MSRC Summer Student Research Program

In 2011 the LSU Musculoskeletal Research Consortium (MSRC) started a research program for sophomore medical students to introduce concepts of basic musculoskeletal research. The goals of this program are to cultivate students’ interests in pursuing careers in the medical/surgical aspects of the musculoskeletal system. The research is primarily basic science related and is conducted in the summer between the first and second years of medical school with an ongoing commitment to project completion during the following years. The research is primarily based at our sister campuses in Baton Rouge, although some projects may take place at the New Orleans Health Sciences Center. Research is an important part of a well rounded medical education, but becomes even more important when applying for residencies and careers in competitive fields such as orthopedic surgery. Our hope is this will provide our students not only with a valuable learning experience but will help position the student for a competitive application during the residency application process. Each project will be overseen by a Primary Investigator (PI) who will guide and mentor the student throughout the project.

Application Process:

All students interested in the MSRC summer research program (unfunded and funded) must apply through Dr. Gregory’s program (stating preference in MSRC):

http://www.medschool.lsuhs.edu/genetics/summer_med_students.aspx

- Funded positions vary from year to year and will be determined by Dr. Gregory.
- Unfunded positions will be available based on qualifications and project availability.

Program Expectations:

- Conduct your own research project or work on a part of an ongoing research project.
- Develop your technical skills and familiarize yourself with current literature.
- Be available for all dates of your program and report to work on time as designated by your mentor to work on assigned research project.
- Eventual publication of work in a peer reviewed journal
- Prepare oral and poster presentations

MSRC Faculty:
Andrew King MD- Chair, LSU Dept of Orthopedic Surgery
Vinod Dasa MD- MSRC Co-director
Mandi Lopez DVM, PhD- MSRC Co-director
Marty Feldman PhD
Jeff Gimble MD, PhD
Jeff Hobden PhD
Daniel Hayes PhD
Jean Jacob PhD (LSUHSC director of research development)
Todd Monroe PhD
Michael Murphy PhD

**Important Dates/Timeline:**

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<th>Date</th>
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<tr>
<td>March 1\textsuperscript{st}</td>
<td>Deadline for summer research application</td>
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<td>Mid-April (or sooner)</td>
<td>Notification of selection</td>
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<td>End of April</td>
<td>Contact PI for details of research and to begin planning</td>
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<td>End of May (end of L1 year)</td>
<td>Begin research project:</td>
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<td>- Daily lab work</td>
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<td>- Weekly educational meetings and project updates</td>
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<td>Mid-July (begin L2 year)</td>
<td>End of dedicated research time</td>
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<td>End of July</td>
<td>Begin abstract</td>
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<td>Mid-August</td>
<td>Abstract due to first research meeting</td>
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**MSRC Summer research is required to be submitted to the following meetings:**

1) PHI ZETA Research Emphasis Day at LSU Veterinary School (End of September)
   - Abstracts due by Mid-August

2) SOM Student Research Day (Mid-October)
   - Abstracts are due by 5PM on Monday, October 1\textsuperscript{st}
   - Posters must be submitted for printing by Friday, October 5\textsuperscript{th}

3) LSU Orthopedic Surgery Core Conference
   - Oral Presentation (In the Spring in preparation for LOA)

4) Louisiana Orthopedic Association (LOA) annual conference (Early March)
   - Abstract submission deadline is November 1\textsuperscript{st}
Student: Sean Michael Rider  
PI/Mentor: Dr. Mandi J. Lopez DVM, MS, PhD, LSU School of Veterinary Medicine  
Title: Chronic Alcoholism Inhibits Adult Stromal Cell Osteogenesis In Vivo Through Alterations in Cytokine Ratios  
Research: Inguinal adipose stromal cells (ASCs) isolated from Sprague-Dawley rats were loaded onto osteogenic scaffolds. The scaffolds were implanted into control and alcohol treated rats for L4-L5 spinal fusions. The spinal fusions containing the scaffolds were harvested and analyzed using immunohistochemistry, mRNA quantification, micro-CT, and compositional analysis. The effect of alcoholism in decreasing osteogenesis appears to be exacerbated by ASC implantation by effecting cytokine ratios.  
Status: Publication in progress

Student: Brandon Hicks  
PI/Mentor: Dr. Jeffery A. Hobden LSUHSC Dept. of Microbiology, Immunology, & Parasitology  
Title: Killing Staphylococcus epidermidis Biofilms on Prosthetic Joint Materials with the Antiseptic Agents Povidone-iodine and Chlorhexidine di-gluconate  
Research: Investigating the effectiveness of two antiseptics (povidone-iodine and chlorhexidine digluconate) in killing Staphylococcus epidermidis biofilms (a leading cause of prosthetic joint infections) on prosthetic materials (titanium, polymethyl methacrylate bone cement, and ultra-high molecular weight polyethylene. Both antiseptics in both trials significantly reduced CFU of S. epidermidis on all orthopedic implant materials. The results suggest that antiseptics might serve as alternatives to antibiotics in treating PJI.  
Status: In progress

Student: Trevor Stubbs  
PI/Mentor: Dr. Dan Hayes  
Title: Composite Scaffold for Bone Regeneration with Osteogenic and Antimicrobial Properties  
Research: Bioceramic scaffolds can be a useful tool for regenerating bone tissue in a critical size bone defect. Scaffolds must have adequate physical and mechanical stability as well as the porous structure to allow for bone growth on and throughout the scaffold. By creating a composite scaffold composed of multiple materials, additional benefits can be gained such as an increased rate of osteoblastic differentiation resulting in increased bone formation and the prevention of infection. My project characterized scaffolds composed of different mixtures of a polymer, the known osteogenic molecule beta-tricalcium phosphate, and silver nanoparticles.  
**Status:** Publication in progress

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**MSRC 2012 Summer Projects**

**Student:** Sarah Frischhertz  
**PI/Mentor:** Dr. Mandi J. Lopez DVM, MS, PhD, LSU School of Veterinary Medicine  
**Title:** Primate Femur Histomorphometry and Gene Expression: Effects of Chronic Alcohol Abuse on Bone  
**Research:** Examined and quantified the microscopic structural effects of chronic alcohol abuse on bone in a primate model using the techniques of histomorphometry through both manual and software assisted methods. Compared this to alcohol induced alterations in gene expression as determined through RT-qPCR performed by another member of the lab.  
**Status:** In progress

**Student:** Mason Adams  
**PI/Mentor:** Dr. Martin Feldman  
**Title:** Design of Methods and Fabrication of MEMS Endoscope  
**Research:** The objective of the research work was to design and engineer the MEMS endoscope with all of its functioning components. Project required a lot of etching, sawing, sanding, and processing on microchips and mirrors.  
**Status:** In progress

**Student:** Jake Trahan III  
**PI/Mentor:** Michael C. Murphy, PhD & Taehyun Park, PhD, LSU Dept. of Mechanical Engineering  
**Title:** A Rapid Processor for Methicillin-Resistant *Staphylococcus aureus* (MRSA) Identification in the Operating Room  
**Research:** Worked on designing and fabricating a micro-/nanochannel polymer chip to be used in identifying bacterial infections in fluid samples.  
**Status:** In progress

**Student:** Raeanna Simcoe  
**PI/Mentor:** Dr. Mandi J. Lopez DVM, MS, PhD, LSU School of Veterinary Medicine  
**Title:** Localization and Enumeration of Progenitor Cell Surface Markers and Primordial Keratins in the Laminitic Equine Hoof  
**Research:** Studied cellular changes that occur during equine laminitis, a devastating condition affecting a significant number of horses. Used qRT-PCR and immunohistochemistry to observe differences in expression of stem cell and keratinocyte markers in laminitic hooves versus normal hooves. Found changes that may give insight into the cellular cause of laminitis as well as human diseases of the epidermal-dermal junction including epidermolysis bullosa and pemphigus foliaceus.
**Status:** In progress

**Student:** Timothy Machen  
**PI/Mentor:** Dr. Daniel Hayes  
**Title:** Hemolytic Properties of the Anti-Bacterial Compounds CSA-124 and CSA-124 Bound to Silver Nanoparticles.

**Research:** The project dealt with synthetic antimicrobial compounds termed cationic steroid antibiotics, or CSAs. These compounds mimic the bactericidal action of innate antimicrobial peptides found in host tissues, and could be used to potentially combat infections associated with orthopedic implants. However, past experiments in our lab have hinted that CSAs can cause hemolysis. Our goal was to gather a better understanding of the hemolytic property of the CSA compound (particularly CSA-124), and attempt to enhance its biocompatibility by combining the compound with silver nanoparticles. Our thinking was that the silver nanoparticles would provide a steric hindrance on some of the membrane active functional groups, making the compound less hemolytic.

**Presentations:** Future Presentations: Medical Student Research Day (2012, Poster), LSU Orthopedic Core Conference (2013, Oral)  
**Status:** In progress

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**Clinical Research Projects**

For students who do not participate in the summer research program there are still many opportunities for research. Clinical research projects in musculoskeletal medicine vary widely by department. Various departments that have some relation to musculoskeletal medicine include Orthopedic Surgery, Radiology, Anesthesiology, Neurosurgery, Physical Medicine and Rehabilitation, Neurology, General Surgery/Trauma, Primary Care, and Allied Health such as Physical Therapy. Most departments have a research requirement for their residents and faculty creating numerous opportunities based on the department and personnel. Student involvement in research can be as limited as helping a resident with data collection or as involved as developing an independent project with one of the faculty. Typically each department has a research coordinator or a faculty member who either directs the research activities or has a large personal interest. In the department of Orthopedic Surgery, there is a director of research (Dr. Vinod Dasa) and a research coordinator (Jennifer Perilloux). Clinical projects can involve a range of activities ranging from retrospective chart reviews, cadavers studies, biomechanics, and prospective clinical research. These projects, depending on scope, can take months to years to complete. The time/work commitment is generally dependent on the student and their effort. The research coordinator can help pair the student with an existing project or help initiate your own project based on interests and experience.

Participating in research can be an extremely rewarding experience and create tremendous opportunities; however, this requires a certain commitment. Please realize this is a “double edge sword” and if you commit to a project and do not follow through this will reflect poorly on your future aspirations. We want to give you as many opportunities for success as possible; however,
the ultimate responsibility remains with you. Please do not participate if you do not think you can commit the required amount of effort.

**Contact Information:**

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Class of 2014

Class of 2015