Intersection of Fracture Healing and Infection Workshop

Educational need:
One of the main causes of poor fracture healing is infection; unfortunately, bone regeneration and infection research are typically approached independently and viewed as two different disciplines. Here we aim to bring these two groups together in an educational workshop to promote research into the basic and translational science that will address the clinical need of delayed fracture healing due to infection.

Clinical relevance:
Infection and nonunion are known to be common complications of bone fractures and often occur within the same injury. Although they frequently are associated with one another, the treatments and approaches for them are different and done sequentially (i.e., prevent/treat infection and then get the bone to heal). This requires more time, surgeries, and morbidity to the patient. The ability to heal fractures in a contaminated defect would benefit both the patient and the health care system.

Abstract:
Infection is often the cause of impaired fracture healing. In the clinic al setting, the two complications are treated separately and sequentially. In other words, definitive treatment and closure of wounds are after infection is abated. The ability to prevent/treat infection while promoting fracture healing will greatly reduce the cost, number of procedures, and patient morbidity. In order to develop new therapies, scientists must understand the clinical need, current standards of care, pathology of infection on fractures, and available models to evaluate novel technologies. This workshop will merge and inform these often-separated scientific disciplines through a diverse, cross-disciplinary panel of speakers.

Agenda:
1) Overview of purpose and goals (Moderators – Drs Wenke and Bahney)
2) Clinical Burden and Current Standards of Care (Dr. Zach Working)
3) Understanding the pathophysiology of infected nonunions (Dr. Laura Certain)
4) Preclinical models to assess emerging therapies (Dr. Josh Wenke)
5) Approaches to regenerate bone in contaminated defects (Dr. Andres Garcia)
6) Panel discussion
Workshop Organizers

Chelsea Bahney, PhD
Program Director of Bone Repair and Skeletal Engineering at Steadman Philippon Research Institute (SPRI)
Associate Adjunct Professor position at the University of California San Francisco (UCSF)
Affiliate Bioengineering Faculty at Colorado State University (CSU)

The overall goal of Dr. Bahney’s research is to develop translationally relevant therapies or diagnostics that improve musculoskeletal health. Her laboratory focuses predominantly on the central process of endochondral ossification, which is the mechanism of indirect bone formation by which cartilage transforms into bone during embryonic development, postnatal growth, fracture healing, and osteoarthritis. The primary research goal is to develop novel strategies to drive endochondral bone regeneration and her laboratory utilizes a cross-disciplinary tools combining biologically modified scaffolds, stem cell biology, and murine models of orthopaedic injuries. Dr. Bahney is recognized for her research in bone regeneration and holds multiple leadership roles across the fields of fracture and tissue engineering: she is currently Chair of the ORS International Section of Fracture Repair (ISFR); serves on the Board of Directors for the Tissue Engineering and Regenerative Medicine International Society (TERMIS) as Treasure (2019-2022); was recently nominated to the Orthoapedic Trauma Association Strategic Initiative Committee (2020-2023); and recently complete service on the Board of Directors for the Orthopaedic Research Society (ORS).

Josh Wenke, PhD
Adjoint Professor at the US Army Institute of Surgical Research

Joseph C. Wenke, PhD arrived at the US Army Institute of Surgical Research in San Antonio, TX as a National Research Council Postdoctoral fellow in 2003. The following year he accepted a position at ISR as a Research Physiologist and is now the manager for the Extremity Trauma & Regenerative Medicine Task Area and the Orthopaedic Extremity Trauma Research Program. His primary research focus is improving outcomes of open fractures. Much of his previous work has been focused on improving early therapies (e.g., wound irrigation techniques, negative pressure wound therapy, and local delivery of antibiotics); current and future projects focus on regenerating bone in a contaminated bone defect, organizing clinical studies, allograft transplants, and ex vivo perfusion techniques. One of the main strengths of his research program is the ability to utilize or develop clinically relevant orthopaedic trauma animal models to evaluate different therapies or develop clinical guidelines.
Workshop Pannelist

Zachary Working, MD
Assistant Professor of Orthopaedics and Rehabilitation at Oregon Health & Science University’s School of Medicine

Dr. Working is an orthopaedic trauma surgeon who specializes in treating broken bones at the Marquam Hill campus. His clinical interest is in the care and needs of traumatically injured adults and children of all ages. He treats patients with fractures of the pelvis, arm, elbow, shoulder, ankle, foot, leg and knee. He is particularly interested in the prevention and care of musculoskeletal infections resulting from trauma.

Dr. Working earned his medical degree at the Pittsburgh School of Medicine. He completed an orthopaedic residency at the University of Utah where he began to focus his interest on the traumatically injured patient. He completed an orthopedic trauma fellowship at the Orthopaedic Trauma Institute at the University of California at San Francisco. His research focuses on optimizing clinical orthopaedic trauma care, musculoskeletal infections and their treatment, and problem fractures (nonunion).

Laura Certain, MD, PhD
Clinical Assistant Professor at the University of Utah Hospital

Dr. Certain is an Assistant Professor of Medicine in the Division of Infectious Diseases at the University of Utah and Chief of Infectious Diseases at the George E. Wahlen VA Medical Center in Salt Lake City. She specializes in orthopedic infections, and works closely with the University of Utah Orthopedics Department to provide clinical care for their patients. Prior to moving to Utah in 2017, she completed her residency and fellowship training at the Massachusetts General Hospital in Boston, followed by a post-doctoral research fellowship studying prosthetic joint infections in an animal model at the Wyss Institute for Biologically Inspired Engineering. Her current research and quality improvement efforts include: outpatient parenteral antibiotic therapy, prosthetic joint infections, and bone concentration of antimicrobials. She is a member of the Musculoskeletal Infection Society (MSIS) and will serve on its Executive Board beginning in August 2020.
Dr. García's research centers on cellular and tissue engineering, areas which integrate engineering and biological principles to control cell function to restore and/or enhance function in injured or diseased organs. Specifically, his research focuses on fundamental structure-function relationships governing cell-biomaterials interactions for bone and muscle applications. Current projects involve the analysis and manipulation of cell adhesion receptors and their extracellular matrix ligands. For example, a mechanochemical system has been developed to analyze the contributions of receptor binding, clustering, and interactions with other cellular structural proteins to cell adhesion strength.

In another research thrust, bio-inspired surfaces, including micropatterned substrates, are engineered to control cell adhesion to direct signaling and cell function. For instance, biomolecular surfaces have been engineered to target specific adhesion receptors to modulate cell signaling and differentiation. These biomolecular strategies are applicable to the development of 3D hybrid scaffolds for enhanced tissue reconstruction, “smart” biomaterials, and cell growth supports. Finally, genetic engineering approaches have been applied to engineer cells that form bone tissue for use in the development of mineralized templates for enhanced bone repair.