Summer Student Research Program
Project Description

FACULTY SPONSOR'S NAME AND DEGREE:*J. Christopher Fritton*
PHONE: (973) 972 - 2595
DEPARTMENT AND INTERNAL MAILING ADDRESS:*Orthopaedics*
E-MAIL:*chris.fritton@rutgers.edu*
PROJECT TITLE (200 Characters max):

The effects of bisphosphonate treatment on bone formation and maintenance

HYPOTHESIS:
Bisphosphonate treatment will alter the rate of osteocyte incorporation into newly formed bone following a controlled remodeling event.

PROJECT DESCRIPTION **(Include design, methodology, data collection, techniques, data analysis to be employed and evaluation and interpretation methodology)**
The purpose of the experiment is to evaluate any differences that occur in intracortical bone remodeling between drug-treated and vehicle-treated controls. All work is to be conducted by the faculty sponsor and an advanced Ph.D. student with the summer M.D. student assisting.

The experimental design incorporates rat ulna loading, which is the established model used to investigate intracortical bone remodeling [(Bentolila et al., 1998 http://doi.org/10.1016/S8756-3282(98)00104-5)]. In vivo fatigue loading of the rat ulna creates microdamage within the medial cortex at the ulna midshaft, subsequently triggering the bone remodeling process. For this experiment, female Sprague-Dawley rats (5-6 months of age) will be randomly assigned into one of three groups and treated with either a sterile saline control (Veh) or one of two alendronic acid treatments (AlnLow: 0.002 mg/kg; AlnHigh: 0.007 mg/kg) for 8 weeks.

After the first 2 weeks of treatment, the right ulna will be exposed to a single bout of sinusoidal, cyclic, mechanical load with a peak force of under 24 N at 2 cycles per second, until a 20% reduction in ulnar stiffness is achieved. The reduction in stiffness represents induction of microdamage within the cortical bone tissue of the ulna. The left ulna serves as an intra-animal control.

At 21 and 7 days prior to euthanasia, all rats will receive intraperitoneal injection of calcein. Calcein is a fluorochrome that is taken up by the bone and allows visualizing new bone formation and provides margins between which new cells will be evaluated by histology after death.

At 6 weeks post-fatigue loading, limbs will be processed for histology.

SPONSOR'S MOST RECENT PUBLICATIONS RELEVANT TO THIS RESEARCH:
Bajaj, D., Geissler, J.R., Allen, M.R., Burr, D.B., and Fritton, J.C., "The resistance of cortical bone tissue to failure under cyclic loading is reduced with alendronate," Bone, 64:57-64, 2014. http://dx.doi.org/10.1016/j.bone.2014.03.045

Geissler, J.R., Bajaj, D., and Fritton, J.C. "ASB Award: Cortical bone tissue mechanical quality and biological mechanisms possibly underlying atypical fractures." J Biomech, 48:883-94, 2015. http://dx.doi.org/10.1016/j.jbiomech.2015.01.032

Summer Student Research Program
Project Description

IS THIS PROJECT SUPPORTED BY EXTRAMURAL FUNDS?
Yes ☐ or No ☒
(IF YES, PLEASE SUPPLY THE GRANTING AGENCY'S NAME)

THIS PROJECT IS: ☐Clinical ☒Laboratory ☐ Behavioral ☐ Other

THIS PROJECT IS CANCER-RELATED☒
Please explain Cancer relevance
Bisphosphonates are a commonly prescribed drug to prevent metastases to bone from prostate and breast cancers. Since patients are living longer with these treatments the quality of their bone has become an issue as reports of fractures are emerging. We are developing a model that will allow testing of new treatments that may lead to better bone quality for these patients and thus a better quality of life.

THIS PROJECT IS HEART, LUNG & BLOOD- RELATED☐
Please explain Heart, Lung, Blood relevance

THIS PROJECT EMPLOYS RADIOISOTOPES☐

THIS PROJECT INVOLVES THE USE OF ANIMALS ☒
PENDING ☐ APPROVED ☒ IACUC PROTOCOL #

THIS PROJECT INVOLVES THE USE OF HUMAN SUBJECTS ☐
PENDING ☐ APPROVED ☐ IRB PROTOCOL # M

THIS PROJECT IS SUITABLE FOR:

UNDERGRADUATE STUDENTS	☐	ENTERING FRESHMAN	☐
SOPHMORES	☐	ALL STUDENTS	☒

THIS PROJECT IS WORK-STUDY: Yes ☐ or No ☒

THIS PROJECT WILL BE POSTED DURING ACADEMIC YEAR
FOR INTERESTED VOLUNTEERS: Yes ☐ or No ☒

WHAT WILL THE STUDENT LEARN FROM THIS EXPERIENCE?
The M.D. student will: 1) gain an understanding of orthopaedic research in bone and tissue regeneration; 2) learn different techniques used in bone research; 3) learn how biomedical engineering is applied in biomedical research; 4) become familiar with a research project; 5) learn about research and data collection; and 6) learn basic laboratory bench work.