:	The projects in my lab are testing the hypothesis that volatile anesthetics can induce neuronal apoptosis by abnormally releasing calcium from the intracellular calcium stores. The medical students will use cell culture and fluorescence microscope to determine changes of intracellular calcium concentration and cell damage by apoptosis after exposure to different volatile anesthetics or other intravenous anesthetics.

Research Topic:	Novel gene role in glutamatergic transmission
Mentor(s):	Raymond Roginski, MD, PhD
Student Role:	Projects focus on the signaling roles of a novel gene discovered in our lab, GRINL1A. The first project will determine how closely one of the GRINL1A proteins interacts with

	NMDA receptor (NMDAR) subunits using fluorescence resonance energy transfer (FRET). The student will help express the fluorescent proteins in cultured cells, and then use fluorescence microscopy to measure FRET. The second project also uses fluorescence microscopy to examine the effect of GRINL1A proteins on calcium entry through the NMDAR, and then attempt to modulate activity with antibodies and RNA interference (RNAi). The student will participate in lab meetings and present a summary of their work at the end of the summer.
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Research Topic:	Anesthetic effects on amyloidogenic proteins
Mentor(s):	Roderic G. Eckenhoff, MD
Student Role:	This project uses cell culture and flow-cytometry to measure effects of different volatile anesthetics on apoptosis in various types of cultured cells. The student will design and conduct assays, analyze and summarize data, and prepare initial abstracts and presentations for meetings.

Research Topic:	Anesthesia and sleep neurobiology
Mentor(s):	Max Kelz, MD, PhD
Student Role:	The global hypothesis being tested in my laboratory is that volatile anesthetics exert their hypnotic properties via specific interactions with the neural circuits governing sleep and wakefulness. Ongoing projects use behavioral (righting reflex), physiological (processed EEG/EMG indices) or immunohistochemical (looking for sub-regions of brain whose activity is altered by anesthetics) approaches following pharmacologic or genetic manipulations in mice to determine whether our treatments have altered the organism's sensitivity to inhaled anesthetics. The student will choose to focus on one of these approaches, collect and analyze data and prepare abstracts.

Research Topic:	Anesthetic enhancement of Alzheimer pathogenesis
Mentor(s):	Roderic G. Eckenhoff, MD
Student Role:	This project involves the student in ongoing animal experimentation. Transgenic animals that develop Alzheimer-like pathology and behavior will be used to determine whether certain anesthetics accelerate the pathogenesis. This will involve hands-on rodent behavior testing, surgical procedures, and biochemistry. The student will focus on a particular aspect of this work, collect and analyze data, and prepare initial abstracts and presentations for meetings.

Research Topic:	Gene therapy for transient neuroprotection.
Mentor(s):	James G. Hecker, PhD, MD
Student Role:	Non-viral gene delivery to the brain depends on the composition of lipids and their formulation with nucleic acids. Dr. Hecker's lab offers opportunities to learn gene delivery to cells, optimization of transfection methods, measurement techniques for analysis of transfection of GFP, luciferase, or Heat Shock Proteins, and to assist with delivery, expression, and in vivo imaging in rodents.

Research Topic:	Protein targets of inhaled anesthetics
Mentor(s):	Jonas J. Johansson, MD, PhD
Student Role:	This project involves the student in ongoing research of how volatile anesthetics bind to proteins. This may involve techniques like isothermal titration calorimetry, fluorescence spectroscopy, x-ray crystallography and photoaffinity labeling. The student will focus on a given approach, collect and analyze data and then prepare initial abstracts and presentations for meetings.

Research Topic:	Targeted drug delivery
Mentor(s):	David M. Eckmann, PhD, MD
Student Role:	This project studies targeted drug delivery by exploiting ligand-receptor binding interactions between drug carriers and endothelial cells. Experimental goals include developing nanocarriers for vascular delivery to desired sites - target cells, or tissues. Experiments in cell culture and in rodent models allow tuning of ligand or gene delivery to specific cellular compartments. Recombinant fusion proteins, liposomes, polymer nanocarriers, monoclonal antibodies and other affinity ligands are design elements of drug delivery systems being tested. Targeted drug delivery may lead to improved treatment pain syndromes, cancer, cardiovascular, metabolic and genetic diseases, diabetes, inflammation and infectious diseases, among many others. The student will choose an ongoing project, assist in design, collect and analyze data, prepare abstracts, and present the project to the department.

Research Topic:	Mechanisms of organ dysfunction in sepsis
Mentor(s):	Clifford S. Deutschman, MD
Student Role:	Our lab studies the effects of sepsis, or overwhelming inflammation, on gene transcription, signal transduction, cell viability and organ function. We use a model of sepsis induced by peritoneal infection in rats and mice. Current projects underway in his lab include 1) The effects of white cell mediators IL-6 and TNF on transcription, signal transduction and cell death in the liver, 2) the effects of adenoviral gene therapy to increase intra-pulmonic expression of the heat shock protein HSP-70 in septic rats on the development of lung injury, 3) altered mitochondrial cytochrome c oxidase activity as an etiology for failed energetics during sepsis, 4) alterations in neutrophil function and modulation of septic responses by the signal transducer dPKC. The student will join an ongoing project, and use state-of-the-art techniques in molecular and cell biology and also focus on outcome.

Research Topic:	Perioperative outcomes and costs in high risk surgical patients
Mentor(s):	Lee A. Fleisher, MD
Student Role:	The student will perform retrospective chart reviews and analysis of large databases in selected populations such as bariatric surgery, endovascular stent placement, or obese surgery. They will help select a population and design abstraction instruments and develop the databases after literature reviews to help define predictive models and outcome definitions. If appropriate, they will work with economists or MBAs in the Department to outline the costs of care and adverse events and develop cost-effectiveness models for different interventions. They will be required to present their work at an internal conference and work with members of the Department to develop a manuscript.

Research Topic:	Lung injury via Functional MRI
Mentor(s):	Mauricio Cereda, MD
Student Role:	Our group is investigating the use of functional MRI of the lung (using hyperpolarized ^3He) in acute lung injury due to sepsis. Existing data suggest that ^3He MRI of the lung can provide pathophysiological and topographical information that cannot be obtained with conventional imaging techniques. We believe that functional MRI has the potential to be a valuable diagnostic tool in patients with sepsis and that it will allow to better monitor the physiological response to mechanical ventilation and to other therapies. We are using a murine model of septic acute lung injury obtained by cecal ligation and punctures. Animals then undergo MRI under mechanical ventilation at different times point, as we seek correlations between imaging data, histological appearance, and pulmonary function tests. Students will be involved with animal surgeries, ventilatory support, imaging procedures,

	data collection, and imaging analysis. The students will also help in abstract and manuscript preparation and will present the study to the department.
Research Topic:	tPA and treatment of stroke
Mentor(s):	William Armstead, PhD
Student Role:	tPA is the only FDA approved treatment for stroke. However, the brief therapeutic window of tPA and the high incidence of post-treatment complications has constrained the clinical use of this potentially life saving drug. The medical student will use an anesthetized piglet model of stroke to determine the effects of this insult on cerebral blood flow, will collect CSF samples to perform biochemical assays, and will use immunohistochemistry and histopathology to determine mechanism and outcome in experiments designed to improve clinical outcome by separating the favorable and harmful activities of tPA.
Research Topic:	Endogenous plasminogen activators contribute to impaired cerebral hemodynamics and tissue injury after traumatic brain injury
Mentor(s):	William Armstead, PhD
Student Role:	Endogenous plasminogen activators such as tPA enhance excitotoxic neuronal cell death through interactions with the NMDA glutamate receptor. In the context of the neurovascular unit, cerebral hemodynamics is thought to influence neuronal cell integrity after CNS ischemic events such as traumatic brain injury (TBI). The medical student will use an anesthetized piglet model of fluid percussion brain injury to determine the effects of this insult on cerebral blood flow, will collect CSF samples to perform biochemical assays, and will use immunohistochemical and histopathologic techniques to determine mechanism of neuronal cell death in experiments designed to identify new therapies to treat victims of TBI.
Research Topic:	Lung function after surgery
Mentor(s):	E. Andrew Ochroch, MD, MSCE
Student Role:	We are studying the effect of several perioperative interventions to try to maintain lung function after surgery. The student will become familiar with clinical research theory and practice. They will participate in Patient Oriented Research education, and become certified. They will become familiar with the development of a research protocol and the role of the IRB. Direct patient contact will involve performing pulmonary tests on patients preoperatively and postoperatively.
Research Topic:	Genetics of Chronic Pain
Mentor(s):	E. Andrew Ochroch, MD, MSCE
Student Role:	Students will be doing chart review and adding data to an existing database. The database is of patients who have undergone thoracic surgery. The students will participate in Patient Oriented Research education, and become certified. They will learning fundamental of clinical research including study design, data integrity and analysis.
Research Topic:	Morbid Obesity: An Anesthetic Challenge
Mentor(s):	Ashish Sinha, MD
Student Role:	Student Role: We are evaluating the outcomes with different interventions in the care of the morbidly obese. We are doing this by looking at outcomes in different surgical procedures. For instance, do larger patients with ankle fractures have delayed discharges or longer operative times or more infections etc? The same question will be addressed to other surgical procedures in the OR. We have near complete data capture for all patients that pass through the OR. A student would collect and analyze data and prepare abstracts or other write ups and be given credit with authorship if appropriate. Dr Sinha's group is also active in clinical trials of anesthetic drugs on patients. Current trials include pain drugs, anti-nausea and vomiting drugs, and drugs to decrease side effects of other

	'necessary' drugs. Any student that joined us would be involved in patient recruitment and data collection exercises. Another project involves the use of hyperbaric oxygen for decreasing post surgical neurocognitive deficit.
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University of Pittsburgh

Research Topic:	Volatile Anesthetic Interactions with Membrane Proteins
Mentor(s):	Yan Xu, PhD
Student Role:	Experimental and theoretical approaches are combined to study how low affinity neurological agents, particularly general anesthetics and alcohols, exert their effects on the central nervous system at the molecular level. The goal is to understand the molecular mechanisms of general anesthesia. Trainees in Dr. Xu's laboratory have the opportunity to learn a variety of modern techniques, including expression and purification of membrane proteins, immunohistochemistry, high-resolution nuclear magnetic resonance imaging and spectroscopy, imaging reconstruction, 3-D protein structure calculation, and molecular dynamics simulations

Research Topic:	Membrane Protein Structural and Dynamical Studies by NMR
Mentor(s):	Yan Xu, PhD
Student Role:	NMR is used to determine the transmembrane domain structures of the human glycine receptor, which is the primary inhibitory receptor in the spinal cord and brainstem and responsible for a wide range of diseases. The long-term goal is to provide the structural basis for novel design of drugs that are disease specific and devoid of side effects. Trainees in Dr. Xu's laboratory have the opportunity to learn a variety of modern techniques, including expression and purification of membrane proteins, immunohistochemistry, high-resolution nuclear magnetic resonance imaging and spectroscopy, imaging reconstruction, 3-D protein structure calculation, and molecular dynamics simulations

Research Topic:	Gene and Stem Cell Therapy for Brain Protection and Revitalization After Cardiac Arrest and Resuscitation
Mentor(s):	Yan Xu, PhD
Student Role:	New gene therapy strategies are being developed to target reperfusion injury after cardiac arrest and resuscitation. Recently, Dr. Xu's group combined gene therapy with stem cell therapy using a non-controversial source of stem cells, in an effort to stop and reverse the neuronal loss and to rebuild neuronal circuitry after reperfusion from prolonged cardiac arrest or stroke. Trainees in Dr. Xu's laboratory have the opportunity to learn stem cell transplantation, Various stroke models, high-resolution magnetic resonance imaging (MRI), image reconstruction, and confocal microscopy.

Research Topic:	Molecular Mechanisms of General Anesthesia: an Experimental Approach
Mentor(s):	Pei Tang, PhD
Student Role:	Dr. Tang's major research interests include the determination of sequence-, structure-, and dynamics-function relationships of proteins (particularly those proteins in the central nervous system) and the investigation of the interactions between proteins and low-affinity drugs at the atomic resolution. The ultimate goal is to achieve rational designs of safer drugs with minimal side effects. Both experimental and theoretical approaches are taken in her laboratory to predict protein structures and to understand the molecular mechanisms of complex biological processes, with a strong emphasis on the molecular mechanisms of general anesthesia. Computational sequence analysis, homology modeling, and molecular dynamics simulations are combined with the state-of-the-art experimental tools, particularly multidimensional NMR spectroscopy, to validate theoretical predictions and to provide protein structural and dynamical information. Dr. Tang's research emphasis lies on elucidating the collective mechanisms of protein-protein, protein-membrane, and

	protein-ligand interactions in ion channels, particularly the neurotransmitter-gated receptors. Students will receive training in both experimental and theoretical approaches to biomedical research. Experimentally, they will gain hands-on experience in our state-of-the-art instruments, including recently installed high-field NMR spectrometers, to (1) determine high resolution structures of proteins that have been recognized as potential anesthetic targets; (2) characterize interaction sites of anesthetic drugs on proteins and the impact of anesthetic interaction to protein structure and dynamics; (3) evaluate potential factors that contribute to protein aggregations and the aggregation related diseases.
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Research Topic:	Molecular Mechanisms of General Anesthesia: a Computational Approach
Mentor(s):	Pei Tang, PhD
Student Role:	Students will receive training in both experimental and theoretical approaches to biomedical research. The theoretical approach will expose them to the computational facility at Pittsburgh Supercomputer Center and learn various computation methods, including (1) parameterizations of drug molecules for further use in molecular dynamics simulations; (2) all-atom molecular dynamics simulations of proteins in the absence and presence of anesthetic drugs; (3) the steered molecular dynamics (SMD) simulations to study anesthetic effects on ion permeation in ion channels; (4) simulations of collective protein motions using coarse-grained models.

Research Topic:	Data Mining in the North American Malignant Hyperthermia Registry
Mentor(s):	Barbara W. Brandom, MD, Michael Young, M.S. Biostatistics
Student Role:	Dr. Brandom's group maintains the North American Malignant Hyperthermia Registry. Trainees will participate in research projects involving de-identified data already acquired by the North American Malignant Hyperthermia Registry (over 4,000 cases), in developing and executing projects based on contacting patients with the malignant hyperthermia (MH) susceptible or MH negative diagnosis, or on clinical research involving patients undergoing anesthesia in the operating room at Children's Hospital. Together with other members of the Anesthesia Pain Service at Children's Hospital, we will perform studies of the management of post-operative or chronic pain in pediatric patients. In the next few years, Dr. Brandom will continue to expand the methods by which MH susceptible patients can document their physical condition. Research will focus on measures of muscular function that could document the sub-clinical chronic myopathy that is one of the manifestations of some mutations in the ryanodine receptor gene. Trainees will have the opportunities to collaborate with geneticists who can document these and other mutations that increase risk of anesthetic and other stress induced episodes of muscle injury.

Research Topic:	Role of GABA _A Receptors in Anesthetic Action
Mentor(s):	Gregg E. Homanics, PhD
Student Role:	Research in Dr. Homanics laboratory applies genetic dissection of putative molecular targets of inhaled anesthetics to explain the neurophysiologic basis of their actions. A novel genetic approach for creating conditional gene knockin mice will be pioneered. Knockin mice with alterations in specific GABA _A -R subunit genes will be created, characterized, and tested. These novel mice will be analyzed with tests spanning molecular, cellular, and behavioral levels. Such a multi-level approach allows a determination of the relevance of a specific drug target (receptor) as a mediator of a specific phenotype (e.g., amnesia). Techniques student may learn: Molecular biology: genomic library screening and cloning, PCR, Southern blotting, vector construction. Cell culture: embryonic stem cell culture, electroporation, drug selection of clonal cell lines. Animal analysis: whole animal drug responses, behavioral characterization.

Research Topic:	The Genetics of Pain (in rodents)
Mentor(s):	William R. Lariviere, PhD
Student Role:	Dr. Lariviere's group is determining the genetics of heritable variability in several pain traits in mice and rats, including inflammatory and neuropathic hypersensitivity. Advanced biostatistics is used to understand which genetic mechanisms are involved in the traits, and in which tissues. Novel genetic targets are then tested with molecular and behavioral methods to ascertain which of the mechanisms are indeed involved. Students would become familiar with the common behavioral pain tests that we use in the lab, the online biostatistical archives and tools that we use to go from the behavioral traits to the underlying genetic mechanisms, and common molecular and neuropharmacological techniques (drug admin methods) applied to the pain tests.

Research Topic:	Asleep-Awake-Asleep Craniotomies and Anesthetic Morbidity and Mortality according to Technique
Mentor(s):	Edward Teeple, MD, Sharad Khetarpal, MD, Arlen Mintz, MD
Student Role:	<p>Project Goal: To collect data from a series of awake and general anesthesia craniotomies to compare the incidents of problems, complications, and benefits of the two techniques.</p> <p>Methods: A list of patients already exists. An excel sheet will be designed now for use with data collection for this study. The data will be statistically analyzed for significant differences.</p> <p>Background: A meta analysis of a group of papers describing different methods of anesthesia for awake craniotomies already exists. This project would look at outcomes after applying a new inclusion exclusion criteria grid for these patients. This clinically significant project would be a good learning experience for the student.</p>

Research Topic:	The Effect of Microglial Activation on Neurologic Outcome after Deep Hypothermic Circulatory Arrest in Rats
Mentor(s):	Patrick M. Kochanek, MD, Tomas Drabek, MD
Student Role:	The role of the student would be assisting during rodent experiments involving cardiopulmonary bypass, assessment of neurobehavioral outcome after deep hypothermic circulatory arrest, evaluation of neurohistochemistry, and magnetic resonance imaging (in cooperation with Carnegie Mellon University).

Research Topic:	The Use of the Sonosite® Micromaxx® Ultrasound System to Decrease the Failed Epidural Placement Rate at Magee-Women's Hospital
Mentor(s):	Manuel C. Vallejo, MD
Student Role:	The medical student will help in the recruitment of patients, enter data and write an abstract for presentation at a national meeting.

Research Topic:	Prevention of Dental Injury Under Anesthesia: The Dental Risk Reduction and Injury Prevention Program (DRRIPP)
Mentor(s):	Manuel C. Vallejo, MD
Student Role:	The medical student will help in entering data, data analysis and will write an abstract for presentation at a national meeting.

Research Topic:	Randomized, Prospective, Placebo-Controlled, Double Blind Trial to Evaluate the Efficacy of Preoperative Aprepitant in Patients at Moderate-to-High Risk for Postoperative Nausea (PONV) undergoing Ambulatory Plastic Surgery
Mentor(s):	Manuel C. Vallejo, MD
Student Role:	The medical student will help in entering data, data analysis and will write an abstract for presentation at a national meeting.

Research Topic:	Modification of Shear Induced Hemolysis by Anesthetic Agents
Mentor(s):	Jonathan Waters, MD
Student Role:	Patient consenting, blood drawing, inducing hemolysis utilizing a validated shear model, blood centrifugation, measurement of hemolysis through spectrophotometry

Research Topic:	Inherited Coagulation Dysfunction in Women Who Have Had a Postpartum Hemorrhage
Mentor(s):	Jonathan Waters, MD
Student Role:	Patient consenting, blood drawing, data collection activities

Research Topic:	A Comparison of Lidocaine Versus Ropivacaine for Bilateral Continuous Thoracic Paravertebral Nerve Blocks for Post-Bowel Surgery Analgesia
Mentor(s):	Jacques E. Chelly, MD, PhD, MBA
Student Role:	Data collection from patients, patient monitoring, and other clinical research duties.

Research Topic:	Continuous Ropivacaine Infusion via Bilateral Paravertebral Catheters Versus Thoracic Epidural Catheters
Mentor(s):	Jacques E. Chelly, MD, PhD, MBA
Student Role:	Data collection from patients, patient monitoring, and other clinical research duties.

Research Topic:	Mechanisms of Hyperalgesia Following Cutaneous or Visceral Organ Insult
Mentor(s):	Gerald Gebhart, PhD
Student Role:	A principal focus of the Gebhart laboratory is investigation of the mechanisms of enhanced sensitivity to pain (hyperalgesia - a plastic change in the nervous system) that develops following tissue injury, a common example being sunburn. A complementary research focus is study of the organization and operation of endogenous systems of pain control and their contribution to chronic pain states. Experimental approaches include: single sensory nerve fiber recording, patch clamp recording from slices and from identified nerve cell bodies in dorsal root ganglion neurons, and procedures for quantification or localization of peptides, G protein-coupled receptors, immediate early genes and ion channels that play an important role in pain.

Research Topic:	Noninvasive Study of Neuroreceptor Systems in the Living Brain
Mentor(s):	Ferenc Gyulai, MD
Student Role:	Dr. Gyulai studies anesthetic mechanisms in nonhuman primates and in humans. The first project takes advantage of recent developments in positron emission tomography (PET) that permits the study of neuroreceptor systems noninvasively in the living brain, and thus offers a means to define the neurophysiological basis of unconsciousness produced by general anesthetics. PET is used to study the effect of the general anesthetic isoflurane on the functional state of the GABA _A -receptor (GABA _A -R), as well as postsynaptic processes directly linked to the receptor, such as neuronal metabolism, in the intact, living brain. Abundant data obtained from <i>in vitro</i> and small animal models support that the GABA _A -R is an important target for general anesthetics, which potentiate the actions of GABA at the receptor complex. The relevance of this potentiation of receptor function, however, has not yet been explored. This is due to inherent limitations of previous experiments employing destructive techniques. In sharp contrast, using PET methodology and the benzodiazepine ligand ¹¹ C-flumazenil (¹¹ C-FMZ), Dr. Gyulai's group recently demonstrated in fully intact brain, that isoflurane dose-dependently, and specifically, enhances GABA _A -R ligand binding, indicating that modulation of GABA _A -R conformational state occurs. To determine whether ¹¹ C-FMZ binding is a valid reflection of GABA _A -R functional state in the living brain, experiments are underway to test the specific hypothesis in nonhuman primates that the GABA _A -R agonist muscimol enhances ¹¹ C-FMZ binding in a dose-dependent manner, as has been shown in <i>in vitro</i> studies. To determine whether muscimol-related increase in

	<p>GABA_A-R function translates into enhanced inhibitory transmission, the effect of increasing doses of muscimol on regional neuronal metabolism, (rCMR_{glu}) is measured by ¹⁸F-deoxyglucose (¹⁸F-DG) PET. Analogous muscimol-¹¹C-FMZ binding and muscimol-rCMR_{glu} dose-response curves are also obtained in the presence of isoflurane, to test whether the anesthetic produces a left-shift of these dose-effect curves indicating an increase in agonist affinity for the receptor, as well as a decrease in regional neuronal metabolism due to enhanced GABA_A-R function, respectively. The experiments are expected to yield insights into the relationship between isoflurane's effect on the GABA_A-receptor alone, as well as the translation of this effect into enhanced inhibitory transmission in various brain regions in the intact, living brain.</p> <p>Anesthetic mechanisms are also studied <i>in vivo</i> in the intact human and primate brain. Studies are in progress to test the specific hypothesis that isoflurane specifically increases GABA_A-R <i>apparent affinity</i> (K_d) for the ligand ¹¹C-FMZ, rather than <i>receptor density</i> (B_{max}) in humans, in a dose-dependent manner using PET. Furthermore, to assess the functional relevance of GABA_A-R effects, the association of this conformational change with enhanced GABAergic transmission leading to inhibition of neuronal activity, and decreased rCMR_{glu} is tested. The GABA_A-R hypothesis would predict that general anesthetics produce quantitatively similar dose-dependent effects on GABA_A-R conformation, as well as on rCMR_{glu}. To test these hypotheses, alterations in B_{max} and apparent K_d of the GABA_A-R are measured in parallel with reductions in rCMR_{glu}, in the same subjects, in selected brain regions, by ¹¹C-FMZ and ¹⁸F-DG PET, respectively, in the presence and absence of 1.0 and 2.0 MAC isoflurane. The isoflurane-related changes in B_{max} and apparent K_d of the GABA_A-R and rCMR_{glu}, measured in the same brain regions, are then correlated by least squares regression.</p>
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Research Topic:	The Role of Adenosine in Experimental and Clinical Traumatic Brain Injury
Mentor(s):	Patrick Kochanek, MD
Student Role:	<p>Adenosine is a powerful endogenous neuroprotectant that modulates excitotoxicity and regulates cerebral blood flow in the injured brain. In studies supported both by an RO-1 award to Dr. Kochanek, and the University of Pittsburgh Brain Trauma Research Center (supported by a program project in its 13th year of funding from NINDS), Dr. Kochanek and his team are studying the role of adenosine in experimental and clinical traumatic brain injury. Recent studies in the Kochanek laboratory have demonstrated a critical role of the adenosine A1 receptor in defending the traumatically injured brain against acute excitotoxicity. Specifically, it is demonstrated that A1 receptor knockout mice develop lethal status epilepticus in the initial two hours after the injury. In addition, the Kochanek group has demonstrated powerful effects of adenosine A2a-receptor agonists in augment cerebral blood flow, both in naïve animals and early after experimental traumatic brain injury. In these studies, cerebral blood flow has been assessed using magnetic resonance imaging with arterial spin labeling. The effect of traumatic brain injury on cerebral blood flow along with functional and histological outcome in adenosine A2a receptor knockout mice is also being assessed. Finally, from brain bench to bedside, the Kochanek laboratory has been studying levels of adenosine and purine degradation products in cerebrospinal fluid and microdialysis samples in adults and children after severe traumatic brain injury, particularly the relationship between cerebrospinal fluid levels of the weak A1 receptor agonist caffeine and long term outcome in human head injury. These projects take advantage of the rich environment in neurointensive care, neurotrauma, neuroanesthesiology, and neurorehabilitation at the Safar Center for Resuscitation Research, which includes a spectrum of brain injury models, considerable experience with a variety of cellular, molecular, functional, histological, and pharmacological methods, and an outstanding faculty which includes clinicians-scientists and scientists in resuscitation medicine from the field, to the emergency department, to the operating room, through intensive care, and into rehabilitation.</p>

Research Topic:	Creating a Human Patient Simulation of a Clinical Scenario
Mentor(s):	William McIvor, MD
Student Role:	Students working on these projects, under Dr. McIvor's supervision, pick a clinical scenario to program and test that lends itself well to the current fidelity and capabilities of our human patient simulator. Past projects have included scenarios simulating congestive heart failure, acute uncal herniation, diabetic ketoacidosis, and managing patients with or without comorbidities having inductions of general endotracheal anesthesia. Students do a literature review to determine treatment recommendations and published descriptions of the associated vital signs. They then interview local experts (neuro, OB, cardiac anesthesiologists, or whoever is most appropriate) to get their recommendations for the likely vital sign changes seen and treatment interventions, and insight into the pathophysiology being emulated. They then work with Dr. McIvor to program our simulator, the Laerdal SimMan. After honing the program to Dr. McIvor's satisfaction the students arrange to test their scenario with local experts who comment on its validity and fidelity. Students can also participate in designing and carrying out experiments which examine experts' performance during human-patient simulations as a function of conditions associated with the simulation, like fidelity, location, and familiarity with the surroundings.

Research Topic:	Cellular Ca^{2+} Homeostasis in Skeletal Muscle and its Relationship to Malignant Hyperthermia
Mentor(s):	Jerome Parness, MD
Student Role:	<p>The major area of research in the Parness laboratory surrounds the regulation of intracellular Ca^{2+} release in skeletal muscle as it relates to excitation-contraction coupling. The skeletal muscle sarcoplasmic reticulum (SR) calcium release channel is the ryanodine receptor (RyR1), a homo-tetrameric ion channel, each subunit of 565kDa molecular mass. RyR1 is associated with many SR proteins, but the identity and function of only a few of these are known. A single amino acid change at position 615 of RyR1 in pigs results in a sensitivity to volatile anesthetics comparable to a similar, if not identical, rare, pharmacogenetic syndrome in humans known as malignant hyperthermia (MH). An affected individual exposed to volatile anesthetics responds by releasing massive amounts of intracellular Ca^{2+} in skeletal muscle which stimulates both muscle contraction and various Ca^{2+} dependent metabolic processes resulting in elevated body temperatures and death. Dantrolene, a hydantoin derivative and the only specific therapy for MH, inhibits the release of intracellular Ca^{2+} from SR, presumably by affecting ryanodine receptor/Ca^{2+} channel function. The Parness lab uses dantrolene to help pick apart the regulation of the ryanodine receptor, and attempts to identify the molecular target of dantrolene. Dr. Parness and his collaborators have synthesized [^3H]dantrolene and a photoactive congener [^3H]azidodantrolene and used these compounds to demonstrate specific binding site for the drug in highly purified skeletal muscle SR membranes. By photoaffinity labeling we have demonstrated that a dantrolene binding site exists somewhere between amino acids 1-1400 on the amino terminus of RyR1. Using synthetic peptides corresponding to various regions of RyR1, the Parness group has identified one specific region (590-609) that is both specifically photolabeled and recognized by an anti-RyR1 monoclonal antibody whose epitope was heretofore undefined. In addition, there are at least two other proteins in SR that specifically label with [^3H]azidodantrolene.</p> <p>The trainees in Dr. Parness's laboratory will be introduced to the field of cellular Ca^{2+} homeostasis as it relates to the pharmacogenetic syndrome Malignant Hyperthermia (MH), an autosomal dominant syndrome of the hypermetabolic response of skeletal muscle to volatile anesthetics, and the mechanism of action of dantrolene, the drug that truncates this hypermetabolism.</p> <p>The trainees will learn the techniques related to understanding the process of excitation-contraction coupling and Ca^{2+} release in skeletal muscle. These include: skeletal muscle organelle isolation and gradient centrifugation, membrane protein purification, radioligand binding techniques and analysis, cell culture, cDNA purification, mutational</p>

	analysis, PCR, transfection, and Ca fluorescence microscopy. The trainees are expected to learn hypothesis generation, experimental design, the importance of controls, and techniques of data analysis.
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Research Topic:	The Interplay of Oxidants with Nitric Oxide in the Pathogenesis and Pathophysiology of Vascular Dysfunction
Mentor(s):	Margaret Tarpey, MD
Student Role:	Dr. Tarpey's research is centered on the interplay of oxidants with nitric oxide in the pathogenesis and pathophysiology of vascular dysfunction, including hypertension and atherosclerosis. Our laboratory is particularly interested in the involvement of the enzyme, xanthine oxidoreductase in elevated steady state production of superoxide and hydrogen peroxide in diseased vascular tissue. Recent studies have demonstrated that moderate hypoxemia significantly enhances the expression and activity of xanthine oxidoreductase. The implication for enhanced vascular dysfunction in patients with hypoxemia secondary to cardiopulmonary disease is actively being explored. An additional focus of research endeavors is the development of site-directed antioxidants to ameliorate local production of oxidants. Finally, the laboratory directs significant effort to methods of accurate detection of these evanescent reactive species, particularly within a biologic or clinical milieu. Trainees will have the opportunity to study these questions from a variety of experimental approaches, such as kinetic modeling of enzyme inhibition, molecular and cellular biology studies of vascular cells in tissue culture, as well as organ physiology approaches and translational studies in patients with heart failure. Such investigations, aimed at better understanding of the chemical, biochemical and cellular genesis of vascular dysfunction will provide opportunities to develop targeted therapies for the increasing number of patients with cardiovascular disease.

Research Topic:	Peripheral Nerve Blocks With Multimodal Analgesics
Mentor(s):	Brian Williams, MD, MBA
Student Role:	Dr. Brian Williams aims to develop appropriate animal models (rat) addressing the multimodal analgesic nerve block, in order to further advance opioid-sparing analgesia, and aim to reduce patient dependence on opioid analgesics as the primary mechanism of analgesia in the first week(s) after orthopedic surgery. Continuous nerve blocks have helped to reduce opioid requirements, but are technically complicated and subspecialized, while local anesthetics can produce unwanted motor block that may lead to the injury of an insensate extremity. This current study is designed to develop multimodal single-injection nerve blocks, in order to provide (i) sustained pain relief after surgery, (ii) reduced motor block, and (iii) reduced opioid requirements. The applicant student would have roles that would include rat habituation and training, nociceptive and locomotive behavioral testing, and data collation.

University of Rochester Medical Center

Research Topic:	The bioactivation of nitrite by mitochondria in cardiac ischemia It is well known that nitrite (NO_2^-) is carried in the bloodstream, and can be converted to bioactive nitric oxide by a variety of mechanisms, under hypoxic conditions. In addition, nitrite is now entering clinical trials as a cardioprotective agent for the prevention of myocardial infarction. What is less clear is the role of mitochondria in this process. Several proteins within the mitochondrion have been proposed to exhibit nitrite reductase activity, and this project will aim at delineating the relative importance of these pathways, as well as identifying potentially novel nitrite reductases. In addition the project will look at the downstream mitochondrial signaling effects of nitrite-derived reactive nitrogen species, with an aim of finding novel targets for NO-mediated post-translational protein modifications (e.g. S-nitrosation).
Mentor(s):	Paul S. Brookes, PhD

Student Role:	Student would learn several lab' skills including animal models of cardiac ischemia, isolation of mitochondria, and a variety of biochemical measurements of nitric oxide metabolites. Student would be expected to generate sufficient data to submit an abstract to a scientific meeting and to present his/her research to the department in a seminar style presentation.
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Research Topic:	To elucidate functional significance of mitochondrial dynamics. My lab studies the regulation of shape/morphology, of the cellular organelle mitochondrion (i.e. "mitochondrial dynamics"). Our previous studies have identified the protein machinery that regulates mitochondrial dynamics, via the processes of fusion and fission. The functional importance of changes in mitochondrial shape is less clear however. This project will employ various stimulations to cells (both physiological signals and pathologic perturbations) and analyze mitochondrial morphology and cellular functions to define the cause-and-effect relationship, and the participating signaling processes. Multiple molecular reagents, techniques, and model systems are available for this research.
Mentor(s):	Yisang Yoon, PhD
Student Role:	The student will be involved in cell culture, design of experiments, preparation and testing of specific molecular reagents (i.e. recombinant DNA technology), as well as the collection of data on mitochondrial morphology using fluorescence microscopy. The student will be expected to keep accurate lab records, and to present their work at lab meetings.

Research Topic:	Neuroprotective effects of curcumin in a cell model of Alzheimer disease. It has recently been reported that curcumin may be neuroprotective, in part by reducing protein aggregation. We have recently found that a form of tau that is found in Alzheimer disease brain sensitizes neurons to cell death, and this is likely due in part to its oligomerization, altering protein-protein interactions. Further, we found the expression of this mutant tau compromises mitochondrial structure and function and this is likely due to the pathological conformation of the mutant tau. The focus of this study will be to determine if curcumin can protect neurons expressing this mutant form of tau against cell death and if so, is it due to its effects on the conformation of tau or on mitochondrial function, or both. This is an important project because curcumin and its derivatives are already being considered as therapeutics for the treatment of neurodegenerative conditions and limited clinical trials are already underway. Therefore curcumin can be considered a promising therapeutic for the treatment of Alzheimer disease.
Mentor(s):	Gail V. W. Johnson, PhD
Student Role:	The student would learn cell culture, immunoblotting, immunocytochemistry, and chemiluminescent oligomerization assays. In addition, the student will also learn how to measure mitochondrial status both biochemical and by using microscopic approaches.

University of Texas, MD Anderson Cancer Center

Research Topic:	Clinical Mechanisms of Cancer Pain Management
Mentor(s):	Allen Burton, MD
Student Role:	Spinally-administered (neuraxial) medications are being increasingly studied and utilized in the treatment of both cancer and non-cancer pain. In spite of the use of neuraxial combination therapy, with its better clinical efficacy and reduced side effects, some patients continue to suffer unrelieved pain. Efforts must be made to continue efficacy and safety testing of newer neuraxial compounds, including such medications as gabapentin, tizanidine, methadone, midazolam, ketamine, conopeptides, and others. Due to the relatively small market for these compounds, the academic community cannot rely on the pharmaceutical industry to underwrite this effort. In addition to the real ramifications of having a more effective analgesic armamentarium, this research will provide a further mechanistic understanding of different severe pain states and the mechanism of action of some novel analgesic compounds.

	<p>As these compounds are identified, the most direct path to the clinical realm will be through a coordinated, three-prong approach. Students participating in this research program will have the opportunity to participate in any of these three phases. The study of compounds in small animal pain models assesses efficacy as a first basic research step. The second phase is the use of large animal models to assess toxicity and also to complete development of a pain model in the large animal species. The final phase is the translation of these animal studies into early phase human trials (perhaps in advanced cancer patients) to glean overall safety and efficacy in humans.</p>
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Research Topic:	Mechanisms of Chemotherapy-Induced Peripheral Neuropathy
Mentor(s):	Patrick M. Dougherty, PhD
Student Role:	<p>It is well known among cancer care providers that the most common cause of pain in cancer patients arises not from the disease but from the disease treatments. For example, painful neuropathy is the principal dose-limiting factor in chemotherapy with vincristine, taxol and cisplatin. This neuropathy not only produces distress in cancer patients but also limits the effectiveness of their therapy thereby impacting on survival. Chemotherapy-induced pain is also refractory to treatment and often persists in cancer survivors limiting quality of life, rehabilitation and the return to productivity. In that these drugs are the treatment of choice for a multitude of lymphoid and solid tumors, hundreds of thousands of patients each year are affected. The long-term goal of this project is to determine the mechanism of chemotherapy-induced pain and identify potential therapeutic interventions for its relief and prevention. This project is composed of both clinical and basic science projects.</p> <p>1. The clinical project involves psychophysical testing in patients who are undergoing or have undergone chemotherapy with Cisplatin, Taxol, Vincristine, or Bortezomib. Specific modalities of sensation are conveyed to the spinal cord in specific subsets of primary afferent fibers. The function of these fiber types can therefore be assessed by applying well-defined stimuli to the skin and quantifying the intensity of stimulation required to provoke reports of sensation in patients. Significant changes in the intensity required to provoke given sensations will indicate dysfunction in specific primary afferent fiber types. In some patients blood levels of pro-inflammatory cytokines will be measured and/or skin biopsies will be collected. A student participating in this project will assist in the psychophysical testing and sample collections from patients who are undergoing or have undergone cancer chemotherapy.</p> <p>2. The basic science project is geared toward modeling chemotherapy neuropathy in rodents. Rats develop hypersensitivity to mechanical stimulation following 5 to 10 days of treatment with vincristine, taxol or cisplatin. Neurophysiological, immunocytochemical, and biochemical studies are used to define the underlying mechanisms. A student participating in this project will learn how to conduct behavioral analysis of pain sensation in rats, surgical preparation of rats for neurophysiological recording, and the basics of neurophysiological analysis of spinal dorsal horn neurons.</p>

Research Topic:	Dorsal Horn Mechanisms of Somatosensory and Pain Encoding
Mentor(s):	Patrick M. Dougherty, PhD

Student Role:	<p>Hundreds of thousands of patients each year develop chronic pain and hyperalgesia that cannot be adequately managed due to our limited understanding of functional organization in the spinal dorsal horn. This project is composed of a series of interrelated intracellular neurophysiological studies in intact animals and in reduced spinal cord-dorsal root-dorsal root ganglion-preparations with follow-up immunohistochemical analysis of the subject tissues as a means to advance our understanding of spinal mechanisms of somatosensory and pain encoding.</p> <p>Students participating in this project will assist in conducting whole-cell patch clamp neurophysiological studies of dorsal horn neurons from either intact anesthetized adult rats or using <i>in vitro</i> isolated spinal cord preparations from neonatal or young adult rats.</p>
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Research Topic:	Proteomic Approaches to Opioid Tolerance and Addiction
Mentor(s):	Howard B. Gutstein, MD
Student Role:	<p>The primary focus of our research is to understand the molecular mechanisms underlying the development of opioid tolerance and dependence and the interactions of pain and analgesic signaling. We employ a multidisciplinary approach to understand these problems using cutting-edge techniques. After demonstrating clinical and physiological relevance in animal behavioral studies, we dissect mechanisms underlying opioid tolerance, physical dependence, and pain. Since these are very complex phenomena, involving the interaction of genetic, environmental, and social factors, we have turned to the emerging field of proteomics in an effort to determine in the broadest possible fashion which changes in cellular signaling are responsible for the adaptations causing opioid tolerance and chronic pain. Combining the techniques of laser-capture microdissection to analyze neurons expressing specific markers, 2-dimensional gel electrophoresis to separate proteins, and high-throughput mass spectrometry for protein identification permits us to address this issue with a power never before imagined.</p> <p>The overall goal of these projects is to develop more effective therapies for treating chronic pain without causing the devastating side effects of tolerance, dependence, and addiction. Trainees gain experience integrating molecular, genetic, neuroanatomic, biochemical, and behavioral techniques to explore important neurobiological questions from many perspectives. Close relations with clinical colleagues in the pain clinic provide opportunities to translate our basic findings into clinical practice and eventually see the direct application of our efforts.</p> <p>A tutorial in our laboratory would introduce students to concepts in addiction, pain mechanisms and opioid pharmacology. Students would employ a wide range of integrative techniques to explore these important neurobiological questions from many perspectives. Experience can be gained with techniques such as <i>in situ</i> hybridization, immunocytochemistry, cell culture and transfection, 2-D gel electrophoresis, mass spectrometry, image analysis, and behavioral studies on rats and mice.</p>

Research Topic:	The Role of Energy Metabolism in Surgical Risk Assessment
Mentor(s):	Curtis E. Hightower, DVM, MD
Student Role:	<p>Economic constraints on healthcare resources (aging population, healthcare disparities, among others) require an emphasis on efficient utilization of healthcare resources. Accurate and reliable prediction of perioperative risk carries with it more appropriate postoperative care, improved outcomes and better utilization of available resources. The common methods of subjectively categorizing perioperative risk are unreliable at predicting morbid outcomes. Single-organ evaluations used to supplement the perception of surgical risk provide objective, reproducible information about an isolated organ's functioning under test conditions. These tests frequently fail to predict the organ's functioning during the perioperative period. On the basis of this data we have conclude that current methods of perioperative risk assessment do not discriminate well enough to credibly influence surgical treatment plans.</p>

	<p>In this laboratory students will have the opportunity to participate in clinically based research studies exploring the relationship between energy metabolism and surgical outcomes. The postoperative period is a hyperdynamic state with an increased energy requirement. Energy metabolism can be used as a measure of stress, thus the preoperative stress capacity can be defined as physiologic capacity (energy reserve capacity) and the postoperative stress intensity can be defined in terms of energy demand. We believe the relationship between preoperative energy reserve capacity and postoperative energy demand will predict postoperative morbidity. Breath by breath analysis of inspired vs expired gases (gas exchange analysis) reflects the efficiency of the body's oxygen utilization and energy production. Gas exchange analysis combined with controlled exercise (cardiopulmonary exercise testing) will be used to determine oxygen uptake and carbon dioxide output, reflecting energy utilization capacity. Postoperative resting gas exchange analysis will be used to reflect energy demand. The relationship between preoperative energy reserve capacity and postoperative energy demand will be evaluated as a predictor of morbid surgical outcomes.</p>
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Research Topic:	Prediction of Postoperative Adverse Cardiac Outcome in Cancer Patients: Significance of the Intraoperative Course
Mentor(s):	Mohamed Naguib, MD
Student Role:	<p>Adverse cardiac events account for more than 50% of postoperative mortalities in the United States. The multifactorial risk indexes developed for predicting postoperative cardiac outcome suffer from several limitations. First, they were mostly developed using data from patients undergoing vascular surgery and it is not known whether these models are applicable for patients with malignant disease. For instance, many of these patients have additional cardiac risk factors due to radiotherapy or chemotherapy, the significance of which on the perioperative adverse cardiac events have never been evaluated. Secondly, all of the currently published multivariate cardiac risk models have ignored the contribution of both the intraoperative and postoperative course on the cardiac outcome and their "clinical validity" has been questioned. This trial takes advantage of our patient population and our intraoperative anesthetic management system. We are interested in developing a predictive model for postoperative adverse cardiac outcome in cancer patients undergoing major surgery and who have or are at risk for coronary artery disease on postoperative cardiac morbidity and mortality. This is the first trial attempting to assess the risk of cardiac outcome in cancer patients.</p> <p>Students in this project will assist in the preoperative evaluation, data collection, and data analysis. Students will be exposed to the clinical research process and all its complexities.</p>

Research Topic:	Endothelial Cell Mechanisms of Post-Operative Morbidity
Mentor(s):	Curtis Hightower, MD
Student Role:	<p>Endothelial dysfunction is recognized as a predictor of risk for cardiovascular events, including perioperative cardiovascular events, and is also implicated in the pathogenesis of acute lung injury and sepsis. Our current study tests the hypothesis that endothelial dysfunction is an independent predictor of adverse perioperative outcome following major thoracic surgery. The ability to identify those patients with impaired endothelial function may allow for timely implementation of strategies to improve endothelial function, in an attempt to reduce perioperative morbidity and mortality rates.</p> <p>Students participating in this project will assist in the preoperative evaluation of endothelial function by using i) high-resolution ultrasonography to measure brachial artery flow-mediated dilation (FMD), an endothelium-dependent measure, and ii) flow cytometry to quantify circulating endothelial progenitor cells (EPCs) in peripheral blood. These measures will be correlated with adverse cardiopulmonary events, duration of intensive care unit or hospital stay, and mortality.</p>

Research Topic:	Mechanisms of Opioid Tolerance and Dependence
Mentor(s):	Zhizhong Z. Pan, PhD
Student Role:	<p>Currently, opioid-based drugs are still the most effective and widely used analgesics for moderate to severe pain and cancer pain. However, repeated use of opioid drugs required for chronic pain conditions induces analgesic tolerance and physical dependence, which significantly limit the analgesic efficacy and prolonged use of opioid analgesics, leaving millions of chronic pain patients under-treated. As other more effective non-opioid analgesics will not emerge to replace opioid drugs in the foreseeable future, improving the current opioid therapies for chronic pain is a critical and achievable goal. Opioid research over the past several decades has extensively advanced our understanding of how opioids produce analgesia in the central nervous system. Recent animal studies focus on what adaptive changes chronic opioids produce in central pain-modulating circuits and how those changes lead to behavioral tolerance and dependence. New insights from these animal studies will provide a pharmacological basis for circumventing the problems of tolerance and dependence and for targeted improvements of opioid therapies for chronic pain.</p> <p>Research in this laboratory is animal-based, involving a rat model of opioid tolerance and dependence. Multiple approaches at molecular, cellular and behavioral levels are used to identify chronic opioid-induced adaptations at opioid receptors, signal transduction pathways and synaptic networks in the brain. Based on new research findings, a variety of compounds and pharmacological strategies are tested in the animal model for their effectiveness in reducing analgesic tolerance to chronic opioids and physical dependence as measured by withdrawal symptoms.</p> <p>Students participating in this program will conceptually gain frontier knowledge on analgesic functions of different types of opioid receptors and the underlying molecular and cellular mechanisms in acute and chronic conditions. Technically, those students will learn small animal surgeries, creation of small animal models of opioid tolerance and dependence, basic molecular methods for real-time RT-PCR and Western blotting, basics of whole-cell patch-clamp recording <i>in vitro</i> and various behavioral pain tests for assessment of opioid tolerance and dependence in the animal model. Short-term research projects are available to investigate the analgesic efficacy, chronic tolerance and functional interactions of laboratory and clinical opioid or non-opioid compounds with differential pharmacological profiles for opioid receptors.</p>

Research Topic:	The Role of Glutamate Transporters in Spinal Pain Mechanisms
Mentor(s):	Han-Rong Weng, MD, PhD
Student Role:	<p>Sensitization of <i>postsynaptic</i> neurotransmission via glutamate receptors on spinal neurons has emerged as one of the key events underlying chronic pain and hyperalgesia and many insights to potential new therapies have been identified as a consequence of this work. However, the role that glutamate transporters, the system used to terminate excitatory neurotransmission, plays in regulating normal spinal sensory processing and the role that dysfunction in this system might play in acute and chronic pain states has gone largely unexplored. Three subtypes of glutamate transporters are normally expressed in cells of the spinal cord, two (GLAST and GLT-1) in astrocytes and one (EAAC1) in neurons, any or all of which might provide targets for new pain treatments.</p> <p>Students participating in this project will assist in a series of inter-related behavioral, neurophysiological and immunocytochemical studies in rats.</p>

Research Topic:	Acute Chronic Pain
Mentor(s):	Hui-Lin Pan, MD, PhD
Student Role:	Student Role: One of the major interests of our laboratory is to determine how pain information is regulated in the spinal dorsal horn and how spinally administered analgesics

	<p>work in acute and chronic pain. We use the following complementary approaches in our studies:</p> <ol style="list-style-type: none"> 1. Whole cell patch-clamp recordings in the spinal cord slices to determine the state of synaptic transmission; 2. Immunocytochemistry and Western blots to define the location of proteins and quantify their changes in various pain models; 3. Genetic techniques such as siRNAs and RT-PCR are also used to manipulate gene expressions and examine their relation to phenotypic changes in the spinal cord. <p>Students will participate in the ongoing projects and will be closely supervised by the senior postdoctoral fellows and faculty members. They will learn the general surgical preparation, the principal of the experimental techniques and gain some hand-on experience in the study design and the experiments.</p>
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Research Topic:	Central Control of Autonomic Function
Mentor(s):	Dei-Pei Li, MD
Student Role:	<p>Student Role: The major goal of the ongoing project is to determine the neural and hormonal mechanisms involved in the central control of autonomic function in normal and disease conditions such as hypertension and heart failure. A combination of techniques including retrogradely tracing and whole cell patch-clamp recordings is used to study the projection neurons in the hypothalamic or brainstem slices. We also use techniques of microinjection of drugs into the central nucleus and recording cardiovascular parameters to study central control of cardiovascular function in normotensive and hypertensive rats. Also, we may also perform immunocytochemistry and Western blots to test the alteration of receptor proteins in hypertensive rats. Students involved in the ongoing project will gain knowledge of neural and hormonal control of circulation and neurotransmission of the central nervous system. They will learn techniques of general experimental preparation, the principal of performing experiment, basis of scientific study design.</p>

University of Utah

Research Topic:	Is there a genetic component to surgical site infection (SSI) and health care associated infection (HCAI)? It is known that there is a genetic component to susceptibility to sepsis and infection in general, but the genetic contribution to surgical site infection has not been investigated. The Utah Population Database will be used in this pilot study to identify families with a higher than average rate of HCAI and SSI. In subsequent studies, blood samples will be obtained from consenting families (high risk and control) to perform analysis of genes likely to be responsible for such differences, including the phagosomal oxidase
Mentor(s):	Harriet W. Hopf, MD
Student Role:	The student will be responsible, with supervision, for interacting with the staff of the Utah Population Database (UTPD) to obtain the necessary data to analyze this question. Once the data from the UTPD have been analyzed, the student will begin the process of identifying target genes and obtaining IRB approval to contact families to collect samples for genetic analysis.

Research Topic:	Does high intraoperative inspired oxygen reduce postoperative arterial oxygen saturation?
Mentor(s):	Harriet W. Hopf, MD
Student Role:	The student will be responsible, with supervision, for identifying and enrolling subjects, including informed consent; ensuring that protocol is followed by the anesthesia residents and attendings caring for the patient intraoperatively, collecting data in the PACU and on the ward, and analyzing the data.

Research Topic:	User Interface to Prevent Intravenous Infusion Pump Errors. The unintentional administration of incorrect medication doses through intravenous infusion pumps results in the most dangerous and the most frequent errors occurring in hospitals. A primary factor in the misuse of infusion pumps is the complicated and unintuitive nature of the user interface. Our objective is to improve the user interface and thereby reduce the frequency of drug administration errors. Our new interface will be a touch-screen on the anesthesia workstation. With the pump interface next to trend plots of blood pressure, heart rate and processed EEG, changes in drug delivery will be better informed and more rational. We will use wireless technology to remotely control infusion pumps located next to the patient. A small display panel on the pump will showing drug name, infusion rate and time until empty. The user can program the pump through this small display should the wireless connection fail. We plan to compare the usability of our new interface (with remote infusion pumps) to two commercially available infusion pumps in a simulated operating environment. These simulations will identify potential sources of error introduced with a remote pump, identify means to eliminate these errors and document an improvement in overall human performance for the remote pump interface. We will prepare a journal publication describing the improved pump interface and will work closely with commercial infusion pumps manufacturers to implement the interface in the operating room, intensive care units and outpatient surgical centers. If successful a major source of error in the operating room will be reduced and patient safety will improve.
Mentor(s):	Dwayne Westenskow, PhD
Student Role:	The medical student will set up the equipment and write protocols to compare the usability of our new IV infusion pump interface (with remote infusion pumps) to two commercially available infusion pumps in a simulated operating environment. The student will collect data on human performance during the simulations. The student will prepare an abstract for presentation at a national anesthesia meeting to report potential sources of error introduced when using a remotely controlled infusion pump, identify means to eliminate these errors and document an improvement in overall human performance for the remote pump interface.

Research Topic:	Clinical Evaluation of a Rebreathing Adsorber Mask to Facilitate Recovery from Volatile Anesthetics. After surgery patients are transferred to a post anesthesia care unit to fully recover from anesthesia. There is a much higher chance of an adverse clinical event occurring during this recovery time (24%) than in the operating room because patients are not as closely monitored. Airway obstruction is the most frequent complication. Patients with a critical respiratory event stay longer in the care unit have higher rates of unanticipated admission to an intensive care unit and are more likely to have cardiac problems. We propose to develop and test a charcoal filled rebreathing mask that accelerates the rate of removal of anesthetic vapors and shortens anesthesia recovery time. Patients will more quickly regain normal cognitive function, homodynamic normalcy and reflexes to allow for airway protection from secretions and obstruction. They will more quickly gain a sense of well being resulting in earlier discharge from the post anesthesia care unit. We will test a prototype device with a lung/gas exchange simulator and conduct a clinical trial with 44 patients, measuring their rate of recovery and the incidence of critical events during the first 24 hours after surgery. If successful, the charcoal filled rebreathing mask has the potential to shorten the patients stay in the post anesthesia care unit by 20 min and reduce the risk of a critical event occurring by 60%.
Mentor(s):	Dwayne Westenskow, PhD
Student Role:	The medical student will test a prototype device in a clinical trial with 44 patients, measuring the patient's rate of recovery and the incidence of critical events during the first 24 hours after surgery. The student will prepare the data collection forms and will collect data from patients during their recovery from anesthesia. The student will prepare an abstract for presentation at a national anesthesia meeting to report the difference in the time

	patients stay in the post anesthesia care unit and the number of a critical event occurring with and without the device.
Research Topic:	Improving Measurement of Acute Pain (5R01 NR009542-04). This psychometric project addresses the problem of improving quality and precision of pain measurement in patients with acute pain. Current practices obtain simple ratings of pain from patients, but these are imprecise. Using word descriptors for pain, we are developing a simple scaling approach for capturing pain quality and intensity that will yield more precise and clinically useful pain measurement. In addition, we are developing unprecedented ways of quantifying pain resolution over time. We collect large samples from patients with postoperative pain and also patients with pain who present in the emergency department, tracking each patient over six days.
Mentor(s):	C. Richard Chapman, PhD, Gary W. Donaldson, PhD, David Bradshaw, PhD, Jennifer Davis, MD
Student Role:	Patient interview and data analysis
Research Topic:	Behavioral preparation for treating fibromyalgia. This is a clinical trial testing behavioral preparation programs plus activating physical therapy for treating sedentary fibromyalgia. The project involves comprehensive medical, physical, and psychological evaluations at multiple points and a 10 week interdisciplinary treatment for fibromyalgia.
Mentor(s):	Akiko Okifuji, PhD
Student Role:	Data Collection and Coding, Assisting research personnel with daily operation of the projec
Research Topic:	Weight Management for Obese and overweight fibromyalgia patients. This is a clinical trial testing a lifestyle modification program plus nutritional education to help manage weight, fibromyalgia-related symptoms, and overall health for obese and overweight fibromyalgia patients.
Mentor(s):	Akiko Okifuji, PhD
Student Role:	Data Collection and Coding, Assisting research personnel with daily operation of the project
Research Topic:	Blood-based biomarkers distinguishing Chronic Fatigue Syndrome from Healthy Controls and Other Fatigue Disorders. Chronic fatigue syndrome (CFS) is a health problem affecting from 400,000 to 900,000 adults in the USA. It is so debilitating that fully 25% of sufferers are classified as disabled or unable to be employed, with severe economic consequences to the patient's family and to our nation's taxpayers. CFS is characterized by severe fatigue that does not resolve after rest and has lasted from at least 6 months up to many years, and by other chronic symptoms such as deep muscle pain and worsening of symptoms 24 hours or more after exercise. We firmly believe that CFS involves multisystem dysregulation, including the brain, immune and sympathetic nervous systems. Unique to our approach, however, is inclusion of examination of a recently discovered sensory pathway that has not previously been studied in CFS patients, but has been shown in animal models to be active during postexertional fatigue, inflammation and other manipulations inducing deep muscle hyperalgesia. Consistent and mounting evidence in animal models from Dr. Alan Light's lab and others indicates that the recently identified Acid Sensing Ion Channel-3 (ASIC3) may be the functional molecular receptor for enhanced myalgic pain, and that ASIC3 working in concert with other ion channel receptors, including Purinergic 2X Receptors (P2X4 and P2X5), act together to signal myalgia and fatigue. Dr. Kathleen Light's research has recently linked beta-adrenergic receptor activity to enhanced myalgic pain in Fibromyalgia. We hypothesized that CFS patients have enhanced vulnerability to fatigue and muscle pain in part because, in these patients, this ion channel based sensory system is dysregulated in the direction of exaggerated sensitivity. Funded by an NIH R21 grant, our research team jointly led by

	both Drs. Light was the first to complete clinical research showing dysregulation in post-exercise ASIC3, P2X4 and P2X5 ion channel receptors (and also in alpha- and beta-adrenergic receptors) in patients with CFS compared with healthy individuals. Supported by a new grant from the CFIDS Association, we now plan to extend these findings in an effort to determine whether receptor expression of these ion channel receptors on leukocytes, alone or combined with adrenergic receptor expression and measures of pro- and anti-inflammatory cytokine response, can serve as blood sample-based biomarkers for CFS. At present, there is no objective biomarker for CFS, which is greatly needed to aid diagnosis and treatment. This study will serve as the initial effort to use these measures to develop safe and unbiased blood-based biomarkers for CFS.
Mentor(s):	Kathleen C. Light, PhD, Alan R. Light, PhD
Student Role:	The student will serve as a Research Assistant, acquiring skills in laboratory techniques such as real-time quantitative PCR to assess gene expression, in exercise testing of patient populations, and in data entry and analysis

Research Topic:	My primary research interest in the area of lung vascular biology as it relates to endothelial permeability. Specifically, I am interested in lung mechano-transduction and how endothelial glycoproteins sense mechanical forces and the pathways that lead to vascular barrier dysfunction. We use whole animal models, isolated perfused lungs and endothelial cell culture models to pursue questions related to mechanisms of permeability modulation. We routinely perform histological, immuno-histological and molecular analysis to characterize lung injury.
Mentor(s):	Randal O Dull, MD, PhD
Student Role:	A medical student could participate in an on-going project and be trained to perform any of the techniques cited above, in order to generate a successful research project related to lung injury. I have two full-time technicians, two graduate students and several undergraduate students in my laboratory, thus, creating a dynamic environment with ample intellectual and technical support. A medical student could learn anesthetic techniques for small animals, perform pulmonary function test on rodents, learn basic immuno-histochemistry techniques and learn basic cell culture techniques to perform in vitro permeability assay. The Dept. of Anesthesiology has a state-of-the-art physiology core lab for performing animal experiments and the isolated lung work, as well as Core Cell Culture Lab and Molecular Biology lab.

University of Washington

Research Topic:	Is propofol infusion syndrome a symptom of mitochondrial dysfunction?
Mentor(s):	Philip Morgan, MD
Student Role:	Determine IC_{50} for propofol on mitochondrial respiration and relate to whole animal phenotypes.

Research Topic:	RNAi screens for the effects of two-pore domain potassium channels on anesthetic sensitivity.
Mentor(s):	Philip Morgan, MD
Student Role:	Feed RNAi to nematodes, and screen behavior in volatile anesthetics.

Research Topic:	The role of mitochondrial defects on aging and ROS damage.
Mentor(s):	Phil Morgan, MD
Student Role:	Use an animal model to generate specific mitochondrial defects, and assay whole animal and mitochondrial phenotypes.

Research Topic:	The effect of disruption of supercomplexes of the electron transport chain (ETC) on anesthetic behavior.
Mentor(s):	Marge Sedensky, MD
Student Role:	Study the effects of loss of ETC subunits on whole animal behavior and mitochondrial function.

Research Topic:	The effect of anesthetic exposure during early development on adult learning – a mechanistic approach.
Mentor(s):	Marge Sedensky, MD
Student Role:	Use a genetic animal model to test the role of anesthetics on apoptosis and adult behaviors.

Research Topic:	Role of hypoglycemia, glucose variability and insulin on mortality in critically ill patients
Mentor(s):	Miriam Treggiari, MD,PhD,MPH, Steven Deem, MD
Student Role:	Familiarize with the literature and assist with the development of the study design, data analysis, and manuscript writing.

Research Topic:	Time of Secondary Insults after Traumatic Brain Injury
Mentor(s):	Monica S. Vavilala, MD
Student Role:	Data collection, data analysis, preparation of manuscript

Research Topic:	Variation in Head CT Protocols in Pediatric Traumatic Brain Injury in Washington State
Mentor(s):	Monica S. Vavilala, MD
Student Role:	Data collection, data analysis, preparation of manuscript

Research Topic:	Survey of National Pediatric Neurocritical Care Capacity
Mentor(s):	Monica S. Vavilala, MD,
Student Role:	Data Collection, data analysis, preparation of manuscript

University of Wisconsin, Madison

Research Topic:	Spinal Plasticity and Neuropathic Pain
Mentor(s):	Vjekoslav Miletic, PhD
Student Role:	The processing of sensory information in the spinal dorsal horn may undergo significant changes following peripheral nerve injury to ultimately lead to the development of neuropathic pain. We are using a rat model of neuropathic pain to investigate the potential critical contribution of several genes and proteins to this spinal plasticity. The student would participate in multiple phases of data collection and analysis, including surgical preparation and behavioral assessment of the experimental animals and the detection of changes in gene expression by RT-PCR and protein levels by immunoblot procedures.

Research Topic:	Fluoropolymer-Based Emulsions for the Intravenous Delivery of Fluorinated Anesthetics
Mentor(s):	Robert A. Pearce, MD, PhD
Student Role:	Although sevoflurane and other fluorinated anesthetics are traditionally delivered by inhalation, there are potential advantages to delivery by the intravenous route. This project examines the anesthetic characteristics of novel formulations of sevoflurane, using in vitro and in vivo techniques. The student will participate in the design, conduct, and analysis of these studies.

Research Topic:	Evaluating how General Anesthetics Alter Sensory Perception and Neural Coding in Auditory Cortex
Mentor(s):	Matthew Banks, MD
Student Role:	Ongoing research in our lab seeks to understand how neural activity patterns in auditory cortex relate to sensory processing in rats. Specifically, we are using general anesthetics as

	tools to disrupt cortical activity in auditory cortex and asking how these changes in activity relate to changes in performance on sensory discrimination tasks . We are addressing these questions using chronic multielectrode recordings from auditory cortex of rats trained to discriminate acoustic stimuli based on their frequency content. The student will be involved in all aspects of the research, including surgical implants of cortical electrode arrays, behavioral training of implanted rats, electrophysiological recordings from rats and data analysis.
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Research Topic:	Mechanisms of general anesthetic-induced amnesia
Mentor(s):	Misha Perouansky, MD
Student Role:	The purpose of these in-vivo animal experiments is to characterize the effects of general anesthetics on central nervous system network activity underlying learning and memory. The student will participate in behavioral experiments (in selected cases together with micro-EEG recordings from the hippocampus using implanted electrodes) with genetically modified mice. The degree and nature of involvement (planning, conducting behavioral experiments, genotyping, electrode implantation, data collection, and data analysis) will depend on the interests and time commitment of the student.

Research Topic:	Opioid receptors function and regulation in acute and chronic pain
Mentor(s):	Thomas McDowell, MD, PhD
Student Role:	We are interested in the function and regulation of opioid receptors in primary nociceptors in acute and chronic pain states. Ongoing projects include investigations into the interactions between growth factor receptors and opioid receptors, the mechanisms of opioid receptor desensitization and internalization, and the development of opioid tolerance. Students will help plan experiments, assist with animal surgeries, perform patch clamp recordings from isolated neurons, conduct behavioral tests of nociception in rats and measure changes in opioid receptor expression and trafficking.

Vanderbilt University

Research Topic:	Non-routine events during perioperative care
Mentor(s):	Matthew B. Weinger MD, Jason Slagle PhD
Student Role:	Data collection and analysis

Research Topic:	The effects of individual clinician and team workload on surgical quality and outcomes
Mentor(s):	Matthew B. Weinger MD, Jason Slagle PhD
Student Role:	Data collection and analysis

Research Topic:	Simulation modeling of perioperative patient flow: Impact on quality and efficiency
Mentor(s):	Dan France, PhD, MPH, Matthew B. Weinger MD
Student Role:	Data collection, Computer modeling and analysis

Research Topic:	Perioperative handoffs, communication, and coordination
Mentor(s):	Matthew B. Weinger MD, Jason Slagle PhD, Anne Miller, RN, PhD
Student Role:	Data collection and analysis

Research Topic:	Identification of genes and genetic pathways required for protein homeostasis during osmotic stress
Mentor(s):	Kevin Strange PhD
Student Role:	Data collection and analysis

Research Topic:	Determining risk factor for delirium
Mentor(s):	Pratik Pandharipande MD
Student Role:	Data collection and analysis

Research Topic:	Inhibition of ion transport and cell migration
Mentor(s):	Eric Delpire PhD, Kenneth Gagnon PhD
Student Role:	Scratch wound and cell migration assays (cell culture)

Research Topic:	Characterization of novel modulators of KCC2 function
Mentor(s):	Eric Delpire PhD
Student Role:	Ion flux measurements and cell culture

Research Topic:	Obstetric anesthesiology chart accuracy: a comparison of paper versus electronic records
Mentor(s):	Curtis Baysinger, MD, Michael G. Richardson, MD
Student Role:	Chart review, data collection and analysis

Research Topic:	The effects of lidocaine on genetic variants of the cardiac sodium channel
Mentor(s):	Sabrina Kupersmidt, PhD
Student Role:	Data collection, literature search

Research Topic:	Molecular mechanisms of anesthetic action on cardiac potassium channels
Mentor(s):	Jerod S. Denton, PhD
Student Role:	Data collection and analysis

Research Topic:	Effectiveness of parent controlled analgesia
Mentor(s):	JK Deshpande, MD, Stephen Hays, MD
Student Role:	Student PI - a) participate in formalizing study design b) interview parents/patients and staff c) analyze data d) generate draft manuscript/report of study findings for presentation and publication

Research Topic:	Improving patient safety: near miss events in a pediatric perioperative unit
Mentor(s):	JK Deshpande, MD, Ira Landsman, MD, Matt Weinger MD
Student Role:	a) participate in study design b) collate incident reports from the hospital's event reporting system c) analyze reports to identify themes and areas of possible improvement d) participate in designing interventional study aimed at reducing occurrence of patient events/incidents

Washington University

Research Topic:	Define the mechanisms whereby certain genes control hypoxic cellular injury and adaptation.
Mentor(s):	Charles Michael Crowder, MD, PhD
Student Role:	Perform experiments testing various hypotheses about the mechanisms of hypoxic cell death using genetic and genomic methods in the nematode <i>C. elegans</i> .

Research Topic:	Human opioid transport and metabolism
Mentor(s):	Evan Kharasch, MD, PhD
Student Role:	Perform laboratory experiments to evaluate the human cellular transporters and enzymes at the blood-brain barrier, intestine, liver and/or kidney, which are responsible for tissue influx and efflux which determine the onset and elimination of opioid effects.

Research Topic:	Barnes-Jewish Apnea Prevalence in Every Admission Study (B-JAPNEAS)
Mentor(s):	Michael Avidan, MD

Student Role:	Involvement in epidemiological screening program for obstructive sleep apnea (OSA) with the Berlin Questionnaire and the Flemons' Index. Students will learn about data entry and analysis, and will have the opportunity to gain experience with software, such as Microsoft Access and SPSS. Students will have the opportunity to participate in writing scientific manuscripts.
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Research Topic:	BIS or Anesthesia Gas to Reduce Explicit Recall (BAG-RECALL); a 6000 patient multi-center study
Mentor(s):	Michael Avidan, MD
Student Role:	Students will learn about the complication of awareness during anesthesia with subsequent explicit recall. Students will help to implement protocols designed to decrease the likelihood of this complication. They will learn about key concepts of anesthesia as well as electroencephalogram features of general anesthesia. They will be actively involved in practical aspects of the research: in recruiting patients to the study, in conducting the study in the operating rooms, and in administering questionnaires to patients who participate in the study. Students will be expected to present a PowerPoint presentation to the research team, and will have the opportunity to provide input to a scientific manuscript. Details of the study can be found at the following site: http://www.clinicaltrials.gov/ct2/show/NCT00682825 .

Research Topic:	Pharmacogenetics of Nitrous Oxide
Mentor(s):	Peter Nagele, MD
Student Role:	Being actively involved in the clinical trial, screening and enrolling study patients, following them throughout surgery and their postoperative period, collect research data, learn how clinical research works in a large clinical trial.

Research Topic:	Efficacy of a Simulation-Based Curriculum for Cardiovascular Physiology
Mentor(s):	David J. Murray, MD
Student Role:	Students will design a set of four simulation-based Cardiovascular Physiology exercises for 1st year medical students. The student will establish the laboratory procedures that would demonstrate specific physiology concepts as these principles apply to clinical settings.

Research Topic:	Efficacy of a Simulation-Based Curriculum for Respiratory Physiology
Mentor(s):	David J. Murray, MD
Student Role:	Students will design a set of four simulation-based Respiratory Physiology exercises for 1st year medical students. The student will establish the laboratory procedures that would be conducted to demonstrate specific physiology concepts as these principles apply to clinical settings

Research Topic:	Pharmacokinetics of Cefoxitin and Obesity
Mentor(s):	Octavian Toma, MD
Student Role:	Sample collection, data collection; PK modeling, literature review, and manuscript preparation.

Weill Cornell Medical College

Research Topic:	<ul style="list-style-type: none"> • Characterization of blood pressure components and risk in of Ischemic injury in surgical setting with focus on pulse pressure • Inflammatory response during cardiopulmonary bypass and its affect on morbidity and mortality in coronary surgery (specifically looking at its inhibition and outcome) • Nesiritide in CABG Surgery • Preoperative TEE
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Mentor(s):	Manuel Fontes, MD
Student Role:	<ul style="list-style-type: none"> • Learn the fundamentals of clinical research to include participation in data collection, patient recruitment, data analysis, and some aspects of statistics. The clinical research will take place both in the operating rooms and in the intensive care unit • Protocol writing and when possible abstract preparation and submission • Present data at data at departmental national meetings

Research Topic:	<ul style="list-style-type: none"> • Defining the mechanisms of anesthetics in producing anesthesia at the receptor level
Mentor(s):	Peter Goldstein, MD
Student Role:	<ul style="list-style-type: none"> • Perform original laboratory research in supervised setting • Prepare data for abstract submission • Present data at departmental and national meetings

Research Topic:	<ul style="list-style-type: none"> • Perioperative Cardiovascular Remodeling
Mentor(s):	Paul Heerd, MD, PhD, FAHA
Student Role:	<ul style="list-style-type: none"> • Assess contractile function of isolated myocardium • Measurements of calcium cycling by myocytes • Prepare data for abstract submission • Present data at departmental and national meetings

Research Topic:	<ul style="list-style-type: none"> • Molecular mechanisms of general anesthetics • Effect of general anesthetics on neurotransmitter release • Neuronal cell signaling: protein phosphorylation • Cerebral ischemia and neuroprotection
Mentor(s):	Hugh Hemmings, Jr., MD, PhD
Student Role:	<ul style="list-style-type: none"> • Perform original laboratory research in supervised setting • Prepare data for abstract submission • Present data at departmental and national meetings

Research Topic:	<ul style="list-style-type: none"> • Study of the Pharmacokinetics and pharmacodynamics of neuromuscular blocking drugs • Recovery of neuromuscular function after administration of nondepolarizing relaxants • Cognitive function of geriatric patients after general anesthesia
Mentor(s):	Cynthia Lien, MD
Student Role:	<ul style="list-style-type: none"> • Learn the fundamentals of clinical research by assisting in patient enrollment and data collection on human volunteers • Conduct data analysis • Present data for abstract submission • Present data at departmental and national meetings

Research Topic:	<ul style="list-style-type: none"> • Intraoperative intraocular pressure and postoperative visual disturbance
Mentor(s):	Patricia Mack, MD
Student Role:	<ul style="list-style-type: none"> • Learn the fundamentals of clinical research by assisting in patient enrollment and data collection on human volunteers • Conduct data analysis • Present data for abstract submission • Present data at departmental and national meetings

Research Topic:	<ul style="list-style-type: none">• Functional neuroimaging of anesthetics effects on memory and consciousness• Nature of consciousness and memory
Mentor(s):	Kane Pryor, MD
Student Role:	<ul style="list-style-type: none">• Assist in functional neuro-imaging and behavioral human volunteer studies• Conduct data analysis• Present data for abstract submission• Present data at departmental and national meetings