

Research Report

Highlights in Musculoskeletal Research 2019



UCSF Orthopaedic
Surgery



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Message from the Chair of the UCSF Department of Orthopaedic Surgery

Dear colleagues and friends,

The year 2019 marks another remarkable year of growth, achievements and success by our researchers. Looking back as I write this message in late April of 2020, little did we know what challenges we would face as Covid-19 dominated our focus after the close of 2019! Also, late breaking news is the designation of our musculoskeletal research center on the Parnassus campus as a campus priority with Tamara Alliston, PhD taking the lead. Very exciting.

On the university level, it is with great pride to share that UCSF was the top public recipient of funding from the National Institutes of Health (NIH) in 2019, the 13th year in a row that the University as a whole claimed the top spot among public institutions. In total, the University received \$684,912,356 in NIH Funding last year.

On a Department level, the UCSF Department of Orthopaedic Surgery has been ranked No. 1 in the nation in the nation in National Institutes of Health funding for orthopaedic research, according to data released this week by the Blue Ridge Institute for Medical Research.

The Department received \$39,103,498 in peer-reviewed NIH research grants in 2019, surpassing institutions such as Washington University in St. Louis, the University of Pennsylvania, the University of Rochester, and Duke University.

At a time when research dollars are becoming increasingly scarce, the Department increased its funding by nearly 400 percent over the previous year. Since 2013, the Department has consistently ranked among the top five NIH-funded musculoskeletal programs in the country.

Building upon the sustained success of many established NIH investigators across the department's research labs, the increase this year is boosted especially by NIH funding totaling more than \$29 million to establish the UCSF Core Center for Patient-centric,

Mechanistic Phenotyping in Chronic Low Back Pain, or UCSF REACH. The new center will conduct both translational and clinical research to clarify biopsychosocial mechanisms of back pain – the interconnection between biology, biomechanics, psychology, and socio-environmental factors – which will be catalytic for new therapeutic, diagnostic and prevention strategies.

These funds, in addition to many other sources of research support, both extramural and philanthropic, fuel our ability to pursue transformative research, which aims to enhance our understanding of human health, shed light on diseases, and address health inequities in our local communities and broader populations. We are extremely grateful for this support.

As a consequence, our teams of dedicated investigators will be able to continue devising and applying innovative new perspectives to solve fundamental problems afflicting the musculoskeletal system. To this end, we would always welcome more support and investment toward our efforts.

With such success in mind, this report highlights some of our many research accomplishments over the past year. What becomes clear by viewing one year's worth of research activities and products together in one place, is that our investigators are at the leading edge of understanding fundamental mechanisms in musculoskeletal biology and they are working hard to transform how we provide care to patients.

I look forward to watching our research enterprise grow throughout 2020!

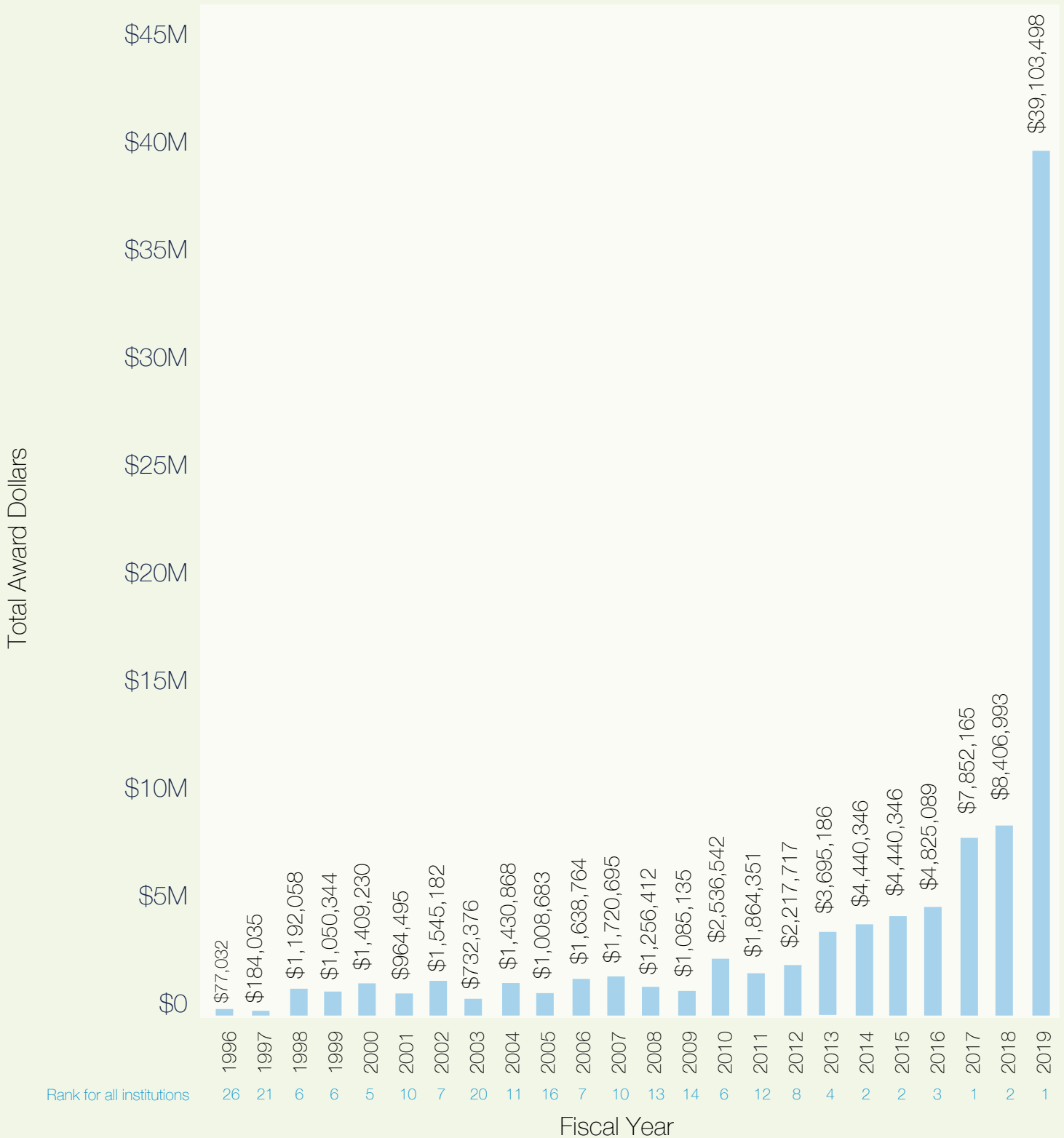
Best wishes,

A handwritten signature in black ink, appearing to read 'P. Vail', written over a white background.

Thomas Parker Vail, MD
James L. Young Professor
Chair, Department of Orthopaedic Surgery

NIH Ranking

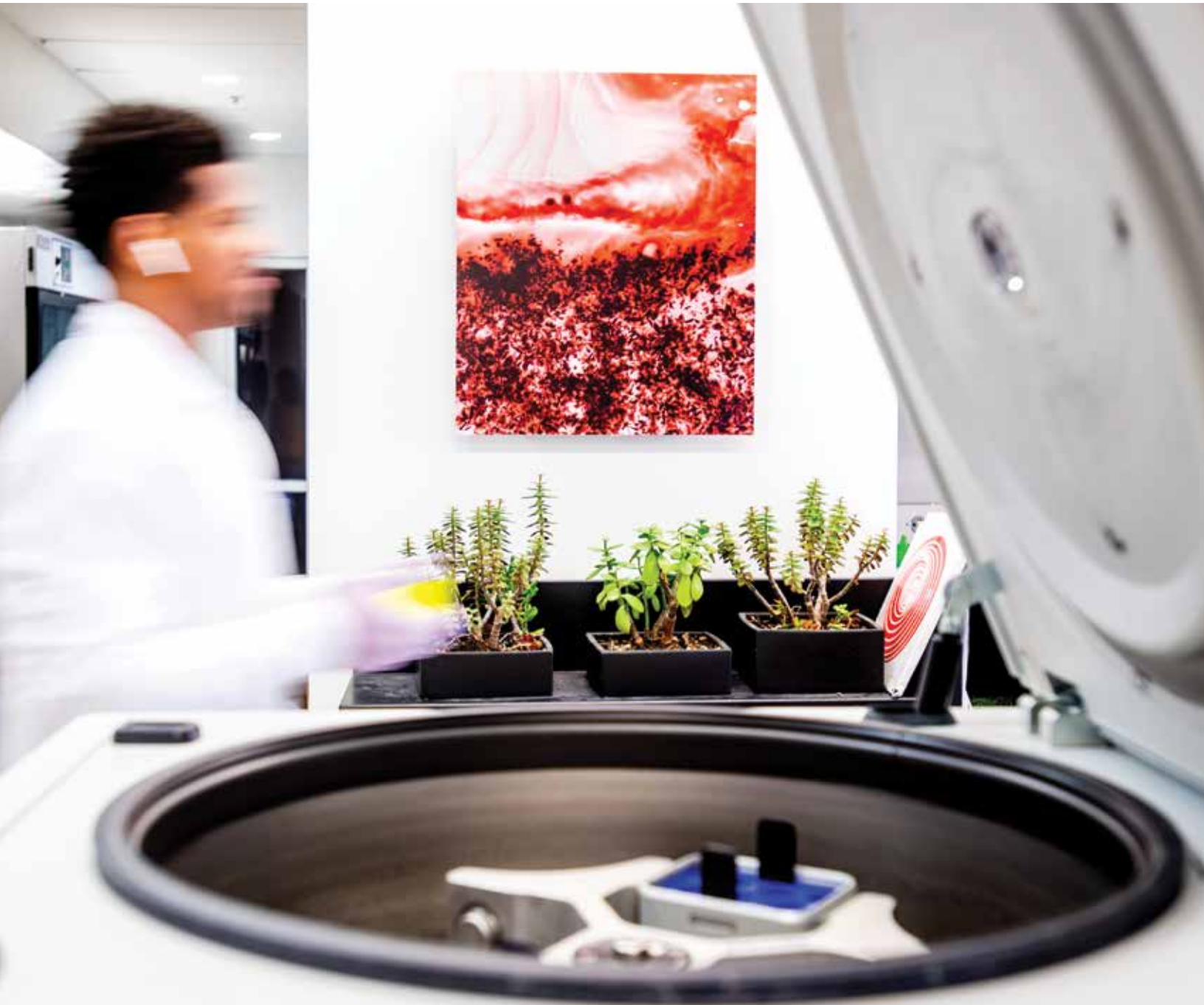
NIH Research Grants for UCSF Department of Orthopaedic Surgery



Our Vision

Pioneering musculoskeletal discovery and innovative care to transform lives.

Devante Horne, a graduate student, performs musculoskeletal research in the Lotz Laboratory for Orthopaedic Tissue Engineering and Regeneration on UCSF's Parnassus campus.



Research Programs and Activities



Researchers in the Department of Orthopaedic Surgery conduct innovative clinical, basic science, and translational research in musculoskeletal biology to improve the delivery and outcomes of orthopaedic care. Neha Dole, PhD, above, performs musculoskeletal research in the Alliston Laboratory for Skeletal Mechanobiology at UCSF's Parnassus Campus.

Basic, Translational and Clinical Research

The UCSF Department of Orthopaedic Surgery has a diverse and broad basic and translational research program in musculoskeletal biology. This is in addition to our clinical research program, which spans all orthopaedic subspecialties. Each of our various research programs are aimed at bringing new insights to our understanding of the musculoskeletal system. A major goal is to develop novel treatments for defects, diseases, conditions, and injuries that affect musculoskeletal function. We are driven by the desire to improve the delivery and outcomes of orthopaedic care.

Additionally, the department has a strong tradition in clinical research across all subspecialties. Over the past decade, clinical researchers have established a large collaborative network both within UCSF as well as with national and international clinical researchers. This has improved the impact and depth of our clinical research.

Over the past year, clinical research has been published in all major orthopaedic surgery journals including the Journal of Bone & Joint Surgery (JBJS), Journal of Shoulder and Elbow Surgery (JSES), Journal of Orthopaedic Trauma (JOT), Spine journal, Journal of Pediatric Orthopaedics (JPO), Clinical Orthopaedics

and Related Research (CORR), and the American Journal of Sports Medicine (AJSM). Faculty, fellows, and residents presented at national and international meetings of the American Academy of Orthopaedic Surgeons (AAOS), the Orthopaedic Research Society (ORS), the American Orthopaedic Society in Sports Medicine (AOSSM), International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS), the Hip and Knee Society, and the Orthopaedic Trauma Association (OTA). For a full list of our departmental contributions to the 2020 AAOS and ORS conferences, please visit <https://orthosurgery.ucsf.edu/education/courses/>.

While the individual projects are too numerous to list in detail, there have been several highlights of collaborative research across spine surgery, osseointegration, 3D printing for improving surgical outcomes, shoulder arthroplasty and instability, imaging analysis using high-resolution MRI and CT, global health through UCSF's Institute for Global Orthopaedics and Traumatology (IGOT), pediatrics and pediatric sports medicine.

Orthopaedic Translational Research

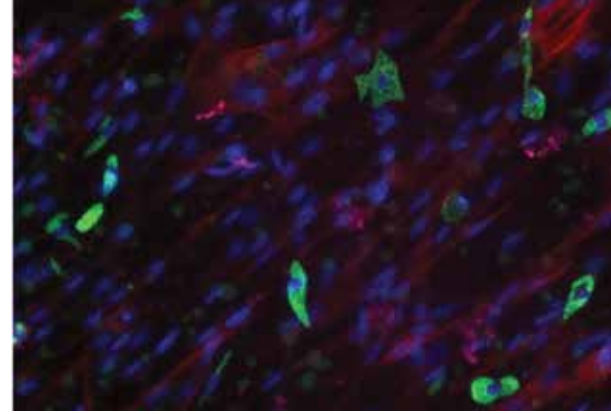
UCSF VA Health Center, Research Facility at Mission Bay

The Laboratory for Orthopaedic Translational Research is directed by **Hubert Kim, MD, PhD** and **Alfred Kuo, MD, PhD** at the UCSF VA Research Facility at Mission Bay.

The focus of the team's research effort is to examine the molecular and cellular mechanisms responsible for secondary injury cascades that are set in motion after trauma. There is particular interest in tissues that have an extremely limited capacity for healing and regeneration, where preservation of existing cells and tissue may be of great clinical significance. The intention is to apply lessons learned in the laboratory to design better treatments for patients.

Additionally, **Brian Feeley, MD** directs the Laboratory for Stem Cell Regeneration and Translational Research, also located at the UCSF VA Mission Bay campus focusing on muscle injury problems. **Brian Feeley, MD** collaborates with **Xuhui Liu, MD** and researchers at UCSF on developing models to study the molecular mechanisms and cellular mechanisms that are responsible for the development of muscle atrophy and fatty infiltration after rotator cuff tears.

The focus of the research is to understand the cellular and molecular changes that occur within the muscle after different injuries, but particularly rotator cuff tears. They have developed novel injury and repair models to study the acute and chronic



Stem cells found within the rotator cuff muscle can be stimulated into fibrotic tissue (red) or fat tissue (green) depending on the stimulus (Feeley-Liu Laboratory for Stem Cell Regeneration and Translational Research)

effects of rotator cuff injury on the important signal transduction pathways that govern muscle cell size and stem cell fate within the muscle. They also focus on understanding how muscle injury patterns affect the stem cell populations within the muscle (satellite cells, FAP cells) in an effort to determine treatment strategies that would improve muscle function after orthopedic injuries.

Within the UCSF VA Health Center, the Orthopaedic Rapid Intelligent Fabrication Group led by **Alan Dang, MD** and **Alexis Dang, MD** focus on translating orthopaedic ideas into orthopaedic products. They maintain a 3-axis CNC mill as well as a small fleet of 3D printers with customized extruders, firmware, and other software optimizations. Active projects include the development of advanced surgical lighting technology as well as surgical instrumentation and implants.

Orthopaedic Edge Innovations Laboratory

Multi-Campus Laboratory

The Edge Innovations Lab is led by **Aenor Sawyer, MD, MS**, **Alexis Dang, MD** and **Alan Dang, MD** and is focused on Engineering, Designing, and Growth Enabling digital (EDGE) and manufacturing technologies.

This group is responsible for clinical 3D printing across the many campuses of the department, including UCSF Parnassus Heights, The Orthopaedic Institute at Mission Bay, ZSFGH, SF VAHC, UCSF Benioff Children's Hospital Mission Bay, and UCSF Benioff Children's Hospital Oakland. Currently, the focus is on the 3D printing of Precision Anatomic Models for surgical preoperative planning and conducting research to assess the efficacy and economics of the technology.

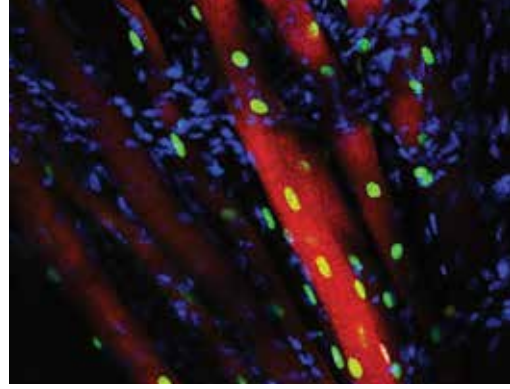
As a result of their collaborative work, both Dr. Alexis Dang and Dr. Alan Dang, received the prestigious San Francisco Federal Executive Board "Federal Employee of the Year" award in Science & Technology related to 3D printing in orthopaedics. <https://gsablogs.gsa.gov/febsanfrancisco/programs/public-service-recognition/>. The Board represents approximately 70,000 federal, postal and military employees throughout the nine bay area counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma), as well as agencies in the Sacramento area.



Edge Innovation Laboratory is led by **Aenor Sawyer MD, MD**, **Alexis Dang, MD**, and **Alan Dang, MD**.

Additionally, Dr. Aenor Sawyer, Dr. Alexis Dang and Dr. Alan Dang spearheaded a multidisciplinary initiative, together with the Pediatric Heart group and Radiology, to develop 3D+ printing technologies at UCSF. The "+" includes augmented reality, virtual reality, and 4D imaging (3D-imaging with a time component). This has received \$1.4 million in funding.

Human muscle stem cells and regeneration (Brack Laboratory for Skeletal Muscle Regeneration and Aging).
Image by Annarita Scaramozza, PhD



Stem Cell Laboratory

Eli and Edythe Broad Center of Regeneration Medicine and Stem Cell Research on Parnassus Heights

The Brack Laboratory for Skeletal Muscle Regeneration and Aging is directed by **Andrew Brack, PhD**, and focuses on the development of strategies to accelerate skeletal muscle repair.

During aging or in response to radiotherapy, the capacity for muscle repair is diminished, leading to reduced mobility and strength.

The Brack Lab uses state of the art machine learning and molecular biology to determine the causes of muscle dysfunction and identify strategies to rejuvenate the regenerative potential of skeletal muscle.

In the future, the Brack Lab hopes that current projects will lead to strategies that reverse aging and improve recovery after radiotherapy.

Andrew Brack, PhD, has developed collaborations with clinical faculty, including sports medicine and oncology. Active studies include studies on muscle aging and muscle recovery after radiotherapy.

Skeletal Mechanobiology

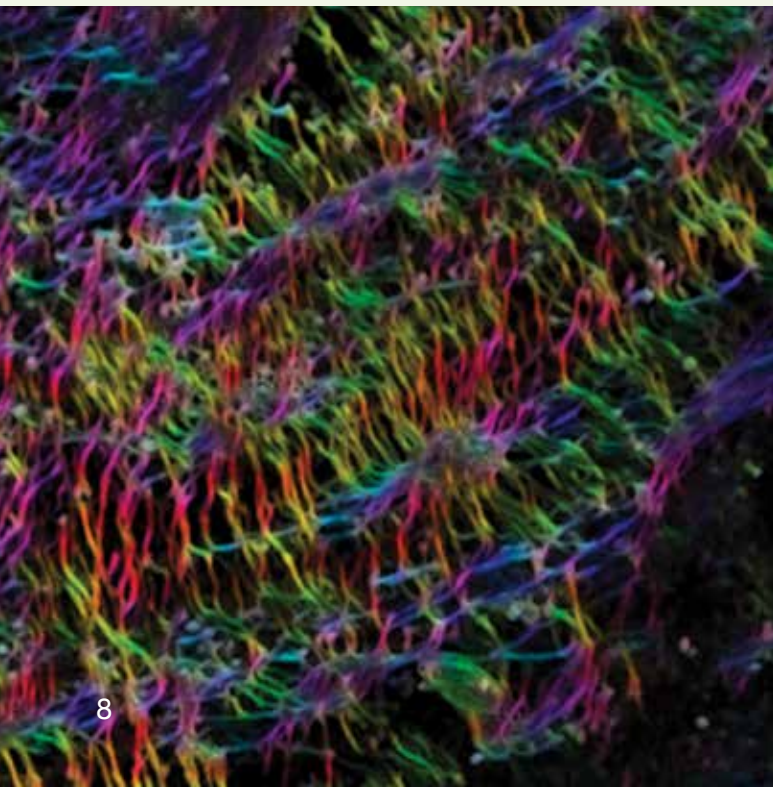
UCSF Parnassus Heights

The Laboratory for Skeletal Mechanobiology is directed by **Tamara Alliston, PhD**.

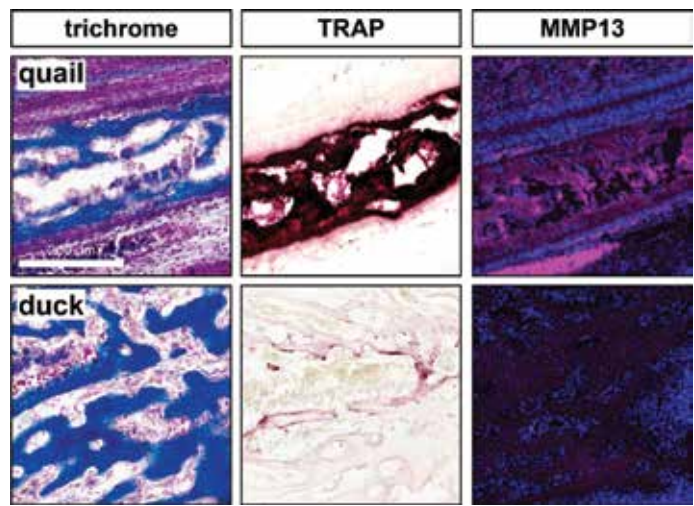
The Alliston Laboratory focuses on the molecular pathways controlling mesenchymal stem cell differentiation, how these pathways coordinate with physical cues to influence mechanical integrity of normal skeletal tissue, and how they can be harnessed to repair tissue damaged in degenerative skeletal diseases.

In particular, they focus on defining the function of TGF β in synergistically coordinating physical and biochemical cues to regulate skeletal cell differentiation. To answer these questions they combine molecular, cellular, physiologic, and materials science approaches. TGF β is a powerful regulator of homeostasis in skeletal cells and tissues. Tamara Alliston, PhD early work identified a transcriptional mechanism by which TGF β inhibits osteoblast differentiation. Specifically, the TGF β effector Smad3 recruits histone deacetylases to repress transactivation by the osteogenic transcription factor Runx2.

This research has led to the identification of new mechanisms that contribute to common musculoskeletal problems, like joint injuries, osteoarthritis, and bone fragility in aging men and women. By understanding these mechanisms, the laboratory aims to discover new therapeutic targets to prevent skeletal disease and to improve skeletal repair.



Osteocyte canalicular networks visualized in silver stained bone.
Image by Charlie Schurman 2018 (Alliston Laboratory for Skeletal Mechanobiology)



Skeletal tissues from quail and duck embryos showing species-specific differences in developing bone (stained blue with trichrome), bone resorption (stained red with TRAP), and matrix metalloproteinase 13 expression (stained pink with an anti-MMP13 antibody) (Schneider Laboratory for Developmental and Evolutionary Skeletal Biology).

Development and Evolutionary Skeletal Biology

UCSF Parnassus Heights

The Schneider Laboratory for Developmental and Evolutionary Skeletal Biology is directed by **Richard A. Schneider, PhD**.

Research is broadly aimed at understanding how the developing musculoskeletal system achieves its structural and functional integration.

To address this question, the lab has created a unique surgical transplantation system that involves embryos from two distinct types of birds (quail and duck), which differ considerably in their functional anatomy and growth rates.

Transplanting skeletal and other progenitor cells between them challenge the resulting chimeric “quack” and “duail” embryos to integrate two different species-specific developmental programs.

By focusing on donor- versus host-controlled changes to embryonic patterning and growth, this strategy has illuminated molecular and cellular mechanisms that regulate the musculoskeletal system and enable bones, cartilages, tendons, muscles, and other tissues to achieve their proper size, shape, orientation, and integration.

A goal is to devise novel molecular- and cell-based therapies for repairing and regenerating musculoskeletal tissues affected by congenital disabilities, disease, and injury. Work from the Schneider Lab has also helped elucidate the role of development in evolution.

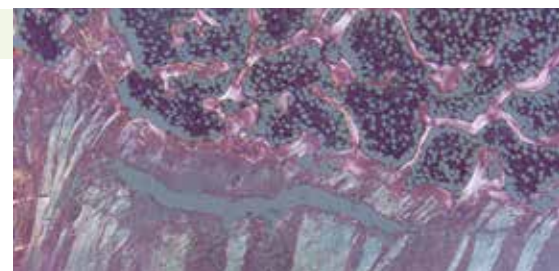
Orthopaedic Tissue Engineering and Regeneration

UCSF Parnassus Heights

The Orthopaedic Tissue Engineering and Regeneration Laboratory is directed by **Jeffrey C. Lotz, PhD**.

The Lotz Laboratory is devoted to conducting basic research in several areas of orthopaedics, including biomechanics of the spine, knee and hand. Biomechanical studies serve to investigate the physical properties of musculoskeletal (MSK) tissues, as well as the functional performance of MSK patients.

The Lotz Laboratory is collaborating with UC Berkeley engineers to design and validate in-clinic tools and sensors that quantify patient movement and augment traditional physical tests and patient-reported data. Similar studies are being conducted with NASA astronauts to understand the adverse effects of microgravity, and to develop countermeasures to maintain astronaut health and safety on long-duration space flights,

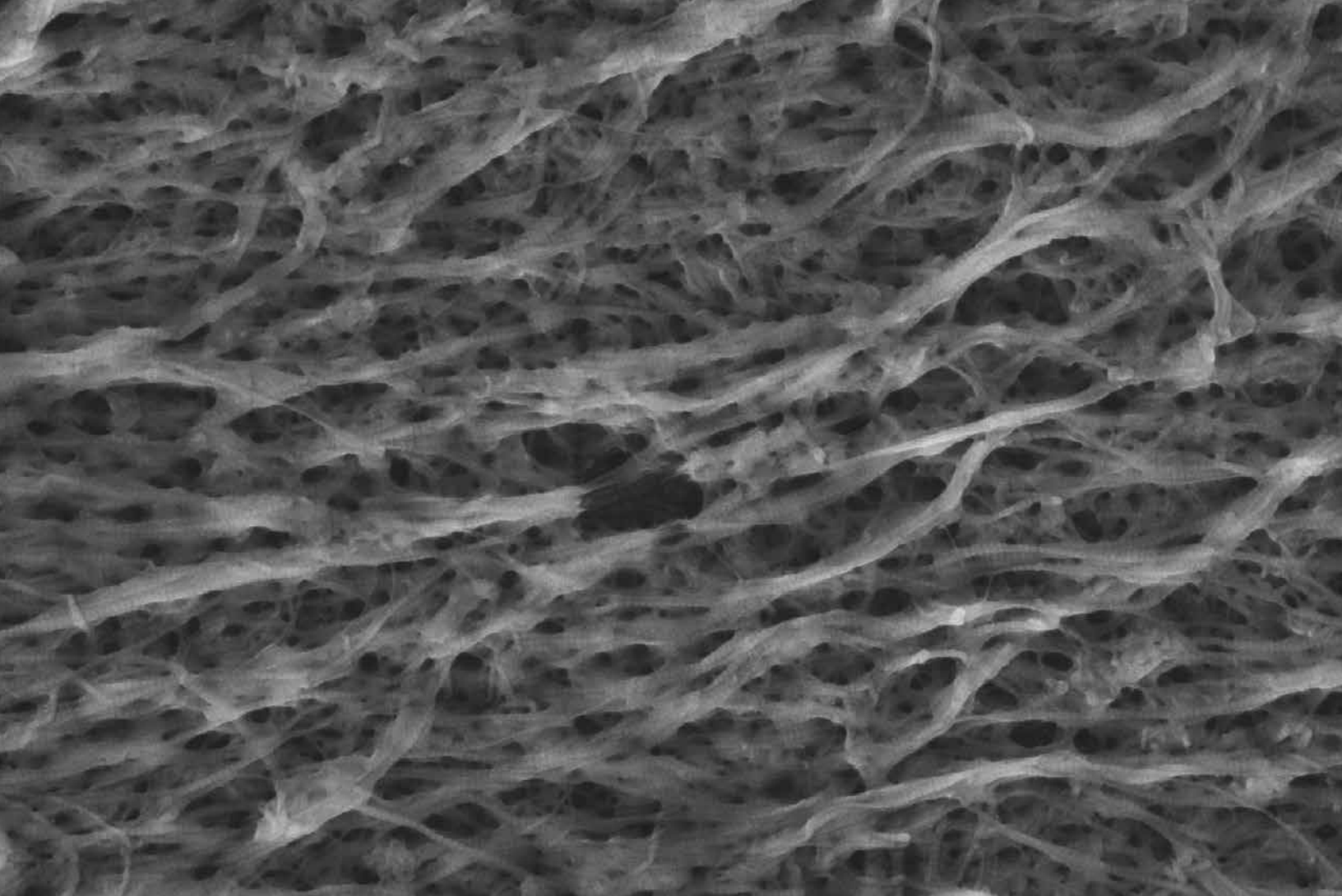


The Lotz Laboratory has pioneered biomechanical, anatomic, and imaging studies of the human disc/vertebra interface (Lotz Laboratory for Orthopaedic Tissue Engineering and Regeneration).

such as the planned Mars missions. Additionally, they have focused on understanding the etiology of different diseases (e.g., disc degeneration, osteonecrosis) and comorbidities (disc degeneration and diabetes).

In the area of regenerative medicine, the Lotz Laboratory is exploring various uses of mesenchymal stem cells for new therapies for disc, cartilage, and bone regeneration.

The diverse research team includes bioengineers, biologists, biochemists, histologists, and orthopaedic surgeons.



Orthopaedic Biomechanics and Biotransport

UCSF Parnassus Heights

The Orthopaedic Biomechanics and Biotransport Laboratory is directed by **Aaron Fields, PhD**.

The broad research interests of the Fields Lab are related to structure-function relationships in musculoskeletal tissues, with a particular focus on the mechanisms of nutrient transport in bone and cartilage, and harnessing nutrient transport for tissue repair and regeneration.

The lab combines engineering and biology approaches for: (1) understanding the effects of aging and disease on structure-transport relationships, and (2) developing translatable diagnostic and therapeutic strategies. An overall theme of this research is the use of advanced experimental and computational tools to

measure how tissue constituents at the nano- and microscales impact whole-organ behavior. The research involves close collaborations with clinicians, including spine surgeons, physiatrists and radiologists.

Active projects include: (1) translational studies aimed at harnessing nutrient transport for disc repair and regeneration; (2) clinical studies testing new diagnostic MRI tools for selecting patients that would most benefit from disc regenerative therapies; and (3) basic science studies comparing healthy vs. pathologic disc cell phenotype. These studies are funded by grants from the National Institutes of Health and the North American Spine Society.

Skeletal Regeneration/Molecular and Cellular Biology

Zuckerberg San Francisco General Hospital (ZSFGH)

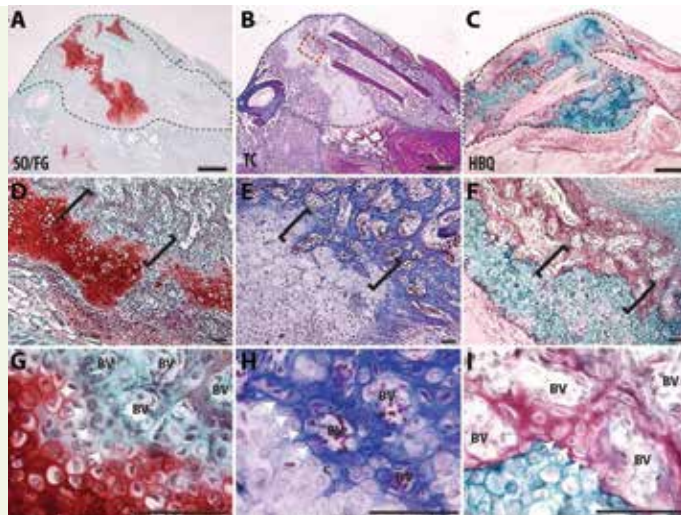
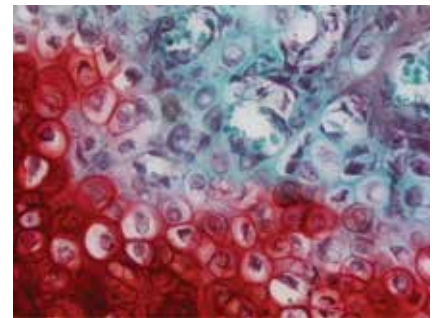
The Molecular and Cellular Biology Laboratory is directed by **Ralph Marcucio, PhD,** and **Ted Miclau, MD.**

The major focus of the work performed is to examine the processes that occur during bone regeneration after traumatic injury. Understanding the events that occur during fracture repair is essential for developing therapies to help people that exhibit difficulties in bone healing. For example, delayed or non-union afflict approximately 10% of all people undergoing fracture repair. By understanding how the body normally responds to orthopaedic trauma, they are laying the foundation for the development of new therapeutic regimens to treat a wide variety of skeletal pathologies.

The research utilizes a murine tibia fracture model that was developed by members of the laboratory and is used in other laboratories throughout the national and international orthopaedic

research community. Current areas of study include the role of muscle in bone healing, the role of inflammation in bone healing, the role of angiogenesis in bone healing, genotype-phenotype correlations during skeletal development, and the role of continuous phenotypic variation in disease production.

Image is from Skeletal Regeneration/Molecular and Cellular Biology.



Visualization of the chondro-osseous transition zone in a fracture callus. (A-C) Low magnification of a murine fracture callus, outlined with black dashed line, stained with (A) Safranin-O/Fast Green (SO/FG), (B) Modified Milligan's Trichrome (TC) or (C) Hall and Brunt Quadruple Stain (HBQ). (D-F) A magnified region of cartilage and bone from the fracture callus, outlined with a red box (A-C), with the TZ indicated by black brackets. (G-I) High magnification images of the TZ show the invading vasculature and the chondro-osseous junction. (Bahney Laboratory for Musculoskeletal Regeneration/Musculoskeletal Regeneration).

Musculoskeletal Regeneration

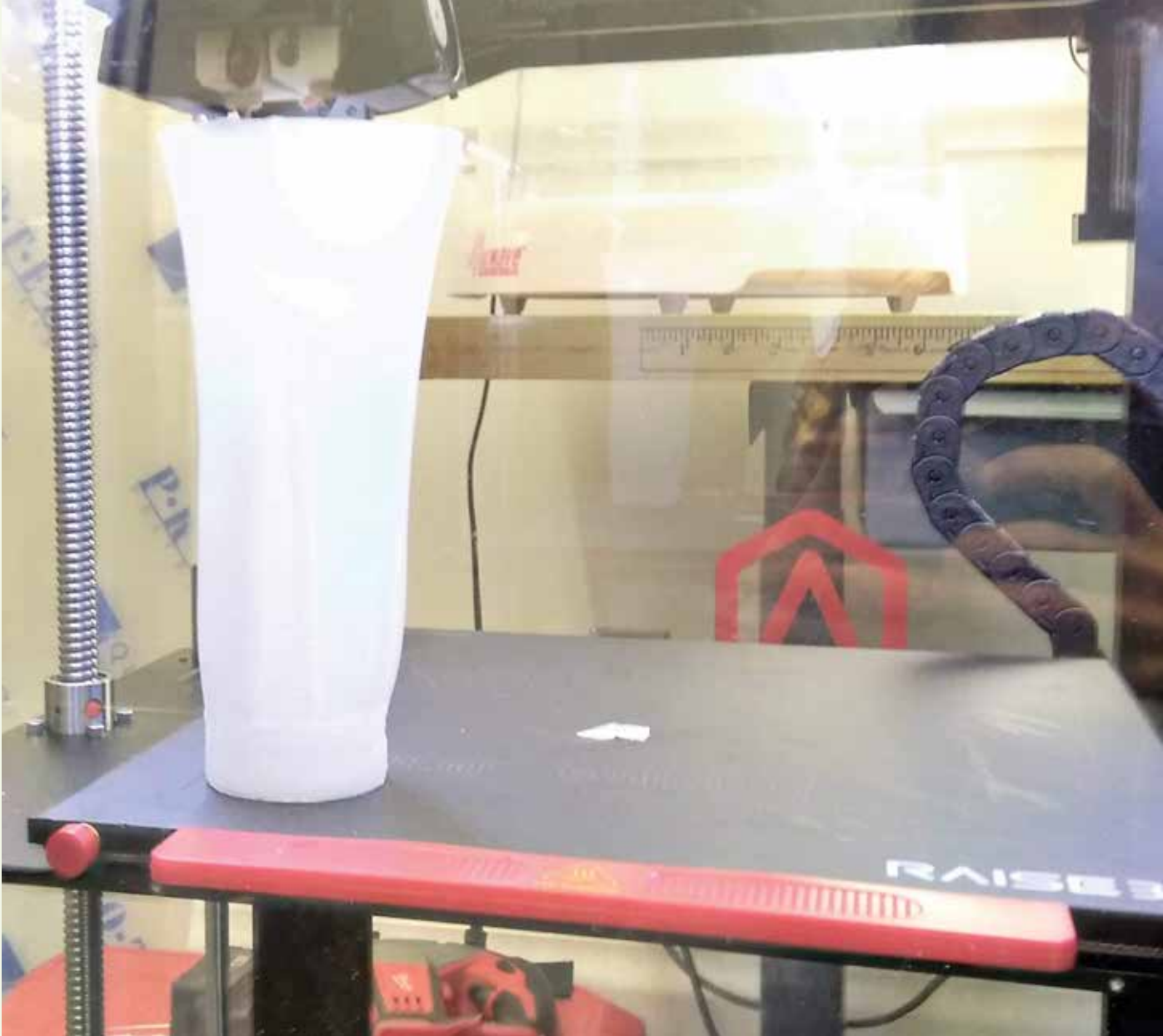
Zuckerberg San Francisco General Hospital (ZSFGH)

The Laboratory for Musculoskeletal Regeneration is directed by **Chelsea S. Bahney, PhD.**

The Bahney Laboratory utilizes a developmental engineering approach to discover novel therapeutic targets for regenerative medicine by first studying the normal mechanisms of repair, then utilizing engineered biomaterials to deliver bioactive signals to promote improved regenerative outcomes.

Currently, the focus of the Bahney Lab is primarily on the process of cartilage turning into bone, either naturally during fracture repair, or in disease processes such as osteoarthritis.

A long-term research goal is to translate new biologics that change healthcare options in fracture healing and post-traumatic osteoarthritis.



Testing facility, Safa Herfat PhD, Transtibial prosthetic socket being 3D printed for a patient at the OTI O&P clinic (OTI Biomedical Engineering Lab).

Orthopaedic Trauma Institute (OTI) Biomedical Engineering Lab

Zuckerberg San Francisco General Hospital (ZSFGH)

Directed by **Safa Herfat, PhD**, the OTI Biomedical Engineering Lab specializes in experimental biomechanical testing and finite element analysis of orthopaedic fracture fixation strategies and implants.

The lab also collaborates with the UCSF Orthotics & Prosthetics clinics on prosthetic innovation projects incorporating 3D scanning and printing to design and manufacture patient-specific prosthetic solutions. The lab houses its own 3D lab, with four 3D printers, a high accuracy white light 3D scanner, and a high-end design workstation. A Hearts Grant from the San Francisco General Hospital Foundation has also generously funded a large

3D printer capable of printing large lower limb sockets, as well as funding the development of a custom pressure sensor system to objectively monitor prosthesis fit in the clinic.

The lab is collaborating with other UCSF and UC Berkeley labs on an NSF grant-funded project to develop an implantable sensor to monitor fracture healing.

Laboratory for Evolutionary Anatomy

Zuckerberg San Francisco General Hospital (ZSFGH)

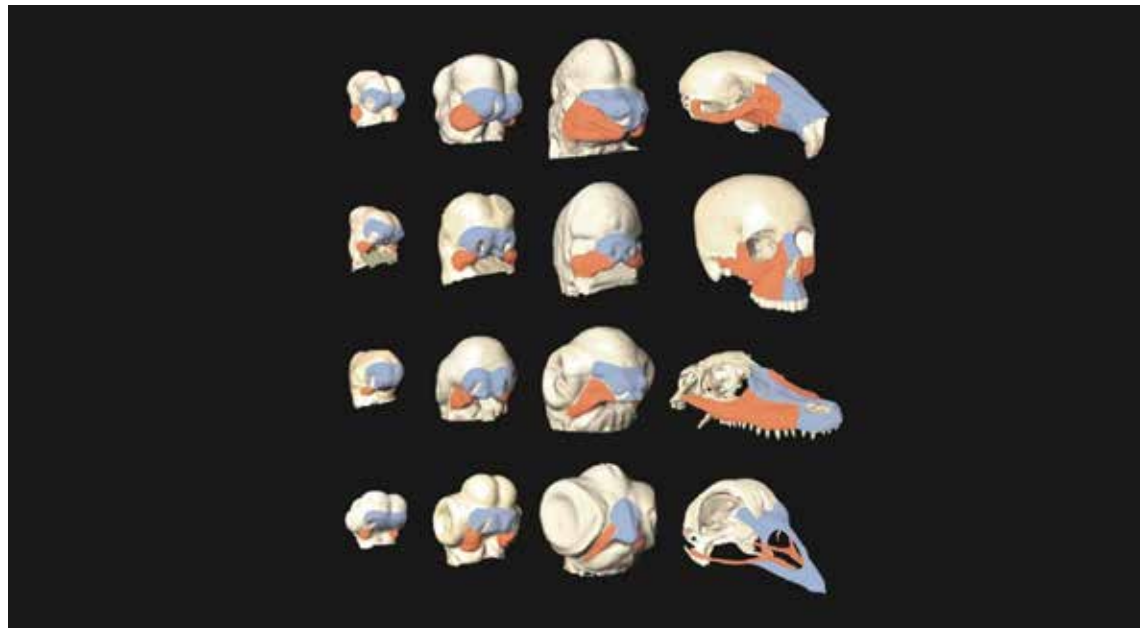
The Laboratory for Evolutionary Anatomy is directed by **Nathan Young, PhD.**

The Young Laboratory addresses basic biomedical research through the lens of evolution, utilizing functional compromise and historical constraint as fundamental explanatory principles. When combined with mechanistic insights from experimental systems, this approach yields significant insights into the generation of individual phenotypes, both normal and abnormal.

The lab research program combines classical embryology, modern experimental and genetic tools, and advanced methods for quantifying and comparing phenotypes at a range of scales.

This approach has significance for understanding not only the processes that contribute to and constrain evolutionary diversity but also the individual phenotypic differences found within species and among individuals, including dysmorphologies associated with human disease states. The research includes the study of normal mechanisms of development as well as the etiology of congenital developmental defects and is strongly relevant to longstanding goals of providing personalized and predictive medicine.

Comparison of facial development from embryos to adults in mouse, human, alligator, and chicken (Young Laboratory for Evolutionary Anatomy)



International Research at the Institute for Global Orthopaedics and Traumatology (IGOT)

Zuckerberg San Francisco General Hospital (ZSFGH)

The IGOT Global Research Initiative (GRI) seeks to improve research capacity in low- and middle-income countries through academic partnerships. Led by Saam Morshed, MD, MPH, PhD, and David Shearer, MD, MPH, the GRI is among the leading centers in the country actively conducting prospective research in the field of orthopaedic surgery in low-resource settings. Our principal partners include academic centers in Tanzania, Malawi, Uganda, Ghana, and Latin America.

IGOT global research sites include:

- Muhimbili Orthopaedic Institute in Tanzania
- Komfe Anoyo Teaching Hospital, Kumasi in Ghana
- Queen Elizabeth Central Hospital, Blantyre in Malawi
- Kumi Hospital in Uganda
- Multi-centers in Latin America

Current IGOT Research Projects:

Tanzania- Intramedullary Nailing Versus External Fixation for Open Tibia Fractures Randomized Controlled Trial [h2]

Open tibia fractures are among the most common and debilitating injuries faced in low-income countries due to high rates of infection and nonunion. This study aims to address the question of whether internal or external fixation is better as a definitive treatment for open tibia fractures in Tanzania. The study enrolled 240 randomized patients and achieved greater than a 90% one year follow up. The study is currently conducting final data analysis, and we anticipate publication in the near future.

Tanzania- Cost-effectiveness of Prosthetics for Above Knee Amputees

Many amputees in low-income countries do not receive prostheses due to high costs and the disinclination of most governments to fund prosthetic programs. As a result, amputees are limited to the use of crutches or a wheelchair. In collaboration with Legworks, a local prosthetics company (www.Legworks.com), IGOT is conducting a prospective study that assesses the costs and benefits of prostheses for above-the-knee amputees. We believe this data will create a compelling case advocating for better access to prosthetics in low-resource settings like Tanzania.

Tanzania - Low-cost Intramedullary K-wires for Pediatric Femur Fractures

Femoral shaft fractures in children are commonly treated with surgery using flexible nails to avoid damage to growth plates. However, flexible titanium nails that are commonly used in

high-income countries are cost-prohibitive for many families in low-income countries where governments do not subsidize implant costs. Substituting flexible titanium nails with stainless steel "Kirschner wires" could reduce the cost of these implants nearly 40-fold, thereby markedly increasing access to surgery for children globally. IGOT is supporting a randomized controlled trial in Tanzania comparing these low-cost implants to the high-cost titanium nails for children with femoral shaft fractures.

Tanzania - Gentamicin Open Tibia- Randomized Control Trial of Local Antibiotics vs. Control

Tibial shaft fractures are the most common long-bone fracture. Deep infection remains a common, devastating complication of open injuries leading to lifelong impairment that disproportionately affects low- and middle-income countries (LMICs). Surgical debridement, followed by fracture stabilization using internal or external fixation, is the mainstay of treatment. One proposed adjunctive measure is prophylactic local antibiotic delivery, which can achieve much higher antibiotic concentrations at the surgical site than can be achieved safely with systemic administration. There is a growing body of literature evaluating local antibiotic administration in both aqueous and powder form at the time of wound closure. While demonstrating potentially promising results, these studies are heterogeneous, of poor general methodologic quality, and none originate from LMICs where this technique would have the greatest potential benefits. Local gentamicin is particularly promising given the broad spectrum of activity against common pathogens in osteomyelitis (staphylococcus, gram-negative rods). It is also widely available and low cost (<1\$ per 80mg vial). IGOT proposed a prospective; a blinded, randomized controlled trial enrolling adult open tibial shaft fractures at the Muhimbili Orthopaedic Institute (MOI) in Dar es Salaam, Tanzania. At the time of initial debridement, participants will be randomly assigned to receive aqueous gentamicin after closure or placebo saline injection. The primary outcome will be a deep surgical site infection at one year. Secondary outcomes include health-related quality-of-life (HRQOL), modified Radiographic Union Scale for Tibial Fractures (mRUST), FIX-IT score for clinical healing, and cost of treatment using time-driven activity-based costing (TDABC) and survey methods.

Tanzania – Total Joint Replacement Registry

Our partners at Muhimbili Orthopaedic Institute in Tanzania created an excel sheet registry ten years ago with 900+ patients. This project will use this excel sheet to create and implement a formal registry prospectively using REDCap for total joint replacement procedures.

Ghana – Predictors of Quality of Life and Economic Impact after Open Tibia Fractures

This study is led by our resident PGY4, Heather Roberts, under the mentorship from Drs. Saam Morshed and Dave Shearer.

This is a prospective study of open tibia fracture management in Kumasi, Ghana. The purpose of this study is to examine the influence socioeconomic status has on the type(s) of treatment available for open tibia fractures and in turn, the influence these type(s) of treatment have on the clinical and economic impacts after open tibia fractures. The results of this study will impact policies that support investment in surgical care and inform evidence-based protocols in low-resourced settings where the burden of orthopedic trauma is highest.

Malawi- Intramedullary Nailing Versus Skeletal Traction for Femoral Shaft Fractures

IGOT is working in collaboration with investigators at Beit CURE Hospital in Blantyre, Malawi, to conduct a prospective multicenter study comparing the quality of life and cost-effectiveness of surgery versus skeletal traction for adult femoral shaft fractures. The study has enrolled more than 200 patients and achieved a follow-up rate at one year of nearly 90%, which is unprecedented. The study is anticipated to complete final follow up in the Summer of 2019. This will be the largest and most rigorous study comparing surgical and non-operative treatment for femoral shaft fractures ever conducted.

Uganda- Post Injection Risk and Gluteal Fibrosis Study

Coleen Sabatini, MD, MPH, leader of IGOT's pediatric outreach efforts, has developed a robust partnership in Uganda, exploring the surgical outcomes of children treated for gluteal fibrosis, along with a qualitative study on injection practices. The qualitative study on injection practices currently has 60 interviews completed and submitted an article to be published. A third study is also being conducted regarding the treatment of intra-articular and extra-articular distal femoral fractures using SIGN nail at Kumi Orthopaedic Center. This study has completed data collection and analysis and found 48% f/u at 16 weeks.

Latin America - ACTUAR Open Tibia Study

Theodore Miclau, MD, Vice Chair and Director of Orthopaedic Trauma at UCSF, fostered our international partnerships in Latin America. There is a need for global North American-South American relationships that allow South American colleagues to access resources available in North American centers, which include expertise, organization, and infrastructure to address research questions relevant to the South American countries. To this end, the Asociación de Cirujanos Traumatológicos en las Americas (ACTUAR) was developed. ACTUAR, led by organizing faculty from UCSF/IGOT, is the product of a group of orthopaedic surgeons interested in international collaborative initiatives focused on building research capacity across institutions throughout Latin America. The consortium is currently in the process of planning a prospective multicenter study to examine the state of care and predictors of quality of life after open tibial shaft fractures in Latin America.



Institute for Global Orthopaedics & Traumatology (IGOT) Global Research Initiative team with IGOT's Tanzania research partner, Dr. Billy Haonga.)

2019 Research Programs and Activities

Latin American Research Consortium- Asociación de Cirujanos Traumatológicos de las Americas (ACTUAR)

ACTUAR held its 3rd Annual Research Symposium on November 1-2 in Hermosillo, Mexico, at the Federación Mexicana de Colegios de Ortopedia y Traumatología conference. ACTUAR is the product of a group of orthopaedic surgeons interested in a collaborative initiative focused on building research capacity across institutions. Professor, Vice-Chair and Director of Orthopaedic Trauma at UCSF, Theodore Miclau, MD., represented ACTUAR, IGOT, and OTI.

San Francisco SMART Course Research Symposium

IGOT's flagship course, the San Francisco SMART Course, concluded with a half-day clinical research symposium attended by 28-course participants. Attendees discussed relevant research methods that can be applied to patient populations in their local communities.

International Research Partners

IGOT's research partner in Malawi, Linda Chokoto, received the 2019 Orthopaedic Trauma Association (OTA) Humanitarian Award and IGOT's Tanzanian Research Partner, Billy Haonga, MD, received the 2018 Orthopaedic Trauma Association (OTA) Humanitarian Award. Dr. Haonga also presented his recently published paper, 'Intramedullary Nailing Vs. External Fixation in the Treatment of Open Tibia Fractures in Tanzania'.



The Orthopaedic Trauma Institute Clinical Research Center

Zuckerberg San Francisco General Hospital (ZSFGH)

The Clinical Research Center (CRC), led by **Saam Morshed, MD, MPH, PhD**, is dedicated to designing and implementing clinical studies to answer the most important questions in the care of patients with musculoskeletal injuries. In collaboration with industry and other major trauma medical centers, the CRC develops innovative clinical trials to evaluate the latest technologies and innovative treatment approaches in orthopaedic trauma. In particular, they are interested in the treatment and management of lower extremity fractures, surgical site infections, and lower limb amputations.

Dedicated to conducting safe and impactful research, our professionally trained clinical research team includes specialists in clinical research methodology, grant administration, data management, and quality control. The CRC also provides training in clinical research for post-doctoral fellows, graduate students, orthopaedic residents, medical, and undergraduate students.

For more information about our research Internship opportunities, please contact the clinical research manager Tigist Belaye, MPA, CCRP (tigist.belaye@ucsf.edu).

A list of our current projects include:

Transtibial Amputation Outcomes Study (TAOS): Comparing Transtibial Amputation with and without a Tibia-fibula Synostosis (Ertl) Procedure

Site Co-Investigators: Theodore Miclau, MD, and Saam Morshed MD, MPH, PhD.

A multi-center randomized clinical trial comparing the functional outcomes of patients undergoing tibia-fibula synostosis (Ertl procedure) versus a standard posterior flap procedure (Burgess procedure). The primary outcome is to assess the fit and alignment of the prosthesis with the level of comfort and satisfaction of each treatment. We will also examine the rate of re-hospitalizations for complications, resource utilization, and overall treatment cost.

Sponsor: Department of Defense Congressionally Directed Medical Research Program (DoD CDMRP).

Prosthetic Fit Assessment in Transtibial Amputees Secondary to Trauma (ProFit)

Principal Investigator: Saam Morshed, MD, MPH, PhD.

The PROFIT trial's objectives are to investigate prosthesis fit, alignment, and conditions of the residual limb in patients currently enrolled in the Transtibial Amputation Outcome Study (TAOS). The goal of this study is to validate and refine the prosthetic assessment tool (ProFit) that was developed by an expert panel of certified prosthetist orthotists (CPOs), orthopaedic trauma investigators, a measurement scientist and a biomedical engineer from the BADER consortium.

Sponsor: Department of the Army – U.S. Army Medical Research Acquisition Activity (USAMRAA)

A Prospective Randomized Trial to Assess PO versus IV Antibiotics for the Treatment of Post-op Wound Infection after Extremity Fractures (POvIV)

Site Co-Investigators: Theodore Miclau, MD, and Saam Morshed MD, MPH, PhD.

A multi-center clinical trial comparing the efficacy of oral antibiotics (PO) versus intravenous (IV) antibiotics in patients that develop a deep post-operative infection after fracture fixation. The differences in rates of re-hospitalization, infection, non-union, and amputation will be assessed. This will also determine the rates of compliance and medical costs associated with each treatment.

Sponsor: Department of Defense Peer Reviewed Orthopaedic Research Program (DoD PRORP)

A Pragmatic Randomized Trial Evaluating Preoperative Aqueous Antiseptic Skin Solutions in Open Fractures (A-PREP)

Site Co-Investigators: Saam Morshed MD, MPH, PhD, and Theodore Miclau, MD.

A-PREP is a multi-center clinical trial comparing the effectiveness of aqueous pre-operative antiseptic skin preparation with 10% povidone-iodine versus 4% chlorhexidine gluconate (CHG) for management of open fractures. Effectiveness will be evaluated by the occurrence of surgical site infection and unplanned fracture-related reoperations.

Funders: US Department of Defense (DoD), Physician Services Incorporated, and McMaster University Surgical Associates

PREPARE: A Pragmatic Randomized Trial Evaluating Pre-operative Alcohol Skin Solutions in Fractured Extremities

Site Co-Investigators: Meir Marmor, MD, and Saam Morshed MD, MPH, PhD.

The overarching objective of this multicenter trial is to compare the effectiveness of iodine povacrylex (0.7% free iodine) in 74% isopropyl alcohol versus 2% chlorhexidine gluconate (CHG) in 70% isopropyl alcohol for the management of extremity fractures that require surgical treatment. The primary outcome for comparison is surgical site infection (SSI), and the secondary outcome is unplanned fracture-related reoperation.

This study is funded by the Patient-Centered Outcomes Research Institute (PCORI).

The Pediatric Orthopaedic Surgery team, back row (left to right), Sanjeev Sabharwal, MD, MPH, Coleen S Sabatini, MD, MPH, Mohammad Diab, MD, and Jason E Jagodzinski, MD; front row: Nirav K Pandya, MD, Kristin S Livingston, MD, and Ravinder K Brar, MD, MPH. Not pictured: Eliana Delgado, MD, Celina De Borja, MD, and Ishaan Swarup, MD.



Pediatric Orthopaedic Surgery, Clinical Research

UCSF Benioff Children's Hospital, Oakland and UCSF Benioff Children's Hospital, San Francisco

As a team, we strive to provide comprehensive care for all musculoskeletal conditions in children and young adults, to lead in medical education, and to advance our field through fundamental and enduring research.

- A Video-Based Intervention to Improve Pediatric Orthopaedic Education and Informed Consent in Children with Operative Supracondylar Humerus Fractures. Dr. Sabatini, Dr. Brar, Dr. Jagodzinski, and Dr. Sabharwal
- Cerebral Palsy: Risk Factors for Readmission After Surgery. Dr. Brar and Dr. Diab
- Cerebral Palsy: Distribution of Operative Treatment in Children versus Adults. Dr. Brar and Dr. Diab
- Surgeon Satisfaction and Burnout Among UCSF Orthopaedic Faculty. Dr. Livingston, Dr. Diab, and Dr. Gornitzky
- Is Elbow Immobilization Necessary for Pediatric Traumatic Elbow Effusions Without Fracture Line? Randomized Controlled Trial of Cast vs No Cast in X-ray and X-ray Tomography Negative Injuries. Dr. Livingston, Dr. Diab, and Dr. Roddy
- Multi-Center Adolescent Clavicle Shaft Fracture Registry**Dr. Sabatini and Dr. Pandya
- Impact of Early Recovery After Surgery program on children recovering from surgery for idiopathic scoliosis. Dr. Shibata (Department of Anaesthesia), Dr. Cheng, and Dr. Diab
- Patient Attitudes Regarding Simultaneous Cervical Spine Surgery. Dr. Theologis and Dr. Diab
- Improving Coping Skills in Children After Spine Surgery. Dr. Gornitzky and Dr. Diab
- Anterior Approach to Thoracic Spine: Novel Incision and Patient Satisfaction. Dr. Diab
- Cost Analysis of Anterior Approach to Spine versus Posterior Approach to Spine. Dr. Diab
- X-ray Tomography: Cadaver Elbow Fractures Study. Dr. Livingston
- Outcomes of Anterior Shoulder Stabilization in Children and Adolescents**Dr. Pandya
- The Impact of Patient Education in the Pre-Operative Holding Area on Post-Operative Opioid Use in Elective Pediatric Orthopaedic Surgery**Dr. Pandya
- Epidemiology of Pediatric and Adolescent Sports Participation**Dr. Pandya
- Comparison of Hamstring versus Bone Tendon Bone Autograft in ACL Reconstruction Patients**Dr. Pandya
- Risk of Growth Disturbance and Re-Tear Rates After Partial Transphyseal ACL Reconstruction**Dr. Pandya
- Impact of Insurance Status on Access to Care for Pediatric Meniscal Injuries**Dr. Pandya
- Impact of Insurance Status on Outcomes After Pediatric Shoulder Stabilization Surgery**Dr. Pandya

The clinical research carried out by the Pediatric Orthopaedics team spans a diverse range of topics including trauma, scoliosis, sports medicine, limb deformity, hip preservation, neuromuscular conditions, health disparities, and global orthopaedics.

- Impact of Post-Operative Bracing on ACL Kinematics after Skeletally Immature ACL Reconstruction**Dr. Pandya
- Outcomes of Arthroscopic Treatment of Elbow Osteochondral Lesions in Adolescent Athletes**Dr. Pandya
- Outcomes of Remplissage for Adolescent Shoulder Instability Patients**Dr. Pandya
- Impact of Social Media on Patient Perception of Physician Performance**Dr. Pandya
- Non-Invasive Monitoring of Return to Play After ACL Surgery: Kinect**Dr. Feeley and Dr. Pandya
- Return to Play After Patellar Dislocation in the Adolescent Athlete**Dr. Feeley and Dr. Pandya
- Demographic Differences in Time to Presentation for Treatment of Idiopathic Clubfoot. Dr. Sabatini
- Outcomes Following Surgical Release of Gluteal Fibrosis in Ugandan Children. Dr. Sabatini
- Do certain antimalarials and antibiotics have a direct fibrotic effect on muscle cells, contributing to the development of muscle contractures in children? Dr. Sabatini, Dr. Feeley, and Dr. Liu
- A Video-Based Intervention to Improve Pediatric Orthopaedic Education and Informed Consent in Children with Clubfoot. Dr. Sabatini
- Treatment of intra-articular and extra-articular distal femoral fractures using the SIGN nail at Kumi Orthopaedic Center. Dr. Sabatini and Dr. Curran
- Supracondylar Humerus Fractures in Resource-Limited Environments Literature Review. Dr. Sabatini
- Access to Orthopaedic Care for Spanish Speaking Patients in California. Dr. Sabatini
- Access to Follow up Care for Traumatic Orthopaedic Injuries for Rural Children in Northern California. Dr. Sabatini
- Access to Pediatric Orthopaedic Care for Children with Operative Supracondylar Humerus Fractures in Northern California. Dr. Sabatini
- Motivations and impact of international rotations for orthopaedic residents: Is there concordance in perceptions amongst stakeholders at academic centers in North America and their partners in Low and Middle-income countries? Dr. Sabharwal
- Improved Orthopaedic Pre-surgical Planning Using 3D Augmented Reality Models. Dr. Livingston, Dr. Diab, Dr. Jagodzinski, Dr. Brar, Dr. Sabatini, and Dr. Pandya, and Dr. Courtier (Department of Radiology and Biomedical Imaging)

To learn more, visit the Pediatric Clinical Research website:
<https://orthosurgery.ucsf.edu/research/clinical-research/Pediatric-Clinical-Research.html>

Orthopaedic Clinical Research

Sports Medicine Clinical Trials

UCSF Sports Medicine is currently performing several prospective clinical trials focusing on arthritis, rotator cuff tears, and cartilage injuries. Current studies include:

A Phase 2, 52 Week, Single Center, Open-Label Study Utilizing Imaging Techniques and Evaluating the Safety and Efficacy of SM04690 Injectable Suspension for the Treatment of Moderately to Severely Symptomatic Knee Osteoarthritis

Site Co-Investigators: C. Benjamin Ma, MD and Drew Lansdown, MD

This study investigates the safety and efficacy of SM04690, an injectable small-molecule inhibitor of the Wnt pathway, in driving progenitor cells resident in the joint to become chondrocytes and potentially enhance cartilage formation. Following a single injection, patients with moderate to severe knee osteoarthritis are evaluated over 52 weeks using advanced MRI techniques to measure changes in cartilage volume, thickness, and quality.

Sponsor: Samumed LLC.

Operative vs. Non-Operative Treatment for Atraumatic Rotator Cuff Tears: A Multicenter Randomized Controlled Pragmatic Trial

Site Co-Investigators: C. Benjamin Ma, MD, Brian Feeley, MD, Christina Allen, MD, Alan Zhang, MD, Drew Lansdown, MD, Anthony Luke, MD, and Carlin Senter, MD

The Arthroscopic Rotator Cuff (ARC) Trial is a large, multicenter, randomized clinical trial comparing operative and non-operative treatment for rotator cuff tears that develop over time. This study aims to find out which treatment works better and for whom, in order to help patients in the future select the best treatment for them.

Funding: Patient-Centered Outcomes Research Institute (PCORI)

Prospective, Randomized, Double-Blind, Placebo Controlled Study to Evaluate the Safety and Efficacy of Pulsed Electromagnetic Field (PEMF) Therapy as an Adjunctive Treatment to Surgical Repair of Full Thickness Rotator Cuff Tears

Site Investigator: Brian Feeley, MD

Using a non-invasive therapeutic device, this study aims to evaluate the safety and efficacy of applying pulsed electromagnetic fields (PEMF) to rotator cuff repairs. It hopes to demonstrate that exposure to PEMF therapy following surgical repair will reduce tendon re-tear rates, improve clinical outcomes and range of motion, and decrease fatty infiltration.

Sponsor: Orthofix Medical Inc.

Evaluation of Muscle Stem Cells in Rotator Cuff and Other Muscle Injury Models

Principal Investigator: Brian Feeley, MD and Xuhui Liu, MD

Our previous data has highlighted the presence of fibro-adipocyte precursor (FAP) cells within muscle in mice, their ability to proliferate after injury, and their capability to regulate muscle quality with pharmacologic modulation. However, their presence and capabilities in human musculoskeletal conditions are not known. This study aims to evaluate the cellular plasticity, differentiation capability, and functional role of human fibro-adipocyte precursor cells (hFAPs) harvested from patients with musculoskeletal injuries.

Funding: NIH, REAC Grant

Effect of Ibuprofen on Postoperative Opiate Medication Use and Shoulder Functional Outcomes After Arthroscopic Rotator Cuff Repair

Principal Investigators: Jennifer Tangtiphaiboonatana, MD and C. Benjamin Ma, MD

This randomized controlled trial seeks to determine if postoperative ibuprofen after arthroscopic rotator cuff repair impacts postoperative opiate medication use, pain, range of motion, and repair integrity.

Funding: OREF

Prospective Post Market Clinical Follow-Up Study of the Zimmer® Trabecular Metal™ Reverse Shoulder System

Site Co-Investigators: C. Benjamin Ma, MD and Brian Feeley, MD

To assess the long-term performance of the Trabecular Metal Reverse Shoulder System, patients undergoing primary or revision reverse shoulder arthroplasty are evaluated annually over a span of 10 years.

Sponsor: Zimmer Biomet Inc.

Advancing the Multimodal Pathway: Investigating the Use of Sleep and Zolpidem in the Recovery After Shoulder Arthroplasty

Principal Investigators: Jonathan Cheah, MD and Alan Zhang, MD

Recent evidence has shown that non-pharmacological sleep interventions and pharmacological agents can both improve fatigue, recovery, pain control, and patient satisfaction. To investigate the efficacy of sleep medicine in the recovery of patients undergoing shoulder arthroplasty, this study randomizes patients to either a control cohort of sleep aid use on a patient requested basis or to an interventional cohort with evening inpatient zolpidem administration and non-pharmacological interventions.

Funding: James O. Johnston Grant

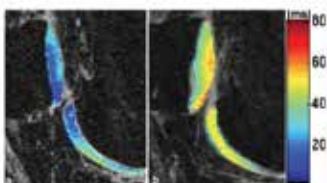


Image is from the Sports Medicine Clinical Trials in Knee and Shoulder Surgery group.

Orthopaedic Clinical Research

Sports Medicine Patient Centered Clinical Outcomes Research

In order to provide exceptional patient-centered treatments, an active collection of patient-reported outcome measurements is paramount. To fulfill this mission, the UCSF Orthopaedic's Sports Medicine Group currently participates in multiple prospective clinical outcome registries.

Locally, C. Benjamin Ma, MD, has enrolled over 1,300 patients in a prospective shoulder arthroplasty database that has successfully published over 20 abstracts and scientific papers. With this database, the team has been able to establish important factors that contribute to the outcomes of shoulder replacement, including a novel technique to decrease the rate of re-infections after shoulder replacements, and techniques to decrease pain. Other studies include the evaluation of socioeconomic status, return to sport, and other factors that influence outcomes in shoulder replacement surgery.



C. Benjamin Ma, MD, treats a patient in the Sports Medicine clinic.

Additionally, Alan Zhang, MD, is actively collecting outcomes measurements on patients undergoing hip arthroscopy surgery. Over 600 patients have been enrolled in this on-going study, yielding multiple research publications.

UCSF is an active member of the Multicenter Orthopaedic Outcome Network (MOON) shoulder group. Along with 12 other institutions from across the United States, MOON actively follows patients undergoing surgery for shoulder instability and rotator cuff repairs. They have collected information on over 1400 patients with shoulder instability, which is the largest cohort reported. Active clinical trials with affiliate groups are further detailed in the clinical trial section.

Dr. C. Benjamin Ma has enrolled over 1,000 patients in a prospective shoulder arthroplasty research study. This study has successfully published over 20 abstracts and scientific papers. Additionally, Alan Zhang, MD, is actively collecting outcomes measurements on patients undergoing hip arthroscopy surgery. Over 400 patients have been enrolled in this ongoing study, yielding multiple research publications.

Digital Health

UCSF Digital Orthopaedics

Digital Health is led by **Stefano Bini, MD**. Digital Health research focuses on using commercial grade sensors to predict patient outcomes following surgery.

Value-based care is a powerful concept that is fundamentally changing the way health care is being delivered in the United States and elsewhere. Arthroplasty as a specialty is front and center in this movement. The advent of vast quantities of Patient Generated Health Data (PGHD) created by commercial grade wearable sensors has raised the question as to whether these devices may provide objective data through which to quantify and compare clinical outcomes in surgical patients. However, many questions remain to be answered relative to these sensor generated data sets such as what data points are predictive of what outcomes, how many data points are needed for accuracy, and over what time frame data needs to be collected. They use PROMs as ground truth for outcomes as these measures are currently considered the gold standard surrogate for clinical quality.

With funding through CDHI **Stefano Bini, MD** coupled the power of Artificial Intelligence (AI) with the data collection capabilities of wearable sensors to test the hypothesis that machine learning can be used to predict clinical outcomes following TKA based on PGHD in the early post-operative period. 22 patients undergoing total knee replacement were prospectively enrolled and tracked

Patient from the research study after knee replacement surgery, wearing sensors on his right wrist from Digital Health.



for 6 weeks after surgery and generated over three million data points. With the aid of AI, he and a team of residents including **Jeff Barry MD**, now faculty, **Ilya Bendich MD**, **Kevin Hwang MD**, **Joseph Patterson MD**, and **Jeffrey Mulvihill MD**, showed that, amongst other things, 42 day PROMs can be predicted with reasonable accuracy using data collected as early as 11 days following surgery. The first paper accepted for publication (Arthroplasty Today) from this research was authored by **Ilya Bendich, MD**.

Having concluded this longitudinal study, **Stefano Bini, MD** was awarded a second grant from CDHI to use similar technology to test post-operative patients at fixed time points to identify a data set that can accurately measure a patient's recovery at a specific moment in time rather than using longitudinally collected data. Novel to this project was the use of commercially available running shoes with embedded sensors. The research is being conducted at the UCSF Human Performance center and shows the potential for interaction between different labs within the department.

Multicenter Trials on Hip and Knee Surgery

UCSF's Arthroplasty group, within the Department of Orthopaedic Surgery, participates in and designs research studies that are on the cutting edge of digital health and technology. Surgeon and Professor, **Stefano Bini, MD** has spearheaded this effort within Arthroplasty with various research projects involving artificial intelligence, mobile applications, and wearable activity trackers.

Led by Surgeons, **Thomas P. Vail, MD**, Professor and Chairman of the Department of Orthopaedic Surgery at UCSF and **Erik Hansen, MD**, surgeon and Professor, the Arthroplasty group also participates in multicenter trials with academic institutions and industries across the country. These trials align with the Department's goals of advancing the knowledge and understanding of topics that influence the effectiveness of orthopaedic surgery practices and improve patient outcomes. A core focus of this research is detecting, preventing and treating periprosthetic joint infections.

Current projects include:

Perioperative Antibiotic Prophylaxis in Patients Undergoing Elective Total Knee Arthroplasty: A prospective, randomized, open-label, controlled multi-center trial

Site Co-Investigators: **Thomas P. Vail, MD**, **Erik Hansen, MD**, **Stefano Bini, MD**, **Derek Ward, MD**, and **Thomas Barber, MD**

Despite advances in surgical care and implant technology, Periprosthetic Joint Infections (PJI) and Surgical Site Infection (SSI) after Total Knee Arthroplasty (TKA) represents a catastrophic complication. Administration of prophylactic antibiotics before surgery is a well-established strategy to prevent PJI and SSI. However, controversy exists regarding the choice of the antibiotic, duration of prophylaxis, optimal timing, and mode of delivery of routine antibiotic prophylaxis. Level I data with regard to prophylactic antibiotics in elective TKA is limited and identifying the correct antibiotic prophylaxis protocol can have profound and wide-reaching impact. The purpose of this study is to identify the comparative effectiveness of various perioperative strategies for antibiotic delivery as prophylaxis for PJI and SSI in elective primary TKA.

Sponsor: Duke University

The Utility of Next-Generation Sequencing for the Diagnosis of Periprosthetic Joint Infection

Site Co-Investigators: **Erik Hansen, MD**, **Stefano Bini, MD**, **Derek Ward, MD**, and **Thomas Barber, MD**

The diagnosis PJI continues to be a source of great concern for orthopaedic surgeons, and the relatively high rate of negative cultures serves to highlight the magnitude of this issue. Next-Generation Sequencing (NGS) is a well-established technique for amplification and sequencing of DNA material and has recently gained much attention in other fields of medicine. The aim of this study is to evaluate the ability of NGS in identifying the causative organism(s) in patients with PJI.

Sponsor: Thomas Jefferson University



External Validation of a Prognostic Calculator for the Surgical Treatment of Periprosthetic Joint Infection

Site Investigator: **Erik Hansen, MD**

This study investigates the use of a prognostic calculator for prosthetic joint infection that is individually tailored to the patient based on their present comorbidities, type of surgical procedure, cultured organism profile, laboratory markers, among other factors. The calculator is based on 1,438 PJIs from two institutions. By identifying the factors that influence the treatment of PJI, the physician would be able to individually assess and optimize the general medical condition of the patient. A mobile application with this risk calculator has been produced and the aim of this study is to externally validate the calculator at multiple centers around the country.

Sponsor: Indiana University

One Stage versus Two Stage for Periprosthetic Hip and Knee Infection

Site Co-Investigators: **Erik Hansen, MD**, **Stefano Bini, MD**, **Derek Ward, MD**, **Thomas Barber, MD**, and **Jeff Barry, MD**

The purpose of this clinical trial is to investigate the outcome of one-stage and two-stage exchange arthroplasty for the management of patients with chronic PJI. The hypothesis of this non-inferiority study is that one-stage exchange arthroplasty, if performed in the appropriate patient population, carries a similar success rate for the treatment of chronic PJI as two-stage exchange arthroplasty and avoids many of the problems associated with two-stage exchange arthroplasty.

Sponsor: OrthoCarolina Research Institute

The OMEGA-SPM-DOSE: Specialized Pro-Resolving Mediators in Patients with Peripheral Artery Disease

Site Co-Investigators: **Erik Hansen, MD** and **Michael Conte, MD**

High dose n-3 Polyunsaturated Fatty Acids (PUFAs) have been shown to play a role in the resolution of inflammation via the downstream production of Specialized Pro-resolving lipid Mediators (SPM). The OMEGA-SPM-DOSE trials, Phase 1a and Bridging phase are two parts of a two part phase study which aims to investigate the effect of a novel formulation of a nutritional supplement containing highly concentrated n-3 PUFA metabolites (SPM Supplement: a concentrated Solutech prep with the monohydroxylated precursors; Metagenics) on the metabolite-lipidomic profile of healthy volunteers and patients with PAD and OA.

Sponsor: Metagenics, Inc.

How to Improve the Results of Irrigation and Debridement for PJI through the use of Intraosseous Antibiotics

Site Co-Investigators: **Jeff Barry, MD**, **Erik Hansen, MD**, and **Derek Ward, MD**

In order to improve upon the modest results seen in irrigation and debridement for periprosthetic infection and limit the number of surgical procedures performed, they look at whether the use of intraosseous regional administration of antibiotics at the time of irrigation and debridement would further improve the results of irrigation debridement for prosthetic joint infection

Sponsor: OrthoCarolina Research Institute

Orthopaedic Clinical Research

Youth Sports Injury Assessment and Prevention

The UCSF Sports Medicine Center for Young Athletes is a comprehensive, integrated clinical and research program which brings together orthopedic surgeons, physical therapists, athletic trainers, primary care physicians, and kinesiologists to provide cutting edge care for athletes under the age of 18.

Led by Nirav Pandya, MD, and Anthony Luke, MD, MPH, the center has successfully published and presented nearly 30 abstracts and scientific papers. They are also one of the few centers in the country participating in a prospective multicenter adolescent clavicle fracture registry as well as an adolescent shoulder instability registry.

Anthony Luke, MD, MPH treats a patient in the Sports Medicine clinic.



Motion analysis technology

Using a mobile depth camera, the group is utilizing motion analysis technology to study normal and abnormal movement patterns. This innovative work is designed to assess for lower extremity injury risks, return to play after knee injuries, and prevention of ACL tears. The study is a collaborative effort that is funded by the National Institute of Health (NIH).

There has been a tremendous rise in athletic injuries in the skeletally immature population. This can be tied to the rise of sport specialization in this age group. The risks of sport specialization have only recently become known. Furthermore, with this rise in sports specialization, an increasing number of adult-type injuries are seen in younger patients. Nevertheless, there are factors which differentiate the treatment of these injuries from their adult counterparts. Nirav Pandya, MD, and Brian Feeley, MD, have worked together, combining the expertise of the adult and pediatric sports medicine services, to publish multiple studies in this topic area.

Research topics covered include studies on patella instability, shoulder dislocations, anterior cruciate ligament reconstructive techniques, and revision surgery in the immature population.

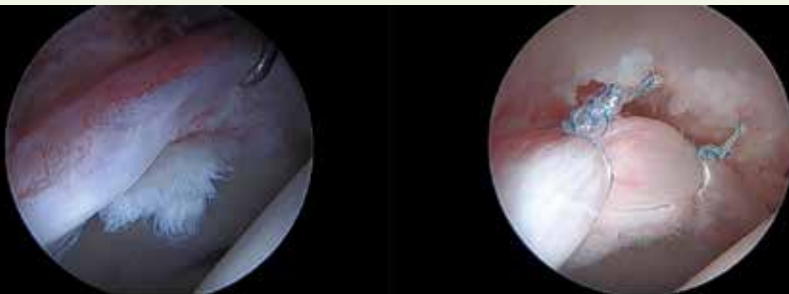
Orthopaedic Clinical Research

UCSF Hip Preservation Center

As Director of the UCSF Hip Preservation center, **Alan Zhang, MD** leads clinical and translation research on hip injuries in active individuals.

Dr. Alan Zhang has prospectively collected clinical outcomes measurements on over 600 patients who have undergone hip arthroscopy at UCSF and has published numerous articles to improve patient-centered care in this arena.

In collaboration with Sharmila Majumdar, PhD, Richard Souza, PhD, PT, and Thomas Link, MD, PhD, the hip preservation center is also conducting ongoing research on whether early hip arthroscopy treatment for labral tears and femoroacetabular impingement can decrease the risk of future arthritis in the hip.



A large tear of the hip Labrum (left) is repaired with Darthroscopic surgery (right), Hip Preservation Center.



Shane Burch, MD (Orthopaedic Clinical Research at the Spine Center).

Orthopaedic Clinical Research at the Spine Center

UCSF Parnassus Heights

Research at the Spine Center, is directed by **Shane Burch, MD** and **Sigurd Berven, MD**.

The Spine Center's mission is to improve nonoperative management, surgical decision-making, and clinical outcomes for patients with chronic and debilitating neck, back, arm, and leg pain in the setting of degenerative disc disease, spondylolisthesis, scoliosis, and kyphosis. Through an unprecedented number of clinical, biomechanical, and economic investigations, the UCSF Spine Center is considered an international think tank for spine research.

Researchers at the Spine Center are working on numerous clinical investigations to defining the safety and efficacy of minimally invasive (i.e., lateral and oblique interbody fusions) and complex (i.e., osteotomies) operations for adults with degenerative cervical and lumbar pathologies, including spinal deformity. Integral to these endeavors is assessing new biomechanical surgical techniques as well as clinical outcomes and complications through comprehensive internal and external national databases. With these tools, they continue to develop robust predictive models for patients with degenerative disorders of the cervical and lumbar spine.

Collaborations are vital to our group's goals of improving the safety of spinal operations. To this end, we have active ongoing collaborations with neurophysiologists involving both human and animal trials that are focused on refining current, as well as creating new neuromonitoring techniques that detect real-time changes in neural functioning during surgery. We also have productive collaborations with the Departments of Mechanical Engineering and Bioengineering at UC Berkeley that focus on structure-function relationships of bone tissue with an emphasis on aging, osteoporosis, frailty, and clinical translational research.

The Spine Center is also conducting pioneering research on quality, cost-effective care in spine surgery. Projects in this arena are diverse and focus on quantifying costs across episodes of care for a variety of spinal operations to reduce cost and improve outcomes. These investigations on bundled payment initiatives for spinal operations are met with considerable excitement and potential.

Orthopaedic Clinical Research

Translational Quantitative Imaging Center

Advanced Translational Imaging Research Core

The Sports Medicine group at UCSF utilizes advanced biomedical imaging techniques to study different conditions of the knee, shoulder and hip. Magnetic resonance imaging (MRI) scans produce high-resolution three-dimensional images. Specialized MRI sequences can also provide detailed information about the biochemical composition of tissue, tissue architecture, or the function of joints. The Sports Medicine group closely collaborates with the UCSF Department of Radiology and the MQIR (Musculoskeletal Quantitative Imaging Research) group to leverage these advanced technologies to better evaluate patients and the effects of non-surgical and surgical treatment.

Knee Imaging

Knee ligament injuries and cartilage injuries are common conditions, especially in active people. Following anterior cruciate ligament (ACL) tears, patients are at an increased risk of developing knee arthritis. We can track the composition of cartilage using two advanced MRI sequences: T1rho and T2 mapping. The T1rho mapping sequence can measure the content of proteoglycans, which are an important component of healthy cartilage. The T2 mapping sequence gives information on the structure of collagen in cartilage. Both sequences can detect the breakdown of cartilage early in the degenerative process. These sequences have been used to monitor improvement after cartilage repair surgery and evaluate for early cartilage breakdown in patients with ACL tears.

Additionally, this group has also used kinematic MRI to evaluate the alignment and motion of the knee after injury to the ACL and following ACL reconstruction surgery. They obtain MRI scans,

with a weight applied to the foot, to simulate standing in the scanner. They use images with the knee straight and then also bent. From this, they can then reconstruct three-dimensional models of the knee and better understand the complex function of the knee through motion. As a result, by combining these imaging technologies, they have linked abnormal knee motion to early cartilage breakdown.

Shoulder Imaging

This research has applied advanced imaging techniques to study patients with rotator cuff injuries. The muscles of the rotator cuff undergo degenerative changes following rotator cuff tears, with the muscle both shrinking in size (atrophy) and being replaced by fat (fatty infiltration). Both degenerative changes are associated with worse outcomes after surgical treatment. Advanced MRI sequence, IDEAL imaging, are used to measure the fat content in the shoulder muscles. The images show that increasing fat content can be observed in larger rotator cuff tears. Additionally, researchers have also studied how the fat content changes after surgical repair of a rotator cuff tear and they have demonstrated that lower fat content prior to surgical repair is associated with a higher chance of successful tendon repair.

Hip Imaging

In Hip Imaging, researchers have applied the T1rho and T2 mapping sequences to track the cartilage health of the hip. In femoroacetabular impingement (FAI), bony mismatch between the femoral head (ball) and the acetabulum (socket) are associated with labral tears and cartilage breakdown. Ultimately, this has shown that T1rho and T2 mapping can identify hip cartilage injuries better than traditional MRI.

Orthopaedic Oncology/Osseointegration

UCSF Mission Bay

The UCSF Orthopaedic Oncology Service, formed by **Richard J. O'Donnell, MD**, **Rosanna L. Wustrack, MD**, and **Melissa N. Zimel, MD**, is involved in a wide array of basic, translational, and clinical research studies.

UCSF Orthopaedic Oncology is poised for a new era of progress as Rosanna L. Wustrack, MD, has been named section chief. "Dr. Wustrack has demonstrated exemplary leadership across all aspects of the department -- clinical care, medical student and resident education, and basic science," said Richard J. O'Donnell, MD, who served 18 years in the chief role. "I can think of no better transition for our group."

Hailed by Dr. Vail for her "unwavering commitment to providing expert care to children and adults diagnosed with tumors and tumor-like conditions," and for her "outstanding mentoring skills," Dr. Wustrack's research, supported through the generosity of Dr. and Mrs. James O. Johnston, focuses on immunotherapy for sarcomas, functional outcomes in cancer patients, osseointegration, and optimizing treatment for metastatic disease. She is also interested in global health and osteoporosis in cancer survivors.

Dr. O'Donnell will continue in caring for orthopaedic oncology patients while stepping up efforts in research administration and program development as director of the iCORES (UCSF International Center for Osseointegration Research, Education and Surgery) and METRICS (UCSF Musculoskeletal Research Consortium) efforts. The newest Faculty member in the oncology pod, Melissa N. Zimel, MD, serves as diversity, equity and inclusion champion for the department while joining Drs. Wustrack and O'Donnell in a wide array of pioneering translational and clinical research studies directed towards normalizing function in patients with limb preservation and limb loss. The trio has spearheaded the development of the multidisciplinary UCSF Sarcoma Program, part of the \$275 million UCSF Bakar Precision Cancer Medical Building, which opened on UCSF's flagship Mission Bay campus in 2019.

Melissa Zimel, MD, at left, Richard O'Donnell, MD and Rosanna Wustrack, MD lead the iCORES research.

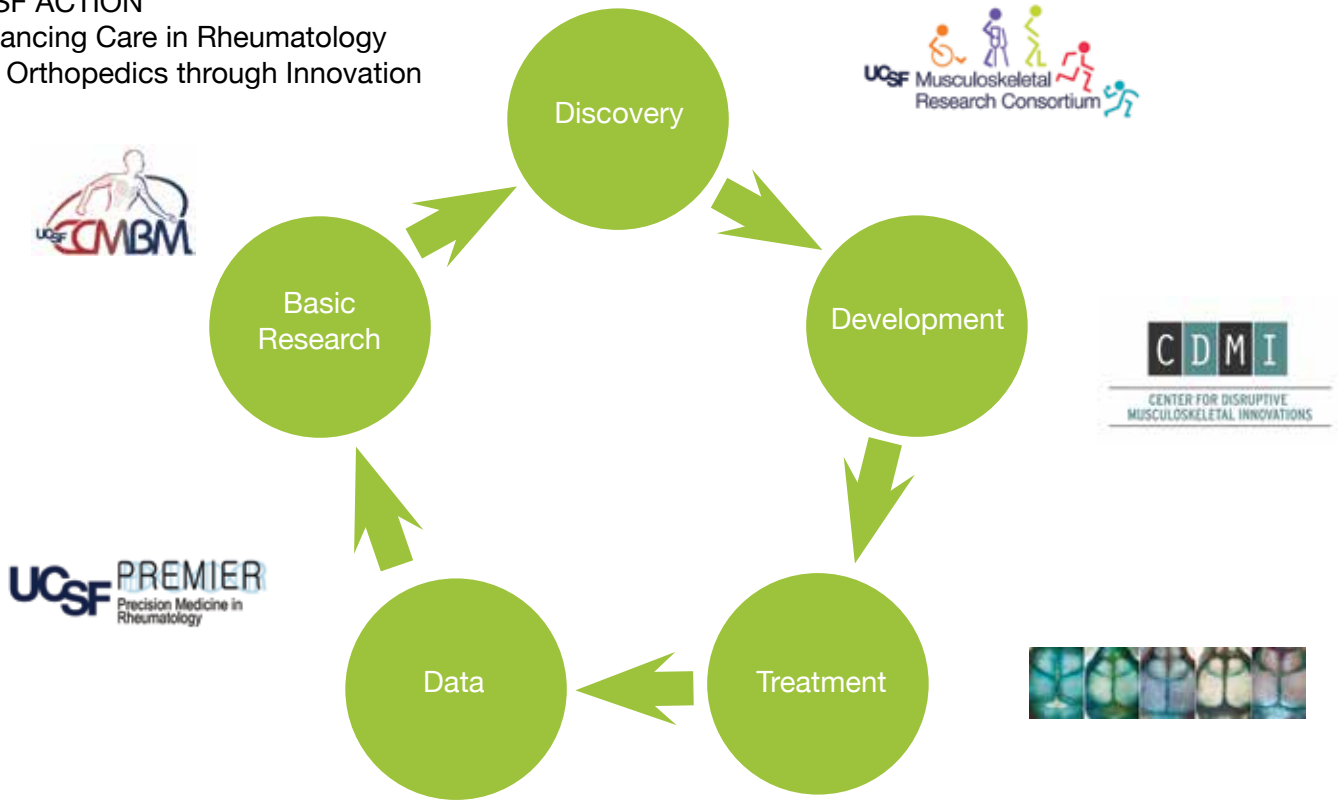


MSK Innovation Centers

UCSF Musculoskeletal Innovation Ecosystem

UCSF ACTION

Advancing Care in Rheumatology and Orthopedics through Innovation



Advancing Care in Rheumatology and Orthopaedics through Innovation



Center Level Activities

Core Center for Patient-centric, Mechanistic Phenotyping in Chronic Low Back Pain (REACH)

The Core Center for Patient-centric Mechanistic Phenotyping in Chronic Low Back Pain (REACH) is a newly funded NIH core center that is part of the NIAMS Back Pain Consortium Research Program (BACPAC) under the HEAL Initiative to stem the national opioid health crisis.

REACH is an interdisciplinary consortium of basic and clinical scientists dedicated to clarifying the biopsychosocial mechanisms of chronic low back pain (cLBP). The need for cLBP research is that it is the most common, non-cancer reason for opioid prescriptions in the US.

Under the direction of the Department of Orthopaedic Surgery (Drs. Jeffrey Lotz and Conor O'Neill), the goal of REACH is to define cLBP phenotypes and pain mechanisms that can lead to effective, personalized treatments for cLBP patients. REACH is one of three BACPAC Mechanistic Research Centers that consists of six cores: 1) Administrative Core; 2) Clinical Core; 3) Informatics

Core; 4) Bio-behavioral Core; 5) Pathophysiology Core; and 6) Physical Function and Biomechanics Core. These cores provide support to a single research project that is focused on developing validated and adaptable tools that enable comprehensive yet routine clinical assessment and treatment of cLBP patients. REACH also fosters scientific exchange through an Enrichment Program; the curriculum includes seminars featuring local and visiting scientists, an annual full-day retreat with the External Advisory Committee, and a half-day symposia with rotating topics relevant to the biopsychosocial model of cLBP.

Another vital component of REACH is its Pilot/Ancillary Studies Program that provides seed money to leverage REACH clinical data and cores. Overall, the object of REACH is to catalyze the discovery and translation of novel diagnostics and therapeutics that improve outcomes of cLBP patients.

To learn more, please contact the REACH Principal Investigator, Jeffrey Lotz, PhD, (Jeffrey.Lotz@ucsf.edu).

Human Performance Center

The Human Performance Center (HPC) optimizes people's function and performance, emphasizing multidisciplinary solutions to advance discovery. With the use of cutting-edge biomechanics and exercise physiology approaches, the HPC provides accurate and precise quantitative assessments of human movement and fitness. The state-of-the-art equipment and expert staff enable the center to handle a diverse range of research projects, from knee osteoarthritis to prostate cancer and more. The HPC is the key center for exercise-related science serving the Department of Orthopaedic Surgery and the UCSF community.

"We're emphasizing a team approach on solving problems. Many of our studies and programs involve experts across the UCSF community, crossing lines and sharing knowledge to join forces. We want to see how exercise can improve people's daily function and prevent disease," explains Benioff Distinguished Professor in Sports Medicine Anthony Luke MD, MPH, who is the director of the HPC.

Brooke Schultz, MS, manages the HPC and serves as a full-time biomechanist for the Vicon Motion Capture system and AMTI force plates. Brooke has graduate-level training in both physics and kinesiology as well as a decade's worth of experience as an American Council on Exercise (ACE) certified personal trainer. Her diverse background provides the perfect balance of movement science technology with patient care.

Neil Panchal, MS, ACSM-CPT, serves as the lab's exercise physiologist. With multiple years of designing and modifying exercise prescriptions and administering graded exercise testing amongst a variety of populations, Neil conducts metabolic and physiological testing, including VO₂max, lactate threshold, RMR, and administering CPETs.

"Our aim is to use quantitative analysis that is accurate and precise when analyzing physical function," explains HPC, Director of Research Richard Souza, PT, PhD. "Our goal is to utilize novel technology and approaches to advance science, revealing new information about pathology and human function. We can consult, administer assessments and data collections, or provide comprehensive support for anyone investigating human performance."

2019 PROJECTS

Dr. Souza leads a team of biomechanists, post-docs, and PhD students on an R01 funded project investigating the progression of hip osteoarthritis, tracking participants over a period of three years. In conjunction with radiology's evaluation of joint tissue health, the study uses the Vicon system and BTE Primus dynamometer to analyze the participants while moving through standard activities of daily living such as walking, stair ascent and descent, as well as squatting. The research follows a similar study on knee

osteoarthritis and has served as an outline for the movement analysis used by Alan Zhang MD and resident Trevor Grace MD on their patients having undergone surgery for FAI syndrome.

Partnership between the Orthotics and Prosthetics division of Orthopaedics and the HPC has assisted in the enhancement of Dr. Richard O'Donnell's Osseointegration program by evaluating metabolic cost and gait kinematics and kinetics of prosthetic patients pre- and post-implant surgery.

Victor Cheuy, PhD, began his collaboration with the HPC after being awarded a RAP grant in 2019 to study joint kinematics and kinetics of type 1 diabetic patients with foot neuropathy. His research utilizes a multi-segment foot model in 3D motion capture as well as the Tekscan HR-mat to map pressure curves during gait.

The HPC began two projects in 2019 with Neurology's Parkinson's patient population. Doris Wang, MD PhD, is decoding the neural control of normal and abnormal gait patterns in Parkinson's disease using adaptive neurostimulation to understand and improve circuit mechanisms of human gait control. Patients have either the Medtronic Activa PC+S or Medtronic Summit RC+S device implanted in their brains. Signals from the device are synced with a gait retraining video, the 3D Vicon motion capture system, and wireless Delsys EMG.

Nijee Luthra, MD PhD, has partnered with the HPC to implement a treadmill-based exercise training program utilizing Heart Rate Zones on early-stage Parkinson's patients. VO₂ max fitness assessments with our Parvomedics Metabolic Cart will be measured at baseline, six months, and twelve-month time points in addition to disease biomarkers and other functional movement tests.

The HPC continues to work with the Department of Urology to conduct exercise interventions of their large studies, including VO₂ max fitness testing and monitoring. Professor of Epidemiology & Urology June Chan, ScD, is working to determine the effects of aerobic training on prostate genomic signatures that predict the risk of prostate cancer progression or aggressive diseases in men on active surveillance for low-risk prostate cancer. We are three years into a randomized controlled trial looking at how introducing regular vigorous exercise-associated routines may reduce prostate cancer progression and cancer-specific mortality, as has been shown with other cancers.

Similarly, Associate Professor of Urology Stacey Kenfield ScD, is investigating how exercise improves overall survival and health-related quality-of-life (QOL) among men with advanced prostate cancer. The goal of Dr. Kenfield's R21 study is to compare aerobic exercise, resistance exercise, and standard of care with their effect on prostate disease burden. Patient's fitness levels are evaluated in the HPC at pre and post-study time points. In addition, the HPC provides coaching for patients about their exercise regimens, keeping them motivated, and monitoring the safety and feasibility of their remote exercise programs.

The HPC is also collaborating with Dr. Stacey Kenfield on exercise interventions for the Department of Urology's Prostate 8 research program, which is performed solely via remote web-based communication. The study is an investigation into a two-year wellness program using exercise, diet and lifestyle interventions to evaluate their potential impact on improving biological, clinical, and quality of life outcomes in men who choose surgery as the primary treatment for prostate cancer.



Center Level Activities



METRiCS: UCSF Musculoskeletal Research Consortium

UCSF Parnassus Heights

Founded in 2018 as “a new orthopaedic research commons,” the UCSF Musculoskeletal Research Consortium, or METRiCS Program, has already been demonstrably successful in fostering collaboration between clinicians and scientists dedicated to finding solutions to vexing problems in musculoskeletal health. Projects must be multi-disciplinary, with a special emphasis on cross-school, inter-Departmental, and cross-campus interactions. By definition, METRiCS focuses on outcomes, in terms of securing extramural grant and philanthropic funding, highlighting patient-centric health-related quality of life measures, and advancing the field through peer-reviewed publications.

In the past year, METRiCS has brought together researchers from across the UCSF School of Medicine, including from the Departments of Orthopaedic Surgery, Physical Therapy, and Radiology. METRiCS is proud to announce new funding of \$350,000 from the Congressionally Directed Medical Research Program (CDMRP), Orthotics and Prosthetics Outcomes Research Program (OPORP) for Jeannie Bailey, PhD's work entitled, Assessing biomechanical function and hip stabilizing muscle quality associated with transfemoral osseointegration. METRiCS has also partnered with electrical engineering Faculty at UC Berkeley for Rob Matthew, PhD's National Science Foundation (NSF) Smart and Connected Health (SCH) proposal entitled, Quantifying amputee functional outcomes from the clinic into the home, which will supplement ongoing studies in

the UCSF international Center for Osseointegration Research Education and Surgery (iCORES) Program, already supported by more than \$6 million in federal contracts and grants, including a gift from Dr. and Mrs. Richard Stern.

Directed by Richard J. O'Donnell, MD, the METRiCS Lab has found a home at 95 Kirkham where the Departmental and Developmental vision of re-imagining the Parnassus Heights campus will be leveraged to transform the space into a state-of-the-art translational facility for gait analysis. METRiCS seeks to develop in-clinic and at-home motion capture tools for assessing amputee rehabilitation that can be used to better understand kinematics in patients with a wide array of orthopaedic pathology, including hip and knee arthritis and degenerative conditions of the spine. A portion of the studies associated with the Department's \$29.4 million National Institutes of Health (NIH) Helping to End Addiction Long-Term (HEAL) Initiative award will also be conducted in the METRiCS Lab.

The METRiCS group hopes to use these biomechanical assessments to inform assistive device design and control. Based on pioneering biomechanical work with electronic percutaneous osseointegrated implants that enable bi-directional volitional motor control of, and sensory/proprioceptive feedback from, external prostheses, METRiCS aims to formulate brain-machine interface platform technology that can be applied to a broad range of motion disorders, including paralysis.

Center Level Activities



Core Center for Musculoskeletal Biology & Medicine (CCMBM)

The NIH-supported P30 Core Center for Musculoskeletal Biology & Medicine (CCMBM) is one of five such centers nationally. The goal of CCMBM is to stimulate and support UCSF transdisciplinary collaborations to accelerate translational research in the musculoskeletal field through grants, mentorship, and networking.

The CCMBM is now in its sixth year of funding and has cultivated a diverse membership of over 150 faculty and trainees that span across three schools and more than 20 departments at UCSF. The Center provides research services through its three cores: biology and biomechanics, and epidemiology, biostatistics, and

study design. Over the last six years, the CCMBM has funded 32 pilot and feasibility grants totaling over \$452 thousand and has leveraged an additional \$954 thousand in grant support for CCMBM members.

The UCSF community can participate in the Center through its many events, including retreats, symposia, seminars, workshops, and networking events.

To learn more, visit ccmbm.ucsf.edu.

Center Level Activities

Core-Center for Disruptive Musculoskeletal Innovations (CDMI)

The Center for Disruptive Musculoskeletal Innovations (CDMI) is a National Science Foundation (NSF) funded Industry/University Cooperative Research Center. Industry representatives from the medical device field form the CDMI Industry Advisory Board and contribute to supporting 'industry-inspired' fundamental research and student training. Projects span a range of areas that include healthcare economics, biomedical science, biomechanics, and clinical outcomes.

Faculty from UCSF, University of Toledo, The Ohio State University, and Northeastern University, along with industry partners collaborate to target novel technologies that will decrease healthcare costs and improve the lives of patients with musculoskeletal conditions. Partnerships with the FDA have initiated several programs in regulatory science related to medical implants and digital sensor technologies.

Over its first five years, CDMI received about \$1.8 million in industry membership support to fund 60 projects across its university sites. These projects have generated pilot data that led to \$4.5 million of additional extramural funding plus \$1.1 million in related 'enhancement' projects with the industry partners.

In December 2019, under the direction of Dr. Jeffrey Lotz, the CDMI team successfully became a Phase II center and secured another five years of funding. The CDMI is now recruiting additional industry partners and growing its faculty research network across the four partner universities.

To learn more, visit nsfcdmi.org.

The vision for C-DOCTOR is to be a national resource for the clinical translation of innovative regenerative technologies to replace dental and craniofacial tissues and organs lost to congenital disorders, trauma, and disease.



Center Level Activities

Center for Dental, Oral, & Craniofacial Tissue & Organ Regeneration (C-DOCTOR)

The Center for Dental, Oral, & Craniofacial Tissue & Organ Regeneration (C-DOCTOR) is one of two national NIDCR-funded Tissue Regeneration Resource Centers. C-DOCTOR is a partnership among several California institutions to recruit, nature, and translate promising tissue regeneration technologies to human clinical trials. Participating universities include UC San Francisco, UC Berkeley, UC Davis, UC Los Angeles, USC, and Stanford University.

C-DOCTOR has built an infrastructure to integrate a comprehensive and dynamic team of clinicians, research scientists, biostatisticians, regulatory scientists, and pre-clinical/

clinical trial experts to enable the clinical adoption of innovative approaches for dental, oral, and craniofacial tissue regeneration. C-DOCTOR has awarded \$4.5M to 17 interdisciplinary translational project (ITP) teams from across the US. C-DOCTOR is currently working with its industry advisor network to advance the most commercially viable products, and preparing those select ITPs for a pre-IND meeting with the FDA.

To learn more, visit c-doctor.org.

Center Level Activities

Industry Research Center (IRC)

The Industry Research Center (IRC) goal is to facilitate efficient industry/university alliances and provide biomechanics, biochemistry, imaging, and animal testing and project management support to industry and faculty and residents in the Department of Orthopaedic Surgery.

For more information, please contact the IRC Director of Operations, Dezba Coughlin, PhD (<mailto:dezba.coughlin@ucsf.edu>).



New Faculty



The UCSF Dept. of Orthopaedic Surgery is pleased to welcome four new faculty members, all of whom have unique research interests.

Jeannie Bailey, PhD

Assistant Professor

Jeannie Bailey, PhD, has more than a decade of interdisciplinary research experience in orthopaedic health outcomes focused on lumbar spinal conditions and low back pain. Her research explores novel methods for identifying clinical-relevant biomechanical phenotypes and exploring potential interactive mechanisms between separate low back pain phenotypes. The impact of her research on spine health is wide-ranging, from exploring the ambiguity of causal features of non-specific chronic low back pain to creating novel approaches for assessing sagittal alignment in adult spinal deformity patients.

She has experience leading prospective low back pain cohort studies, beginning with a multi-year longitudinal study tracking spinal health in NASA astronauts before and after 6-months spaceflight. From this work, she was awarded the 2017 Outstanding Paper award from the North American Spine Society for illuminating mechanistic relationships between spinal biomechanics, muscle health, and underlying spinal pathology for predicting risk for developing chronic low back pain after spaceflight. She has since confirmed similar mechanistic relationships between paraspinal muscle health and endplate pathology in a prospective study exploring imaging phenotypes in a cohort of chronic low back pain patients. She is beginning to explore associations between hip stabilizing muscle quality and long-term biomechanical outcomes in transfemoral amputation patients.

She has valuable experience developing, testing, and deploying precision-based digital health technology to enhance both clinician and patient engagement in treatment and recovery. She recently led a randomized control trial of a digital therapy on chronic low back pain and uncovered the positive impacts of patient engaging technology on adhering patients to conservative care and improved patient-reported outcomes, ideally mitigating the need for opioids or surgery. As a UCSF CTSI Precision Health Fellow (TL1) she collaborated with an interdisciplinary team of engineers and clinicians to develop 3-dimensional depth mapping technology for in-clinic motion assessments. This work awarded them the 2019 ISSLS Prize in Bioengineering Science, where they introduced novel biomechanical outcomes for spine patients and the potential for predicting risk for post-surgical failure. She aims to further develop technology that will capture functional phenotypes from real world data that correspond to phenotypic mechanisms derived from imaging and in-clinical assessments.

Dr. Bailey received her bachelor's degree from the University of California, Berkeley, and her master's and doctorate degrees from the University of Washington. She performed post-doctorate research at UCSF in the Dept. of Orthopaedic Surgery.



Celina De Borja, MD, PhD

Dr. Celina de Borja is a board certified pediatrician with fellowship training in sports medicine, who treats children and young adults with a wide spectrum of musculoskeletal conditions. Her areas of interest include sports and dance medicine, injury prevention, fractures, bone health, and general pediatric orthopaedics.

Originally from the Philippines, Dr. de Borja received her undergraduate degree from De La Salle University Manila, and then subsequently earned her medical degree from the University of the East Ramon Magsaysay Memorial Medical Center. She completed her pediatric residency training through Hackensack Meridian Health at Jersey Shore University Medical Center in Neptune, New Jersey. Dr. de Borja then pursued fellowship training in sports medicine through Harvard Medical School at Boston Children’s Hospital.

During her fellowship in Boston, Dr. de Borja served as team physician for Northeastern University’s women’s field hockey and basketball teams; team physician for Newton South High School’s football team; and consulting physician for Boston Ballet School, Boston Conservatory and Berklee School of Music.

Dr. de Borja has also actively served as a medical volunteer at various sports and mass participation events, including the Boston Marathon. She also participated in the disaster relief operations for rescue victims of Typhoon Haiyan in the Philippines in 2013 -- one of the most powerful tropical cyclones ever recorded.

At UCSF, Dr. de Borja will be based primarily at the Mission Bay Children’s Hospital, and also will see patient’s at Children’s Hospital Oakland.



Ashraf El Naga, MD

Ashraf El Naga, MD, joined the faculty at UCSF in 2019 and works primarily out of the UCSF/Zuckerberg San Francisco General Orthopaedic Trauma Institute (OTI) and Regional Medical Center, San Jose. His clinical interests include Spine.



Ishaan Swarup, MD

Assistant Professor of Orthopaedic Clinical Surgery

Dr. Ishaan Swarup is a fellowship-trained pediatric orthopaedic surgeon who evaluates and treats infants, children, and young adults with a wide spectrum of musculoskeletal conditions. His areas of interest include general pediatric orthopaedics with a focus on scoliosis and spinal disorders, conditions affecting the hip, and pediatric trauma.

Dr. Swarup received his undergraduate degree in public health from the University of California at Berkeley, where he was elected into Phi Beta Kappa for his academic excellence. He earned his medical degree from the Geisel School of Medicine at Dartmouth, where he was inducted into the prestigious Alpha Omega Alpha Medical Honor Society. Dr. Swarup completed his training at some of the nation’s most premier institutions for orthopaedics, including residency in orthopaedic surgery at Hospital for Special Surgery in New York City and fellowship in pediatric orthopaedic surgery at Children’s Hospital of Philadelphia.

In addition to his full-time clinical practice, Dr. Swarup is actively involved in advancing the field of pediatric orthopaedic surgery through his research. His clinical research interests include disease prevention and improving outcomes in pediatric trauma, hip preservation, and pediatric spine surgery. He has numerous peer-reviewed publications, and he has presented his research at nearly 50 scientific meetings. Dr. Swarup has also received several grants and awards for his research from national and international organizations.

Additionally, Dr. Swarup serves on several professional committees, and he is an active member of the American Academy of Orthopaedic Surgery, Pediatric Orthopaedic Society of North America, and American Academy of Pediatrics. At UCSF, Dr. Swarup will also be serving as the Associate Director of the Pediatric Orthopaedic Surgery Fellowship.

Residency Highlights

The year 2019 marks another successful year for the UCSF Dept. of Orthopaedic Surgery Residency Program in terms of outstanding research that directly improves patient care.

Residents performed international, clinical, and basic science research that was published in leading orthopaedic journals across several subspecialties, and presented at national and international meetings. The UCSF Department of Orthopaedic Surgery residents were awarded several awards for research, as well as for clinical care and leadership, as highlighted below.

In the upcoming year, we continue to expand the goals of our research. We will continue to have second year residents apply for the Orthopaedic Research and Education Foundation

(OREF) research grant, and will also expand that opportunity to the interns, with the goal of establishing a research track for longitudinal studies earlier in their research career.

We will continue to expand our Web site and provide information and support on grant writing, manuscript preparation, and how to perform specific studies, such as meta-analyses and systematic reviews, as well as cost effective analyses.

The beginning of 2019 is already a landmark year, with many of the residents presenting at the American Academy of Orthopaedic Surgeons (AAOS) and Orthopaedic Research Society (ORS) annual meeting, and we look forward to the rest of the year and the innovative research that our residents continue to perform.

2019 JOJ Research Recipients



Heather
Roberts, MD

- Awarded the UCSF JOJ Ortho Resident Grant, \$5,000 June 2019

Predictors of quality of life and economic impact after open tibial shaft fractures in Ghana

Purpose and Progress: This funding is being used to support a prospective study of open tibia fracture management in Kumasi, Ghana. The purpose of this study is to examine the influence of socioeconomic status on type of treatment for open tibia fractures, and in turn the influence of type of treatment on clinical and economic impact after open tibia fractures. The results of this study will impact policies that support investment in surgical care and inform evidence-based protocols in low-resourced settings where the burden of orthopedic trauma is highest.



Alex Gornitzky, MD

- Awarded the UCSF JOJ Ortho Resident Grant, \$5,000, June 2019

Coping Skills after Pediatric Spine Fusion

Purpose and Progress: The purpose of this study is to evaluate the efficacy of a novel library of smartphone-based, peri-operative educational and coping skills videos on pain intensity, patient-reported outcomes and pain-related disability for up to six weeks after pediatric spine surgery. We are currently enrolling patients, and are utilizing the JOJ grant to help incentivize participation and for data collection/analysis after completion. Ideally, our results will not only improve children's recovery from major orthopaedic surgery, but also catalyze further investigation into non-pharmacologic methods for optimizing post-operative multimodal pain pathways.

Previous Recipients



Ilya Bendich, MD

Awarded the UCSF JOJ Ortho Resident Grant, \$5,000, June 2018

Predictors of a Change in Patient Willingness to Have Total Knee Arthroplasty: Insights from the Osteoarthritis Initiative

Purpose and Progress: Essentially, we used a large publicly available prospective

database of patients at risk of knee osteoarthritis and identified predictors of patients changing their willingness to have a total knee arthroplasty. This project was presented at ORS in 2019 and has been selected for a podium at AAOS 2020. We are in the process of submitting it to The Knee journal (decision pending). Planning to continue research into Fellowship.



Hao-Hua Wu, MD

Awarded the UCSF JOJ Ortho Resident Grant, \$5,000

Gentamicin for Open Tibia (GO Tibia) Fractures: A double-blinded randomized controlled trial

Purpose and Progress: This is a double-blinded randomized controlled study comparing local gentamicin to placebo in

the reduction of infection rates after operative management of open tibial shaft fractures in Dar es Salaam, Tanzania. The pilot study is currently underway.

Awards, Grants, Presentations



Sachin
Allahabadi, MD

- Oct 2019: 2nd place award in the clinical science category, Orthopaedic Research and Education Foundation 2019 California Resident Research Symposium
- Aug 2019: Omer A. Ilahi Donor Award for paper in the clinical sciences, Western Orthopaedic Association 2019 annual meeting



Ilya Bendich, MD

- JOJ: \$5000, Predictors of a Change in Patient Willingness to Have Total Knee Arthroplasty: Insights from the Osteoarthritis Initiative. Awarded 2018. Presented at ORS 2019 and presenting at AAOS 2020.
- 2019 AAOS Podium - "Hepatitis C may be a modifiable risk factor in Total Joint Arthroplasty: Preoperative treatment of Hepatitis C is associated with lower prosthetic joint infection in US Veterans"



Michael Davies,
MD

- OREF Resident Research Grant (\$5000 for 1 year)
- First Place for Basic Science at the OREF California Region Resident Research Symposium.



Heather Roberts, MD

- JOJ: \$5000, Predictors of quality of life and economic impact after open tibial shaft fractures in Ghana
- CTSI: \$4000, Predictors of quality of life and economic impact after open tibial shaft fractures in Ghana
- AO Trauma North America grant: \$10,000, Predictors of quality of life and economic impact after open tibial shaft fractures in Ghana
- AO Alliance: \$10,000, Predictors of quality of life and economic impact after open tibial shaft fractures in Ghana
- OREF: \$5000, Epidemiology, outcomes, and cost of revision total hip and knee arthroplasty



Caitlin Rugg, MD

- Rugg CM (presenter), Feeley BT. The Impact of Early Sport Specialization on Scholarship Attainment, Injury Rate, and Attrition in NCAA Athletes. Podium Presentation. Western Orthopaedic Association. 2019 August. (Western Orthopaedic Foundation funded research via the OREF)
- Harada G, Arshi A, Rugg CM (presenter), Vail J, Hame SL. Multiple Concussions Increases Odds of Lower Extremity Injury in Collegiate Athletes. ePoster Oral Presentation. AAOS. Las Vegas, NV. 2019 March.

Trainee Highlights

The UCSF Dept. of Orthopaedic Surgery Laboratories have had another successful year in terms of musculoskeletal research. For example JUST LISTED I 5 Oceanside Dr., our Parnassus Heights Labs continue to grow in size and extramural funding. In 2019, the Parnassus Heights Labs welcomed more than 19 new employees to its research enterprise. The Labs currently have more than 45 trainees including postdocs, fellows, visiting scholars, graduate students, technicians, interns, and staff researchers. Their efforts continue to advance the field of musculoskeletal biology through outstanding contributions in the study of bone, cartilage, tendon, and muscle.

Trainees from various UCSF Department of Orthopaedic Surgery Laboratories were awarded competitive and highly prestigious NIH awards including F30, F31, and F32 grants. Additionally, they

have presented at a broad range of national and international meetings, including the Orthopaedic Research Society (ORS) and Gordon Research Conferences. Our basic research scientists continue to publish in leading journals and each day, are accelerating the discovery of novel strategies for healing the musculoskeletal system.

Because of these sustained contributions and our ongoing success, the Department has maintained its high ranking in NIH funding. We look forward to the rest of the year and the innovative research that the lab personnel continue to achieve.



Devante Horne,
Graduate Student
Lotz Laboratory

- Awarded for Poster Presentation

UCSF Department of Orthopedic Surgery Scientific Retreat
April 2019, San Francisco, CA

- Presented at the International Society for the Study of the Lumbar Spine Annual Meeting

Low-intensity Pulsed Ultrasound Far-Field Exposure Increases Matrix Synthesis in Annulus Fibrosus Cells, June 2019, Kyoto, Japan

- Awarded the Young Investigator Travel Grant

The International Society for the Study of the Lumbar Spine Annual Meeting

June 2019, Kyoto, Japan

- Awarded from the Center for Disruptive Musculoskeletal Disorders (CDMI) research grant



An Nguyen,
PhD Candidate
Schneider Laboratory

- Awarded an NIH F30 research grant through August of 2021



Heather A. Richbourg,
PhD
Marcucio Laboratory

- Awarded an NIH NIDCR F32, research grant through 2021

- Won the 'Chancellor Awards for Advancement of Women' in the student/resident/postdoctoral scholar category. "(Dr. Richbourg's) sustained efforts and leadership go well beyond the expectations of a trainee, and will undoubtedly have significant impacts on women within her laboratory, her university, her community, and the world, as she has

made successful, concrete contributions to advancing women at each of these levels." — Ralph Marcucio, PhD, Professor, UCSF Department of Orthopaedic Surgery



**Karsyn Bailey,
MD/PhD Candidate**

Alliston Laboratory

- Presented at the Orthopaedic Research Society Annual Meeting Osteocyte-intrinsic Ablation of TGFβ Signaling Exacerbates Post-Traumatic Osteoarthritis, February 2019
- Awarded Achievement Rewards for College Scientists (ARCS) Award, 2019-2020



**David Monteiro,
Graduate Student**

Alliston Laboratory

- Reviewer, UC Berkeley Summer Undergraduate Research Fellowship Program, March 2019.
- Judge, UC Berkeley Bioengineering High School Competition, April 2019.
- Oral presentation, FASEB: The TGFβ Superfamily Conference: Signaling in Development and Disease. Talk title: Shear stress activation of TGFβ signaling in osteocytes is mediated by Akt. July-August 2019, West Palm Beach, FL. Travel Award.
- Awarded an Insight Health Data Science Fellowship, August 2019.



**Charles Schurman,
Graduate Student**

Alliston Laboratory

- Awarded Ruth L. Kirschstein National Research Service Award (NRSA) Individual Predoctoral Fellowship (F31): Age-related Control of Bone Quality by Osteocyte TGF-beta Signaling
- Presented at American Society for Bone and Mineral Research Annual Meeting Poster: Age-related suppression of osteocyte lacuna-canalicular networks, PLR gene expression, and pericellular fluid flow.
- Publications: Yee, C. S., Schurman, C. A., White, C. R. & Alliston, T. Investigating Osteocytic Perilacunar/ Canalicular Remodeling. *Curr Osteoporos Rep* 17, 157–168 (2019).
- Heveran, C. M., Schurman, C.A., Acevado, C., Livingston, E.L., Howe, D., Schiabile, E., Hunt, H., Levi, M., Donnelly, E., Bateman, T., Lau, A., Alliston, T., King, K. B., & Ferguson, V. L. (2018) "Chronic kidney disease and aging together diminish bone material and microarchitecture in C57Bl/6 mice" In review for *Bone*.



Gaby Baylon, Postdoc

Alliston Laboratory

- Awarded a UCSF Chancellor's Postdoctoral Fellowship, July 2019
- Presented at the University of Adelaide Robinson Research Institute.

Osteocytes: Mechanoregulators of Bone Fragility and Joint Disease, September 2019, Adelaide, South Australia.

- Presented at the University of California, Riverside Mechanical Engineering Fall Colloquium. Biomechanical and Mechanobiological Regulation of Structure-Function Relationships in Musculoskeletal Tissues, November 2019, Riverside, CA.
- Awarded a postdoctoral fellow shooting star award from the Biomedical Engineering Society (BMES) Cellular and Molecular Bioengineering Conference, November 2019.



**Susan Eliazer,
Postdoc**

Brack Laboratory

- Awarded the American Federation for Aging Research (AFAR) award, runs through August 2019



**Spenser Smith,
Postdoc**

Schneider Laboratory

- Awarded an NIH F32 research grant, runs through 2021

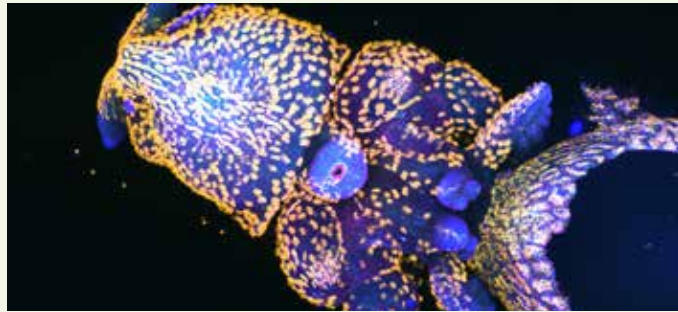


Zuzana Vavrusova, PhD Candidate

Schneider Laboratory

- FASEB BioArt contest winner, December 2019

This image shows a squid (*Loligo pealei*) embryo. Cephalopods, including squid, are animals with high cognitive abilities compared to many vertebrates and their camouflage behavior, the complexity attained with such a speed and precision,



is very fascinating. They can regenerate their arms, despite having large nerve cords running down them, could lead to a breakthrough in addressing human spinal cord injuries.

Studying their embryology could help improve our knowledge of evolution and organismal biology.

Squid is a model organism used to study neurodevelopment, neurodegeneration and Dementia in Mammals. This picture was captured during the Marine Biological Laboratory Embryology Course (2017 with equipment provided by Zeiss).

Zuzana Vavrusova, Daniel Chu, Jennifer L. Fish, and Richard A. Schneider. Species-specific regulation of SHH signaling and jaw size. MBL course - Embryology: Concepts and Techniques in Modern Developmental Biology, Marine Biological Laboratory - University of Chicago, Woods Hole - Massachusetts (USA), June 2019. Short Talk

News and Media



Dec. 30, 2019

UCSF Department of Orthopaedic Surgery appoints Rosanna Wustrack, MD, as Section Chief of the Division of Orthopaedic Oncology

Rosanna Wustrack, MD, will lead the Division of Orthopaedic Oncology in the UCSF Department of Orthopaedic Surgery. (Photo: UCSF Department of Orthopaedic Surgery)

SAN FRANCISCO (Dec. 30, 2019) – Rosanna Wustrack, MD, an orthopaedic surgeon within the UCSF Department of Orthopaedic Surgery, has been named Section Chief of the Division of Orthopaedic Oncology.



December 29, 2019

Gopal Lalchandani, UCSF Department of Orthopaedic Surgery PGY 4, is in Dar es Salaam, Tanzania, at the Muhimbili Orthopaedic Institute for his global resident elective rotation. “I had the wonderful opportunity to learn from the orthopedic surgeons and residents at the hospital, while also sharing some of our experiences from San Francisco. This was a unique chance to participate in orthopedic care in a new practice environment and to also learn to work with limited resources at times. I will return to my residency at UCSF with a newfound appreciation for all the great resources we have available to care for our patients.”



IGOT Research Fellow, Ericka Von Kaeppler, with MOI research coordinator in Tanzania to discuss the GO Tibia research project.

December 30, 2019

One of our IGOT research fellows, Ericka Von Kaeppler, in Tanzania at Muhimbili Orthopaedic Institute. She was working with the local research coordinators and orthopaedic surgeons to set up the Intraoperative Gentamicin versus No Antibiotics in Open Tibia Fractures Randomized Controlled Trial study and began the pilot for the double-blinded study.



December 20, 2019

The Tom Perkins Legacy Foundation has donated \$58,989.99 to the SFGH Foundation for the benefit of ZSFG orthopedic amputee patients.



Carlin Lee, UCSF orthopaedics research team to receive award at society's annual meeting in spring 2020

Dec. 18, 2019

The Society of American Shoulder and Elbow Surgeons (www.ases-assn.org) announced this week that Carlin Lee, a medical student from UC Irvine and a member of the Feeley-Liu Lab within the UCSF Department of Orthopaedic Surgery, has won the 2020 Charles S. Neer Award in Basic Science for his work in evaluating stem cell transplantation to improve muscle quality in a mouse model of rotator cuff repairs.



Faculty at the 4th Annual Nepal SMART course

December 16, 2019

IGOT hosted the 4th Annual Nepal SMART course with faculty from UCSF, the University of Washington and our partners at NAMS and TUTH. Core orthopaedic management and soft tissue principles were taught to 33 Nepalese orthopaedic surgeons.



Pictured here are a few of the collaborators involved in this initiative at the COSECSA conference.

December 6, 2019

IGOT's Co-Directors of Global Research Initiative, Drs. Saam Morshed and David Shearer attended the College of Surgeons of East, Central, and Southern Africa (COSECSA) conference in Uganda from December 4-6th. At the conference, they met with collaborators from the UK, South Africa, and across Sub-Saharan Africa to discuss the development of a research consortium to conduct multi-center research studies in Africa.

Xuhui Liu, MD, presents research findings in Taiwan

Nov. 15, 2019

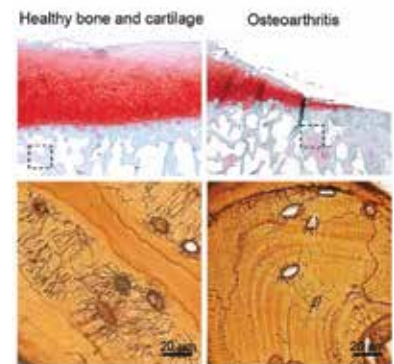
Xuhui Liu, MD, an Associate Professor in the UCSF Department of Orthopaedic Surgery and co-PI in the Feeley-Liu Lab at UCSF, presented research on "Understanding the Mechanism of Muscle Fatty Infiltration—From Cellular and Biomechanics View" at the 10th Asian-Pacific Conference on Biomechanics in Taipei, Taiwan, on Nov. 3, 2019. (COURTESY PHOTO)



UCSF researchers uncover an unexpected role for bone cells in arthritis

Nov. 5, 2019

The paper, entitled “Osteocyte dysfunction promotes osteoarthritis through MMP13-dependent suppression of subchondral bone homeostasis,” was first-authored by Courtney Mazur, a sixth-year graduate student in the UCSF Laboratory of Skeletal Mechanobiology in the Department of Orthopaedic Surgery. Tamara Alliston, PhD, serves as the paper's corresponding author.



UCSF Launches First Space Health Innovation Conference

UC San Francisco and the Translational Research Institute for Space Health (TRISH) are co-sponsoring the inaugural Space Health Innovation Conference to advance research and scientific understanding of how space travel impacts health. Speakers include flight surgeons, scientists, engineers, health care experts, astronauts, and thought leaders from academia, industry, and the National Aeronautics and Space Administration (NASA).



Arin Kim, MD, and Michael Davies, MD, awarded best papers at OREF Research Symposium

Oct. 28, 2019

Arin Kim, MD, and Michael Davies, MD, both third-year residents in the UCSF Department of Orthopaedic Surgery, won awards for best clinical and basic science research papers, respectively, at this year's Orthopaedic Research and Education Foundation (OREF) California Regional Research Symposium held at UCSF on Oct. 22, 2019.



Dr. Linda Chokotho at OTA getting ready to present to the congress

October 26, 2019

Our Malawi partner, Linda Chokotho, MD, presented the IGOT research project on “SIGN Intramedullary Nailing Improves Early Postoperative Quality of Life and Function as Compared to Skeletal Traction for Management of Femoral Shaft Fractures in Malawi” at the 2019 Orthopaedic Trauma Association in Denver, Colorado. Linda also won this year’s OTA Humanitarian Scholarship Award.



From left to right: Jeffrey Lotz, PhD; Conor O’Neill, MD; Aaron Fields, PhD; Jeannie Bailey, PhD; and Dezba Coughlin, PhD.

Oct. 10, 2019

UCSF Orthopaedics receives \$30M from NIH to develop a precision medicine approach for low back pain

The UCSF Department of Orthopaedic Surgery received NIH funding totaling more than \$30 million to establish the UCSF Core Center for Patient-centric, Mechanistic Phenotyping in Chronic Low Back Pain, or UCSF REACH. The new center will conduct both translational and clinical research to clarify biopsychosocial mechanisms of back pain – the interconnection between biology, biomechanics, psychology, and socio-environmental factors – which will be catalytic for new therapeutic, diagnostic and prevention strategies. Heroes and Hearts grant from Genentech for their Junior Academy program.

The San Francisco General Hospital Foundation awarded over 26 grants totaling more than \$500,000 to support vital programs at Zuckerberg San Francisco General.

To learn more about the Junior Academy, visit <https://youtu.be/63f4mC5zz10>



Robert Rhee, Mykel Jensen-Vallar

October 11, 2019

Robert Rhee, Mykel Jensen-Vallar, and the Surgical Training Facility (STF) were recently awarded a \$50,000 San Francisco Heroes and Hearts grant from Genentech for their Junior Academy program.

The San Francisco General Hospital Foundation awarded over 26 grants totaling more than \$500,000 to support vital programs at Zuckerberg San Francisco General.

To learn more about the Junior Academy, visit <https://youtu.be/63f4mC5zz10>



Oct. 2, 2019

Jeannie F. Bailey, PhD, appointed Assistant Professor

The UCSF Department of Orthopaedic Surgery is pleased to announce the appointment of Jeannie F. Bailey, PhD, Assistant Professor.

Jeannie Bailey, PhD, has more than a decade of interdisciplinary research experience in orthopaedic health outcomes focused on lumbar spinal conditions and low back pain. Her research explores novel methods for identifying clinical-relevant biomechanical phenotypes and exploring potential interactive mechanisms between separate low back pain phenotypes. The impact of her research on spine health is wide-ranging, from exploring the ambiguity of causal features of non-specific chronic low back pain to creating novel approaches for assessing sagittal alignment in adult spinal deformity patients.



Resident Alex Gornitzky with pediatrics team at Muhimbili Orthopaedic Institute after OR

October 1, 2019

Alex Gornitzky, MD, UCSF Department of Orthopaedic Surgery PGY4, returned from his global elective at Dar es Salaam, Tanzania. "Beyond the plethora of fractures and infections they treat every day, I also had the opportunity to see a wide variety of neglected disease and chronic injuries that we rarely encounter in the United States. Learning how they manage such conditions in resource-limited settings was extremely educational, and I've come away not only with a renewed appreciation for our resources and the natural history of various injuries but also a valuable new way to think and approach different problems. In addition to surgery, I was also able to participate in call cases, clinics and conferences and had the opportunity to share the different techniques and approaches I've been taught for various pediatric fractures and conditions."



Dr. Nico Lee talking to an attendee about IGOT at the Institute for Global Health Sciences 20th Anniversary Celebration [

September 26, 2019

The IGOT team was invited to share IGOT's work at the IGHS 20th Anniversary celebration. Nico Lee, MD, Michael Terry, MD, Nae Won, and the Orthotics and Prosthetics team discussed the importance of musculoskeletal care in LMIC with the global health community.



Dr. Theodore Miclau

Sept. 23, 2019

The UCSF Department of Orthopaedic Surgery is pleased to announce that Theodore Miclau III, MD, has been appointed as the Orthopaedic Trauma Institute International Chair.

As Chair, Dr. Miclau will continue to support the research, teaching and clinical activities related to international orthopaedic trauma activities for the UCSF Department of Orthopaedic Surgery at the Priscilla Chan and Mark Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG).

"Dr. Miclau exemplifies the department's commitment to medical education in developing countries," said Thomas P. Vail, MD, chair of the UCSF Department of Orthopaedic Surgery. "The endowed chair allows for extra funds to support and strengthen Dr. Miclau's mission in developing the department's international program."



September 19, 2019

Gerald Oguzie, MD, is a faculty and co-director of the Ghana Chapter of the American College of Surgeons (ACS) Advanced Trauma Life Support (ATLS) program. He participated in the IGOT SMART course, after which he did a clinical observership at the San Francisco General Hospital.



Learners and Dr. Michael Terry at the annual San Francisco SMART course (lab session).

September 16, 2019

IGOT's 10th Annual San Francisco SMART course and the Limb Salvage and Complex Wound Management Symposium pre-course geared towards Bay Area regional providers.

The San Francisco Surgical Management and Reconstructive Training (SMART) was attended by 51 participants from 25 countries.



Resident, Heather Roberts, in Ghana for global elective rotation and research project

September 13, 2019

Heather Roberts, MD, a PGY4 Research Resident, will be working with IGOT on several research projects, including one she is leading called the Ghana Open Tibia study. This month, Dr. Roberts visited the orthopedics department at Komfo Anokye Teaching Hospital in Kumasi, Ghana, to set up a new prospective study looking at the socioeconomic effects of open tibia fractures. She also spent time with the orthopedic teams, attending morning conferences, assisting in cases, and going to the clinic.



Dr. Mona Dini shows how to cast to a pre-course participant.

September 14, 2019

IGOT hosted the annual Limb Salvage & Complex Wound Management Symposium on September 14th. The symposium began with several presentations on various wound management topics given by UCSF faculty. The lectures were followed by three workshops: sawbones station, fracture fixation techniques lab, and casting. Special thank you to Drs. Dini, Parks, Hansen, Vartanian, Nguyen, Shearer, Murphy, and Coughlin for volunteering their time for the symposium.



Dr. Brian Feeley

Aug. 29, 2019

UCSF Department of Orthopaedic Surgery appoints Brian T. Feeley, MD, as Section Chief, Division of Sports Medicine and Shoulder Surgery

Brian T. Feeley, MD, an orthopaedic surgeon within the UCSF Department of Orthopaedic Surgery, has been named Section Chief of the Division of Sports Medicine and Shoulder Surgery.

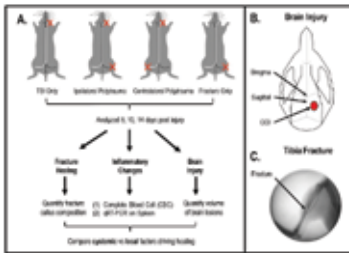


Figure 1. Experimental design overview of traumatic brain injury (TBI) with concomitant tibia fracture. Schematic of experimental design and protocol is described in Materials and Methods. (A) The TBI only group included TBI without tibia fracture, the ipsilateral polytrauma group included TBI with ipsilateral tibia fracture, the contralateral

polytrauma group included TBI with contralateral tibia fracture, and the fracture only group included tibia fracture without TBI. All assessments were performed at three time points, 5, 10, and 14 days post-injury (n = 5–6/group). (B) The diagram of craniotomy site for TBI. (C) The representative radiographic image of closed transverse tibia shaft fracture.

August 21, 2019

Nature magazine

“Differential fracture response to traumatic brain injury suggests dominance of neuroinflammatory response in polytrauma.”

OTI Co-authors: Daniel R. Clark, Ralph S. Marcucio, Theodore Miclau III, Chelsea S. Bahney.



August 12, 2019

News: “3D Printing’s Future in Orthopedics” features Department

The UCSF Dept. of Orthopaedic Surgery was recently featured in the publication MedTech Strategist on in an opinion piece on the future of 3D printing, “3D Printing’s Future in Orthopedics: The Who, What, When, Where, and Why.” Salvage and Complex Wound Management Symposium pre-course geared towards Bay Area regional providers.

The San Francisco Surgical Management and Reconstructive Training (SMART) was attended by 51 participants from 25 countries.



Dr. Amir Matityahu, teaching at the Eldoret MTRH Pelvis course hosted at St Luke's Hospital. fracture.

August 7, 2019

Amir Matityahu, MD, instructed the Eldoret MTRH Pelvis course hosted at St Luke's Hospital. Attended by 30 participants from all over Kenya and Uganda, the course included lectures and live surgery.



Aug. 1, 2019

Drew Lansdown, MD, receives 2019 American Orthopaedic Society for Sports Medicine's Young Investigator Award

The award, in the amount of a \$50,000 grant to be used to finance Dr. Lansdown's research and will support his project: The relationship between ACL grant quantitative imaging characteristics and subjective and functional outcomes after ACL reconstruction.



Aug. 2019

UCSF Chancellor's Postdoctoral Fellowship Program

The UCSF Chancellor's Postdoctoral Fellowship Program offers postdoctoral research fellowships and faculty mentoring to outstanding scholars in all fields whose research, teaching, and service contribute to diversity and equal opportunity at the University of California. The contributions to diversity may include public service towards increasing equitable access in fields where women and minorities are under-represented. In some fields, the contributions may include research focusing on underserved populations or understanding inequalities related to race, gender, disability or LGBT issues.



Kevin Chu with three of IGOT's Muhimbili Orthopaedic Institute Research Coordinators

August 5, 2019

IGOT's McClellan Research Fellow, Claire Donnelley, and UCSF 3rd year medical student, Jordan Holler, attended the Western Orthopaedic Association conference at the end of July in Monterrey Bay, California. They gave presentations on: Surgical Drains after Long Bone Fractures: A Randomized Controlled Trial, Inadequate Soft-Tissue Coverage Following Open Tibia Fractures in Tanzania, Predicting Reoperation and Quality of Life after Open Tibia Fractures, Predicting Loss to Follow-Up after Lower Extremity Fractures, Prostheses Impact Amputee Quality of Life and Function in Tanzania, and Predictors of Changing Surgeon for Subsequent Elective Total Joint Replacement.

Osseointegration patient Carol Davis meets with Matthew Garibaldi, MS, CPO, director of the UCSF Orthotic and Prosthetic Centers, at the UCSF Orthopaedic Institute at Mission Bay in San Francisco. Photo by Barbara Ries



July 30, 2019

U.S. News: UCSF Orthopaedics ranks No. 4 in nation

UCSF Medical Center has been recognized among the nation's elite hospitals in U.S. News & World Report's 2019-2020 Best Hospitals survey, marking the 21st year that UCSF Health has been listed among the top 10 hospitals in the prestigious listings and best in Northern California.



Dr. Nicole Schroeder

July 1, 2019

Beginning July 1, 2019, Nicole Schroeder, MD., an associate professor of orthopaedic surgery, will serve as interim chief of the UCSF Department of Orthopaedic Surgery's Division of Hand, Elbow and Upper Extremity Surgery, a team of orthopaedic specialists who work with adult and pediatric patients to treat all bone and soft-tissue conditions of the hand, elbow and upper extremity.

"Dr. Schroeder brings a wealth of leadership experience to her team," said Thomas P. Vail, MD, Chair of the department. "She currently serves as both the Director of the Orthopaedic Hand Service at Zuckerberg San Francisco General Hospital and Associate Residency Director of the UCSF Orthopaedic Resident Education Curriculum. We congratulate her on taking this new leadership role."

During her interim appointment, Dr. Schroeder will chair the search committee for the new section chief.



Dr. David Shearer at the Yale University grand round

June 21, 2019

IGOT's Co-Director of Research, David Shearer, MD, was invited to present at the Yale University Department of Orthopaedics and Rehabilitation Grand Rounds. He shared with Yale's residents and faculty about IGOT and orthopaedics in low-and-middle-income countries.



Resident Jeff Mulvihill within Tanzania.

June 23, 2019

Jeffrey Mulvihill, MD, our PGY 4, is in Tanzania working with the Muhimbili Orthopaedic Institute (MOI) faculty and residents on several trauma cases. He had the opportunity to present to the MOI department about general arthroplasty principles, techniques, and technology. Dr. Mulvihill will also give a talk to the first-year residents on the gait cycle. "They have a very high trauma volume and do a great job fixing up severely injured patients. There is an increasing volume of arthroplasty cases. I've scrubbed a lot of hip and knee replacements with Dr. Billy Haonga. The local residents are very interested in these cases. A couple of them have thought of research ideas during our conversations in the OR. Overall I'm very happy to have traveled out here."



IGOT's published research study, "The Burden of Femoral Shaft Fractures in Tanzania."

June 10, 2019

One of IGOT's Global Research Initiative projects, "The Burden of Femoral Shaft Fractures in Tanzania," was published in the Injury Journal by Elsevier this past month. Dr. Devin Conway, Patrick Albright, Drs. Billy Haonga and Edmund Eliezer from MOI, and Drs. Saam Morshed and David Shearer were involved with this project. This study describes a novel, cross-sectional study of femur shaft fracture incidence in Tanzania based on empiric data.



Osseointegration patient Carol Davis meets with Matthew Garibaldi, MS, CPO, director of the UCSF Orthotic and Prosthetic Centers, at the UCSF Orthopaedic Institute at Mission Bay in San Francisco. Photo by Barbara Ries

June 2019

UCSF Medical Center has been recognized among the nation's elite hospitals in U.S. News & World Report's 2019-2020 Best Hospitals survey, marking the 21st year that UCSF Health has been listed among the top 10 hospitals in the prestigious listings and best in Northern California.



June 2019

The ARCS Northern California chapter is thrilled to recognize the work of our outstanding scholars for 2019-2020.

Congratulations to Karsyn on receiving the Achievement Rewards for College Scientists (ARCS) Scholarship. Albright, Drs. Billy Haonga and Edmund Eliezer from MOI, and Drs. Saam Morshed and David Shearer were involved with this project. This study describes a novel, cross-sectional study of femur shaft fracture incidence in Tanzania based on empiric data.



Attendees of the 7th Annual Tanzania SMART Course. Dr. Shearer with course participants.

May 30, 2019

The IGOT team just returned from Tanzania after hosting the 7th Annual Tanzania Surgical Management and Training (SMART) course. One hundred and thirty-five participants from over ten countries throughout Central, East, and West Africa attended this four-day conference. The curriculum included didactics, case discussions, surgical simulation lab sessions, and hands-on interactive flap design workshops. Based on their experience and interest, participants chose to attend an advanced flap module, an advanced pelvis and acetabulum module, or a lower extremity

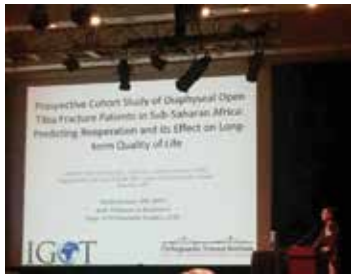
trauma module during the Specialty Day. This year's course also included a pre AO FEP course. Partnering with the AO Alliance in Dar Es Salaam, Tanzania, IGOT taught 16 in-country faculty members presentation and teaching skills at an Educators Course for Orthopaedic surgeons. This course Participants were able to put these learned skills into practice during the actual Tanzania SMART course. A special thank you to Drs. Paymon Rahgozar, Amir Matityahu, Michael Terry, Dave Shearer, Saam Morshed, and Jeremy Bates for volunteering as faculty for this year's course.



May 22, 2019

Study: Inpatient Opioid Use Should Guide Discharge Prescribing in Surgery Patients

In this month's AAOS Now, Trevor Grace, MD, a resident in the UCSF Department of Orthopaedic Surgery, presented the study during the AAOS 2019 Annual Meeting.



Dr. David Shearer presenting at the Inman Abbott

May 10, 2020

IGOT's Co-Director of Global Research, David Shearer, MD, presented results on a prospective cohort study of diaphyseal open tibia fractures in sub-Saharan Africa at the UCSF Inman Abbott Conference. This study was done in collaboration with our Tanzanian partners.

IOTA representatives from Argentina, Brazil, Colombia, Holland, and the US, IGOT surgical education coordinator Madeline MacKechnie, and Dr. Theodore Miclau



April 2019

IGOT collaborated with the International Orthopaedic Association (IOTA), a global association comprised of 17 international orthopaedic trauma organizations. Representatives from Argentina, Brazil, Colombia, the Netherlands, and the US, supported and participated in the Sociedad Colombiana de Cirugía Ortopédica y Traumatología (SCCOT) in Cartagena, Colombia. Madeline MacKechnie, our Surgical Education Coordinator, and Dr. Theodore Miclau III represented IGOT's Latin American initiative, ACTUAR, at this symposium.



UCSF Dept. of Orthopaedic Surgery appoints Erik N. Hansen, MD, as Section Chief, Division of Arthroplasty

April 25, 2019

SAN FRANCISCO – Erik N. Hansen, MD, a hip and knee surgeon within the UCSF Dept. of Orthopaedic Surgery, has been named Section Chief in the Division of Arthroplasty.

In his new role, Dr. Hansen will be responsible for providing the vision and leadership in practice of adult total joint replacement.



Dr. Theodore Miclau

March 14, 2019

Theodore Miclau III, MD, was recently a guest editor for a supplement to OTA International.

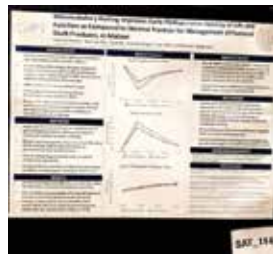
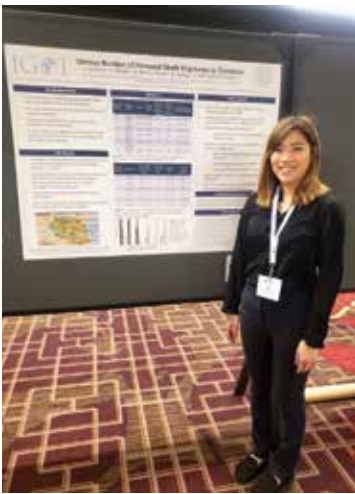


UCSF Dept. of Orthopaedic Surgery appoints Dr. Bobby Tay, MD, as Vice Chair of Quality and Safety

March 6, 2019

SAN FRANCISCO -- The UCSF Dept. of Orthopaedic Surgery is pleased to announce that Dr. Bobby Tay, MD, has accepted the position of Vice Chair of Quality and Safety within the Department.

In his new role, Dr. Tay will provide leadership in the conceptualization, development, implementation and measurement of the Department's approach to quality, patient safety and adverse event reduction. As Vice Chair of Quality and Patient Safety, he will communicate and implement strategic, operational and programmatic plans and policies to achieve the vision of having a culture where patient safety is of the highest priority for clinicians and staff.



Chicago, IL. IGOT Operation Coordinator, Nae Won, presenting the two posters at CUGH.

March 12, 2019

Two of IGOT's research posters were accepted at the 10th Annual Consortium of Universities for Global Health conference in Chicago.



UCSF Department of Orthopaedic Surgery appoints C. Benjamin Ma, MD, as Vice Chair of Adult Clinical Operations

March 4, 2019

The UCSF Department of Orthopaedic Surgery is pleased to announce that Dr. C. Benjamin Ma, MD, has accepted the position of Vice Chair of Adult Clinical Operations within the Department.

In his new role, Dr. Ma will be responsible for providing the vision and leadership in the overall adult clinical operational activities for the orthopaedic surgery department across the health system. As Vice Chair of Adult Clinical Operations, his primary focus will be to advise on the planning and expansion of inpatient and outpatient services in the orthopaedic adult population in cooperation with service chiefs.

in Tanzania, Predicting Reoperation and Quality of Life after Open Tibia Fractures, Predicting Loss to Follow-Up after Lower Extremity Fractures, Prostheses Impact Amputee Quality of Life and Function in Tanzania, and Predictors of Changing Surgeon for Subsequent Elective Total Joint Replacement.



IGOT Portal

March 1, 2019

Introducing the IGOT Learning Portal. The IGOT Learning Portal is an online platform for surgical education that is easily accessible, self-paced, and free. <https://igotportal.org/>



Tamara Alliston, PhD, ORS Women's Leadership Forum Award

Feb. 2019

Each year, the ORS Women's Leadership Forum Award recognizes a woman biologist, clinician, or engineer in our community. In addition to demonstrating leadership and mentorship of colleagues and trainees, the WLF Award recipient has made significant contributions to the understanding of the musculoskeletal system and musculoskeletal diseases and injuries.

The recipient of this year's award is Tamara Alliston, PhD. Since 2006, Dr. Alliston has led her laboratory at the University of California, San Francisco Department of Orthopaedic Surgery. She currently holds the position of Professor in the Department of Orthopaedic Surgery at UCSF, in addition to Adjunct Professor positions in both the Department of Otolaryngology-Head and Neck Surgery, and the Department of Bioengineering and Therapeutic Sciences at UCSF.

Grants and Fellowships



Tamara N. Alliston, PhD

- DOD US Army Med. Res. Acq. Activity W81 A132062

Identification of Novel Osteocyte-Regulatory Therapies to Prevent and Treat PTOA in Warfighters

9/30/2018-9/29/2021

\$999,946

- NIH NIDCR R01 A123992

The Mechanistic Control of Bone Extracellular Matrix Material Properties by TGF β

8/1/2014-7/31/2020

\$2,261,281

- NSF A128025

Mechanoregulation of Growth Factor Receptor Assembly and Signaling

9/1/2016-8/31/2020

\$400,000

- NIH NIAMS R21 A129741

miRNA Coordination of TGF- β / Wnt Signaling in Osteocyte Mechanotransduction

8/1/2017-7/31/2020

\$383,570



Chelsea S. Bahney, PhD

- AO North America, Inc A130659

Validating a Novel Collagen X Bioassay for Accurate Diagnosis of Fracture Healing

8/1/2017-7/31/2019

\$30,000



Ilya Bendich, MD

- UCSF JOJ Ortho Resident Grant

Predictors of a Change in Patient Willingness to Have Total Knee Arthroplasty: Insights from the Osteoarthritis Initiative.

7/1/2018-6/31/2019

\$5,000



Gaby Baylon, PhD

- NIH Diversity Supplement Award

Pairing of osteocyte tension and perilacunar material properties via perilacunar/canalicular remodeling

7/1/18-7/31/20

\$104,941



Sigurd H. Berven, MD

- AO Foundation A123247

Prospective Evaluation of Elderly Deformity Surgery: A Prospective Observational, Multicenter Study, Clinical Trial

7/1/2014-12/31/2021

\$27,645

- Empirical Spine, Inc. A130354

LSS17001

A Concurrently Controlled Study of the LimiFlex™ Paraspinal Tension Band in the Treatment of Lumbar Degenerative Spondylolisthesis with Spinal Stenosis, Clinical Trial

9/26/2017-10/15/2019

\$51,854



Andrew S. Brack, PhD

- NIH NIAMS R56 A131831

Muscle Stem Cell Heterogeneity

9/1/2018-8/31/2019

\$438,603

- NIH NIA R21 A131831

Single cell activation dynamics as a predictor and regulator of aged MuSC dysfunction.

3/15/2019-1/31/2021

\$425,252

- NIH NIAMS R01 A133478

Niche Regulation of Muscle Stem Cells

8/01/2019-5/31/2024

\$2,562,213

- Department of Orthopaedic Surgery, UCSF

Develop a method to study radiotolerance in human muscle stem cells

7/01/2019-6/30/2020

\$25,000



Shane Burch, MD

- Integra LifeSciences Corporation 106548/COV-DRSS-0002 A125223

DuraSeal Exact Spine Sealant System Post Approval Study, Clinical Trial

2/27/2015-2/27/2020

\$48,580

- Misonix, Inc A127141

Comparing Yield of Autologous Bone Graft using Ultrasonic Scalpel with Conventional Techniques, Clinical Trial

3/10/2016-3/10/2019

\$14,169



Patrick F. Curran, MD

• OREF A129158
Intramedullary Kirschner Wire versus Flexible Nail Fixation for Pediatric Femur Fractures
7/1/2017-6/30/2020
\$30,000



Michael Davies, MD

• OREF
Characterizing Human Fibro-Adipogenic Progenitors to Decrease Fatty Infiltration of the Rotator CuffDates?
\$5,000
12/1/2019-11/31/2020



Sibel Demir-Deviren, MD

• Pfizer B3451002 A125917
A Phase 2b, Randomized, Double-Blind, Placebo-Controlled Study to Evaluate the Safety and Efficiency of Staphylococcus Aureus 4-Antigen Vaccine (SA4Ag) in Adults Undergoing Elective Posterior Instrumented Lumbar Spinal, Subcontract, Clinical Trial
9/3/2015-9/3/2022
\$1,996,966

• Nocimed, LLC A128057
Clinical Development and Evaluation of the Nociscan™ Virtual Discogram™ Using Magnetic Resonance Spectroscopy for Identifying Painful and Non-Painful Intervertebral Discs of the Lumbar Spine, Clinical Trial
8/24/2016-12/15/2022
\$1,125,112



Susan T. Eliazzer, PhD

• American Federation for Aging Research (AFAR) A131747
Wnt4 as a Novel Therapeutic for Rejuvenating Muscle Stem Cell Function During Aging
9/1/2018-8/31/2019
\$60,000



Brian T. Feeley, MD

• Zimmer Biomet Holdings, Inc. A130176
IDE 17069
A Multicenter, Double-Blind, Randomized, Saline-Controlled Study of a Single, Intra- Articular Injection of Autologous Protein Solution in Patients with Knee Osteoarthritis, Clinical Trial
10/5/2017-10/4/2022
\$253,581
• Orthofix Inc. A133456
Prospective, Randomized, Double-Blind, Placebo Controlled Study to Evaluate

the Safety and Efficacy of Pulsed

7/8/19-12/31/21
\$491,556
• NIH NIAMS R01 (AR072669)
Utilizing Beige fat to Improve Muscle Function after Rotator Cuff Repair
9/1/18-6/30/23
\$1,770,500



Aaron J. Fields, PhD

• North American Spine Society A131980
Does Enhancing Cartilage Endplate Permeability Improve Nucleus Pulposus Cell Function?
1/1/2019- 12/31/2019
\$50,000
• NIH NIAMS R01 A129156
Role of the Cartilage Endplate in Spinal Disc Degeneration
4/1/2017-1/31/2022
\$1,743,500
• NIH NIAMS UH2 A134016

Novel imaging of endplate biomarkers in chronic low back pain
9/26/2019-8/31/2021
\$1,119,116



Alex Gornitzky, MD

• UCSF JOJ
Ortho Resident Grant
Coping Skills after Pediatric Spine Fusion
7/1/2019-6/31/2020
\$5,000



Erik N. Hansen, MD

• OREF A130350
Surgical Treatment of Chronic Periprosthetic Joint Infection: One-Stage vs. Two-Stage (STUDY), Subcontract, Clinical Trial
11/1/2017- 12/31/2020
\$26,000



Safa T. Herfat, PhD

• NSF 170 1701253
Development of a Diagnostic Device for Monitoring Fracture Healing
8/15/2017-1/31/2019
\$200,000



Devante Horne, PhD Candidate

• Center for Disruptive Musculoskeletal Disorders (CDMI)
Low-intensity Pulsed Ultrasound as a Novel Therapy for Disc Repair and Reduction of Disc Degeneration
10/01/2018 – 09/30/2019
\$40,000



Alfred Kuo, MD, PhD

- Resource Allocation Program (RAP), UCSF Academic Senate

Advanced Ultrasound Techniques for the Evaluation of Total Knee Arthroplasty

1/1/18-7/31/19

\$50,000



Igor Immerman, MD

- Super NOVA Department of Orthopaedic Surgery, UCSF

Patient Outcomes and Costs after Isolated Flexor Tendon Repairs of the Hand

6/1/19-5/31/20

\$10,000



Hubert Kim, MD, PhD

- Medical Device Business Services, Inc. A133722

AO Trauma Basic Principles of Operative Fracture Management Course for Residents

9/5/2019- 9/8/2019

\$2,000

- Medical Device Business Services, Inc. A133724

AO Trauma Basic Principles of Operative Fracture Management Course for Residents

9/5/2019- 9/9/2019

\$2,000



Jeffrey C. Lotz, PhD

- NIH NIAMS U19 A134160

UCSF Core Center for Patient-centric Mechanistic Phenotyping in Chronic Low Back Pain (UCSF REACH)

9/25/2019-5/31/2024

\$29,408,845

- NIH NIAMS P30 A133258

Core Center for Musculoskeletal Biology and Medicine

7/1/2019-6/30/2024

\$3,866,912

- NIH NIAMS R56 A134021

Phenotypes of pathologic vertebral endplate degeneration

9/26/2019-8/31/2020

\$669,247

- NIH NIAMS R01 A127159

Phenotypes of Pathologic Vertebral Endplate Degeneration

6/1/2016-5/31/2019

\$1,358,994

- NIH NIDCR U24 A129002

Center for Dental, Oral, and Craniofacial Tissue and Organ Regeneration (C-DOCTOR)

3/1/2017-2/29/2020

\$11,961,481

- NIH NIAMS P30 A123857

Core Center for Musculoskeletal Biology and Medicine

7/1/2014-6/30/2020

\$ 2,993,910

- National Science Foundation A123593

IIP-1361975

UCRC for Technology Innovation for Novel Cost-Reducing and Quality-Enhancing Musculoskeletal Therapies

4/15/2014-3/31/2020

\$520,500

- NASA Shared Services Center NNX13AM89G A122659

Risk of Intervertebral Disc Damage after Prolonged Space Flight

7/11/2013-7/10/2019

\$435,000

- Orthofix Inc. A120421

Risk of Intervertebral Disc Damage after Prolonged Space Flight

10/24/2012-12/31/2019

\$1,901,338



C. Benjamin Ma, MD

- Samumed, LLC SM04690-OA-08 A131723

A Phase 2, 52 Week, Single Center, Open-Label Study Utilizing Imaging Techniques and Evaluating the Safety and Efficacy of SM04690 Injectable Suspension for the Treatment of Moderately to Severely Symptomatic Knee Osteoarthritis

6/12/2018- 6/12/2023

\$597,996

- Regentis Biomaterials, Ltd A132290

A Prospective, Open-Label, Multicenter Pivotal Study to Evaluate the Safety and Efficacy of GelrinC for the Treatment of Symptomatic Articular Cartilage Defects of the Femoral Condyle: A Comparison to Historical Control Microfracture

10/1/2018- 9/30/2019

\$8,000

- Zimmer, Inc. CIU2012-12E A123542

Multicenter Trial of the Sidus Stem-Free Shoulder Arthroplasty System, Clinical Trial

4/21/2014-4/20/2020

\$170,066

- Arthroscopy Association of North America A125441

Synovial Fluid Profile and T1p in Predicting Cartilage Degeneration after Anterior Cruciate Ligament Injuries

4/25/2015-4/25/2019

\$25,000

- Vanderbilt University Medical Center VUMC63087 A130300

Operative versus Non-Operative Treatment for Atraumatic Rotator Cuff Tears: A Multicenter Randomized Controlled Pragmatic Trial, Subcontract, Clinical Trial

6/1/2017-6/30/2023

\$332,201

- Histogenics Corporation A119412

A Randomized Comparison of NeoCart to Microfracture for the Repair of Articular Cartilage Injuries in the Knee - A Phase III Study

3/15/2012-12/31/2020

\$1,485,759

- Zimmer, Inc. CW47503 A117976

Prospective Post Market Clinical Follow-Up Study of the Zimmer Trabecular Metal-Humeral Stem

6/30/2011-6/15/2024

\$278,800

- Zimmer, Inc. CMU2010-28E A117977

Prospective Post Market Clinical Follow-Up Study of the Zimmer Trabecular Metal-Reverse Shoulder System

6/30/2011-6/15/2024

\$470,460



Ralph S. Marcucio, PhD

- Regents of the University of Michigan R01 AR066028

Regulators of Ischemic Fracture Healing

8/1/2017- 4/30/2020

\$441,853

- NIH NIDCR R21 DE028198

Understanding the Forces that Shape the Face

9/15/2018- 8/31/2020

\$ 443,098

- NIH NIDCR R01 DE019638

The Role of Continuous Phenotypic Variation in Structural Defects of the Face

1/1/2016-12/31/2020

\$ 2,280,717

- Sub-In Calgary, CIHR Prime

The Development and Genetics of the Face

7/1/2018-6/30/2025

\$510,805

- Sub-Contract UC Davis

Craniofacial defects in the manta-ray line. A novel model for ribosomopathies

1/1/2015-12/31/2019

\$111,355



Meir Marmor, MD

- Population Health Research Institute

HIP fracture Accelerated Surgical Care and Treatment Track

1/1/2018- 1/31/2025

\$ 60,600



Theodore Miclau, MD

- Johns Hopkins University - DOD US Army Med. Res. Acq. Activity 2002015246

METRC 2 – Major Extremity Trauma Research Consortium

9/29/2012-8/31/2021

\$135,550

- Johns Hopkins University - DOD US Army Med. Res. Acq. W81XWH-10-2-0133

Task Order: A Prospective Randomized Trial to Assess PO versus IV Antibiotics for the Early Post-op Wound Infection after Extremity Fractures (POvIV)

9/29/2012-8/31/2021

\$18,700

- Johns Hopkins University - NIH NIAMS R01 AR064066-01

Streamlining Trauma Research Evaluation with Advanced Measurement (STREAM Study)

3/1/2013- 9/30/21

\$10,000

- Johns Hopkins University - DOD US Army Med. Res. Acq. W81XWH-12-1-0588

Task Order: Supplemental Perioperative Oxygen to Reduce Surgical Site Infection After High Energy Fracture Surgery (Oxygen)

3/1/2013- 9/30/21

\$13,600

- NIH NIAMS R01AR072707 P0521315

Mechanisms of Skeletal Stem Cell Dysfunctions in Traumatic Bone Injuries

7/12/2018- 4/30/2023

\$ 1,514,183

- Samuel Merritt University

Agreement for Training for Academic Purposes

6/1/2018- 5/31/2019

\$ 24,000



Saam Morshed, MD, PhD, MPH

- DOD US Army Med. Res. Acq. Activity W81XWH-14-1-0563

Prosthetic Fit Assessment in Transtibial Amputees Secondary to Trauma (ProFit)

9/30/2014-9/29/2020

\$628,030

- McMaster University

Fixation using Alternative Implants for the Treatment of Hip Fractures (FAITH-2), Clinical Trial

3/1/2015-3/31/2023

\$1,172

- Microbion Corporation

MBN-101-201: A Phase 2a Randomized, Single-Blind, Placebo-Controlled, 24-week Escalating Dose Study to Assess the Safety, Tolerability and Clinical Activity of 3 Concentrations of Locally Applied MBN-101 to Infected Osteosynthesis

Site, Clinical Trial

8/8/2016-8/8/2021

\$245,891

- University of Maryland, Baltimore

Aqueous-PREP: A Pragmatic Randomized trial Evaluating Pre-operative aqueous antiseptic skin solutions in open fractures

9/30/2018-9/29/2019

\$60,800

- Department of Orthopaedic Surgery, UCSF

Longitudinal comparison of outcomes and cost-effectiveness of intramedullary nailing versus external fixation for the treatment of open tibial fractures in Tanzania

06/01/2019-05/31/2020

\$25,000



An Nguyen, PhD

- NIH NIDCR F30 A129994

Mesenchyme-Dependent Epithelial Signals that Promote Osteogenesis in the Jaw

9/1/2017-8/31/2021

\$177,211



Richard J. O'Donnell, MD

- DARPA 15-05-OpenBAA-FP-014 A131341

Providing Intuitive Prosthetic Movement and Sensation using Residual Nerve Endings to Neurotize Regenerative Muscle Grafts

11/13/2017- 6/30/2020

\$389,314

- DARPA W911NF-17-2-0043 A129870

An Osseointegrated Transfemoral Prosthesis Offering Long-Term Bi-Directional Efferent-Afferent Neural Transmission

3/15/2017-6/30/2020

\$1,114,218

• DoD USAMRMC
W81XWH-17-2-0060 A130749

*Transfemoral Amputee
Osseointegration Study
(TFAOS)*

10/1/2017-9/30/2022

\$4,087,368

• DoD USAMRMC W81XWH-
17R-BAA1 A133886

*An Osseo-Neural Transtibial
Prosthesis with Efferent-
Afferent Neural Control*

5/1/19-4/30/2022

\$308,482



Nirav Pandya, MD

• Pediatric Orthopaedic Soc of
No America A131532

*The Impact of Patient
Education in the Pre-Operative
Holding on Post-Operative
Opioid in Elective Pediatric
Orthopedic Surgery Cases*

6/1/2018- 5/31/2020

\$1,000



Heather A. Richbourg, PhD

• NIH NIDCR F32 A132192

*Mechanisms of Shape
Variation in a Mouse Model of
Craniofacial Birth Defects*

9/1/2018-8/31/2021

\$181,266



Heather Roberts, MD

• UCSF JOJ
Ortho Resident Grant

*Predictors of quality of life and
economic impact after open
tibial shaft fractures in Ghana*

7/1/2019-6/31/2020

\$5,000

• CTSI Resident Grant

*Predictors of quality of life and
economic impact after open
tibial shaft fractures in Ghana*

6/27/2019-6/30/2020

\$4,000

• AO Trauma North America
grant

*Predictors of quality of life and
economic impact after open
tibial shaft fractures in Ghana*

10/7/2019-6/30-2021

\$10,000

• AO Alliance

*Predictors of quality of life and
economic impact after open
tibial shaft fractures in Ghana*

10/22/19

\$10,000

• OREF

*Epidemiology, outcomes, and
cost of revision total hip and
knee arthroplasty*

3/15/2019-3/31/2020

\$5,000



Caitlin Rugg, MD

• OREF A131156

*Single Sport Specialization and
the Collegiate Athlete*

2/15/2018- 1/14/2019

\$5,000



Coleen S. Sabatini, MD, MPH

• Pediatric Orthopaedic
Society of Northern America
A127489

*Post-Injection Injury
in Ugandan Children:
Prevalence, Risk Factors,
Surgical Outcomes*

6/1/2016-5/31/20

\$30,000

• Ruth Jackson Orthopaedic
Society A132501

*Vascularized Fibula Flaps
for the Reconstruction of
Segmental Bone Defects
Secondary to Osteomyelitis in
Children*

1/1/2019-12/31/19

\$30,000



Aenor J. Sawyer, MD, MS

• NASA Headquarters
A132254

*UCSF/TRISH Space Health
Innovation Program*

10/1/2018- 9/30/2021

\$1,950,979



Richard A. Schneider, PhD

• NIH NIDCR R01 A125490

*Mesenchymal Regulation of
Osteogenesis*

7/1/2015-5/31/2020

\$2,072,560

• NIH Office of the Director
S10 OD021664

*Macro Confocal Microscope
System for Large-Scale
Imaging in Basic and
Translational Biology*

3/1/2016-2/28/2019

\$376,749

• NIH NIDCR R01 DE025668

*Mechanisms of Secondary
Cartilage Induction and
Maintenance in the Jaw*

7/5/2016-6/30/2021

\$1,981,250



Charles Schurman, PhD Candidate

• NIH NIA F31 A133909

*Age-related Control of Bone
Quality by Osteocyte TGF-beta
Signaling*

9/11/2019-9/10/2022

\$111,004

• Bowes Discovery Fellowship
Award

9/12/2018 – 6/16/2021

\$6,000



David Shearer, MD

- Super NOVA Department of Orthopaedic Surgery, UCSF

A Pilot Randomized Controlled Trial to Evaluate Local Antibiotics for Open Tibia Fracture in Tanzania

06/01/2019 – 05/31/2020

\$10,000

- Hellman Grant

A Pilot Randomized Controlled Trial to Evaluate Local Antibiotics for Open Tibia Fracture in Tanzania

06/01/2019 – 05/31/2020

\$50,000



Spenser Smith, PhD

- NIH NIDCR F32 DE027283

The Role of TGF-Beta Signaling and Mmps in Neural Crest Mediated Jaw Bone Remodeling

9/15/2018- 9/14/2021

\$194,774



Bobby Tay, MD

- NuVasive, Inc. A131927

NuVasive Spine Fellowship 2018-2019

8/1/2018-7/31/2019

\$40,000

- NuVasive, Inc. A133100

NuVasive Spine Fellowship 2019-2020

8/1/2019-7/31/2020

\$60,000

- OMeGA Medical Grants Association A133117

UCSF Dept of Orthopaedic Surgery Spine Fellowship 2019-2020

8/1/2019-7/31/2020

\$15,000

- OMeGA Medical Grants Association A131127

OMeGA Spine Fellowship

8/1/2018-7/31/2019

\$21,500

- AOSpine North America, Inc. A129341

AOSpine North America Fellowship Committee (AOSNAFC)

8/1/2017-7/31/2019

\$150,000



Alekos Theologis, MD

- Innovasis, Inc. A132498

A Multi-center, Patient Outcome Registry for a Hydroxyapatite infused PEEK Interbody Fusion Device

9/1/2018-9/19/2021

\$20,000



Hao-Hua Wu, MD

- UCSF JOJ Ortho Resident Grant

Gentamicin for Open Tibia (GO Tibia) Fractures: A double-blinded randomized controlled trial

7/1/2018-6/31/2019

\$5,000



Rosanna L. Wustrack, MD

- Canadian Institutes of Health Research SITE 36 A127607

Prophylactic Antibiotic Regimens in Tumor Surgery (PARITY), Subcontract, Clinical Trial

6/13/2016-3/31/2021

\$7,805

- James O. Johnston Immunotherapy Grant

Studying the Role of Immunotherapy in Treating Sarcomas

1/1/2014-1/1/2020

\$150,000

- UCSF Clinical and Translational Science Institute

Identifying and enhancing the host immune response in adult soft tissue sarcoma 6/1/2018-5/31/2019

\$40,000



Nathan M. Young, PhD

- NSF 133873-5090398

The Developmental Genetic Basis for Evolutionary Variation in the Hominin Shoulder

8/1/2015-7/31/2019

\$48,119



Patricia Zheng, MD

- The Spine Intervention Society A132385

ATLAS - Application to Track Longitudinal outcomes After Spine interventions

8/1/2018- 7/31/2019

\$24,978

- Allergan Foundation A132233

Long-term outcomes of an Integrated Spine Service as compared to standard care for patients with chronic back pain

11/1/2018- 10/31/2019

\$10,000

Research Publications 2019

- Albright, P. D., M. C. MacKechnie, J. H. Jackson, A. Chopra, J. T. Holler, A. Flores Biard, L. G. Padilla Rojas, **S. Morshed, T. Miclau, D. W. Shearer** and M. J. Terry (2019). "Knowledge deficits and barriers to performing soft-tissue coverage procedures: An analysis of participants in an orthopaedic surgical skills training course in Mexico." *OTA International* 2(4).
- Ali, S. H., P. Albright, **S. Morshed**, R. A. Gosselin and **D. W. Shearer** (2019). "Orthopaedic Trauma in Low-resource Settings: Measuring Value." *Journal of orthopaedic trauma* 33: S11-S15.
- Alliston, T.** and A. Schafer (2019). "Bone Quality Sleuths: Uncovering Tissue-Level Mechanisms of Bone Fragility in Human Type 2 Diabetes." *J Bone Miner Res* 34(7): 1189-1190.
- Alves, K., J. N. Katz and **C. S. Sabatini** (2019). "Gluteal Fibrosis and Its Surgical Treatment." *J Bone Joint Surg Am* 101(4): 361-368.
- Amara, D., P. V. Mummaneni, C. P. Ames, **B. Tay, V. Deviren, S. Burch, S. H. Berven** and D. Chou (2019). "Treatment of only the fractional curve for radiculopathy in adult scoliosis: comparison to lower thoracic and upper thoracic fusions." *J Neurosurg Spine*: 1-9.
- Ashouri, J. F., L. Y. Hsu, S. Yu, D. Rychkov, Y. Chen, D. A. Cheng, M. Sirota, **E. Hansen, L. Lattanza**, J. Zikherman and A. Weiss (2019). "Reporters of TCR signaling identify arthritogenic T cells in murine and human autoimmune arthritis." *Proc Natl Acad Sci U S A* 116(37): 18517-18527.
- Baal, J. D., J. S. Pai, W. C. Chen, G. B. Joseph, **R. J. O'Donnell** and T. M. Link (2019). "Factors Associated with Osteoid Osteoma Recurrence after CT-Guided Radiofrequency Ablation." *J Vasc Interv Radiol* 30(5): 744-751.
- Bahney, C. S.**, R. L. Zondervan, P. Allison, **A. Theologis**, J. W. Ashley, J. Ahn, **T. Miclau, R. S. Marcucio** and K. D. Hankenson (2019). "Cellular biology of fracture healing." *J Orthop Res* 37(1): 35-50.
- Bailey, J. F., A. J. Fields**, A. Ballatori, D. Cohen, D. Jain, **D. Coughlin, C. O'Neill, Z. McCormick, M. Han, R. Krug, S. Demir-Deviren** and **J. C. Lotz** (2019). "The Relationship Between Endplate Pathology and Patient-reported Symptoms for Chronic Low Back Pain Depends on Lumbar Paraspinal Muscle Quality." *Spine (Phila Pa 1976)* 44(14): 1010-1017.
- Bailey, J. F.**, R. P. Matthew, S. Seko, **P. Curran, L. Chu, S. H. Berven, V. Deviren, S. Burch** and **J. C. Lotz** (2019). "ISSLS PRIZE IN BIOENGINEERING SCIENCE 2019: biomechanical changes in dynamic sagittal balance and lower limb compensatory strategies following realignment surgery in adult spinal deformity patients." *Eur Spine J* 28(5): 905-913.
- Bailey, J. F.**, S. Shefi, M. Soudack, P. A. Kramer and E. Been (2019). "Development of Pelvic Incidence and Lumbar Lordosis in Children and Adolescents." *Anat Rec (Hoboken)* 302(12): 2132-2139.
- Bailey, J. F.**, C. J. Sparrey, F. M. K. Williams, **P. F. Curran, J. C. Lotz** and P. A. Kramer (2019). "The effect of parity on age-related degenerative changes in sagittal balance." *Spine (Phila Pa 1976)*.
- Bauer, M., **B. T. Feeley** and R. A. Gallo (2019). "Effect of Academic Grade Level on Return to Athletic Competition After Anterior Cruciate Ligament Reconstruction." *J Pediatr Orthop* 39(4): 198-201.
- Beckerman, D., M. Esparza, S. I. Lee, **S. H. Berven**, S. S. Bederman, S. S. Hu, **S. Burch, V. Deviren, B. Tay**, P. V. Mummaneni, D. Chou and C. P. Ames "Cost Analysis of Single-Level Lumbar Fusions." *Global Spine Journal*.
- Beleford, D. T., **M. Diab**, W. F. Qubty, M. J. Malloy, R. K. Long and J. T. Shieh (2019). "Schimke immunosseous dysplasia and management considerations for vascular risks." *Am J Med Genet A* 179(7): 1246-1252.
- Bell, D. R., L. DiStefano, **N. K. Pandya** and T. A. McGuine (2019). "The Public Health Consequences of Sport Specialization." *J Athl Train* 54(10): 1013-1020.
- Bendich, I.**, C. Chung, **K. Hwang, J. Patterson, J. Mulvihill, J. Barry** and **S. Bini** (2019). "Changes in prospectively collected longitudinal patient-generated health data are associated with short-term patient-reported outcomes after total joint arthroplasty: a pilot study." *Arthroplast Today* 5(1): 61-63.
- Bendich, I.**, S. Takemoto, **J. T. Patterson**, A. Monto, T. C. Barber and **A. C. Kuo** (2019). "Preoperative Treatment of Hepatitis C Is Associated With Lower Prosthetic Joint Infection Rates in US Veterans." *J Arthroplasty* 34(7s): S319-S326.e311.
- Berven, S.** (2019). "Advances in Preoperative Planning: When, How and What to Measure." *Operative Techniques in Orthopaedics* 29(2).
- Berven, S.**, M. Baron, **V. Deviren**, S. Glassman, K. Bridwell and K. Verma (2019). "The Assessment of Clinically Significant Differences in Treating Spinal Deformity Using the SRS Questionnaire: What Is the Threshold of Change That Is Meaningful to Patients?" *Int J Spine Surg* 13(2): 153-157.
- Bezci, S. E., B. Werbner, M. Zhou, K. G. Malollari, G. Dordhiac, C. Carraro, A. Streets and **G. D. O'Connell** (2019). "Radial variation in biochemical composition of the bovine caudal intervertebral disc." *JOR Spine* 2(3): e1065.
- Bigouette, J. P., E. C. Owen, B. A. Lantz, R. G. Hoellrich, L. J. Huston, A. K. Haas, **C. R. Allen**, A. F. Anderson, D. E. Cooper, T. M. DeBerardino, W. R. Dunn, B. Mann, K. P. Spindler, M. J. Stuart, R. W. Wright, J. P. Albright, A. Amendola, J. T. Andrich, C. C. Annunziata, R. A. Arciero, B. R. Bach, C. L. Baker, A. R. Bartolozzi, K. M. Baumgarten, J. R. Bechler, J. H. Berg, G. A. Bernas, S. F. Brockmeier, R. H. Brophy, C. A. Bush-Joseph, J. B. Butler, J. D. Campbell, J. L. Carey, J. E. Carpenter, B. J. Cole, J. M. Cooper, C. L. Cox, R. A. Creighton, D. L. Dahm, T. S. David, D. C. Flanigan, R. W. Frederick, T. J. Ganley, E. A. Garofoli, J. C. J. Gatt,

- S. R. Gecha, J. R. Giffin, S. L. Hame, J. A. Hannafin, C. D. Harner, N. L. Harris, K. S. Hechtman, E. B. Hershman, T. M. Hosea, D. C. Johnson, T. S. Johnson, M. H. Jones, C. C. Kaeding, G. V. Kamath, T. E. Klootwyk, B. A. Levy, C. B. Ma, G. P. Maiers, R. G. Marx, M. J. Matava, G. M. Mathien, D. R. McAllister, E. C. McCarty, R. G. McCormack, B. S. Miller, C. W. Nissen, D. F. O'Neill, B. D. Owens, R. D. Parker, M. L. Purnell, A. J. Ramappa, M. A. Rauh, A. C. Rettig, J. K. Sekiya, K. G. Shea, O. H. Sherman, J. R. Slauterbeck, M. V. Smith, J. T. Spang, S. J. Svoboda, T. N. Taft, J. J. Tenuta, E. M. Tingstad, A. F. Vidal, D. G. Viskontas, R. A. White, J. S. Williams, M. L. Wolcott, B. R. Wolf, J. J. York and M. Grp (2019). "Relationship Between Sports Participation After Revision Anterior Cruciate Ligament Reconstruction and 2-Year Patient-Reported Outcome Measures." American Journal of Sports Medicine 47(9): 2056-2066.
- Bini, S. A., R. F. Shah, I. Bendich, J. T. Patterson, K. M. Hwang and M. B. Zaid** (2019). "Machine Learning Algorithms Can Use Wearable Sensor Data to Accurately Predict Six-Week Patient-Reported Outcome Scores Following Joint Replacement in a Prospective Trial." J Arthroplasty 34(10): 2242-2247.
- Bishop, J. Y., K. A. Hidden, G. L. Jones, C. M. Hettrich, B. R. Wolf, K. M. Baumgarten, M. Bollier, J. Bravman, E. C. McCarty, R. H. Brophy, M. V. Smith, R. W. Wright, C. Cox, J. Kuhn, **B. Feely, C. B. Ma, A. Zhang**, J. Grant, B. Miller, R. G. Marx and M. S. Grp (2019). "Factors Influencing Surgeon's Choice of Procedure for Anterior Shoulder Instability: A Multicenter Prospective Cohort Study." Arthroscopy-the Journal of Arthroscopic and Related Surgery 35(7): 2014-2025.
- Bolcos, P. O., M. E. Mononen, M. S. Tanaka, M. Yang, J. S. Suomalainen, M. J. Nissi, J. Toyras, **B. Ma**, X. Li and R. K. Korhonen (2019). "Identification of locations susceptible to osteoarthritis in patients with anterior cruciate ligament reconstruction: Combining knee joint computational modelling with follow-up T1rho and T2 imaging." Clin Biomech (Bristol, Avon).
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