

# Research Report

Highlights in Musculoskeletal Research 2018



**UCSF** Orthopaedic  
Surgery



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Produced by Maryam Farshad,  
with contributions from Kathleen Jay,  
William Yau, Jessica Wong and  
Erin Simon.

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Department of Orthopaedic Surgery  
University of California, San Francisco  
500 Parnassus Avenue, 3rd Floor  
Room MU-320W  
San Francisco, CA 94117  
Phone: (415) 476-1166  
Fax: 476-1304

[orthosurgery.ucsf.edu](http://orthosurgery.ucsf.edu)

**UCSF** Orthopaedic  
Surgery





## Message from the Chair of the UCSF Department of Orthopaedic Surgery

### **Dear colleagues and friends,**

The year 2018 marks another year of remarkable growth, achievements and success by our researchers.

On the university level, it is with great pride to share that UC San Francisco was the top public recipient of funding from the National Institutes of Health (NIH) in 2018, the 12th year in a row that the University as a whole claimed the top spot among public institutions.

On a department level, the UCSF Department of Orthopaedic Surgery surpassed our all time high funding mark and ranked No. 2 in the nation by NIH in funding for musculoskeletal research (Source: Blue Ridge Institute for Medical Research).

The Department received \$8,406,993 in peer-reviewed NIH research grants, highly competitive funds that are aimed at supporting UCSF scientists in their efforts to understand the causes of, and potential treatments for, musculoskeletal diseases as well as training the next generation of researchers. Over the last two years, the Department has increased its NIH funding by nearly 50 percent; moreover, since 2013, we have consistently ranked among the top five NIH-funded musculoskeletal research programs in the country. Support includes individual research grants, program grants, and funding for training.

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 the opportunity to continue devising and applying innovative new avenues to solve fundamental problems afflicting the musculoskeletal system. To this end, we welcome all new support and investment toward our efforts.

With an incredible track record of innovative investigation, 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 engaging, encouraging, and supporting our investigators, trainees, staff, and the entire research enterprise throughout 2019!

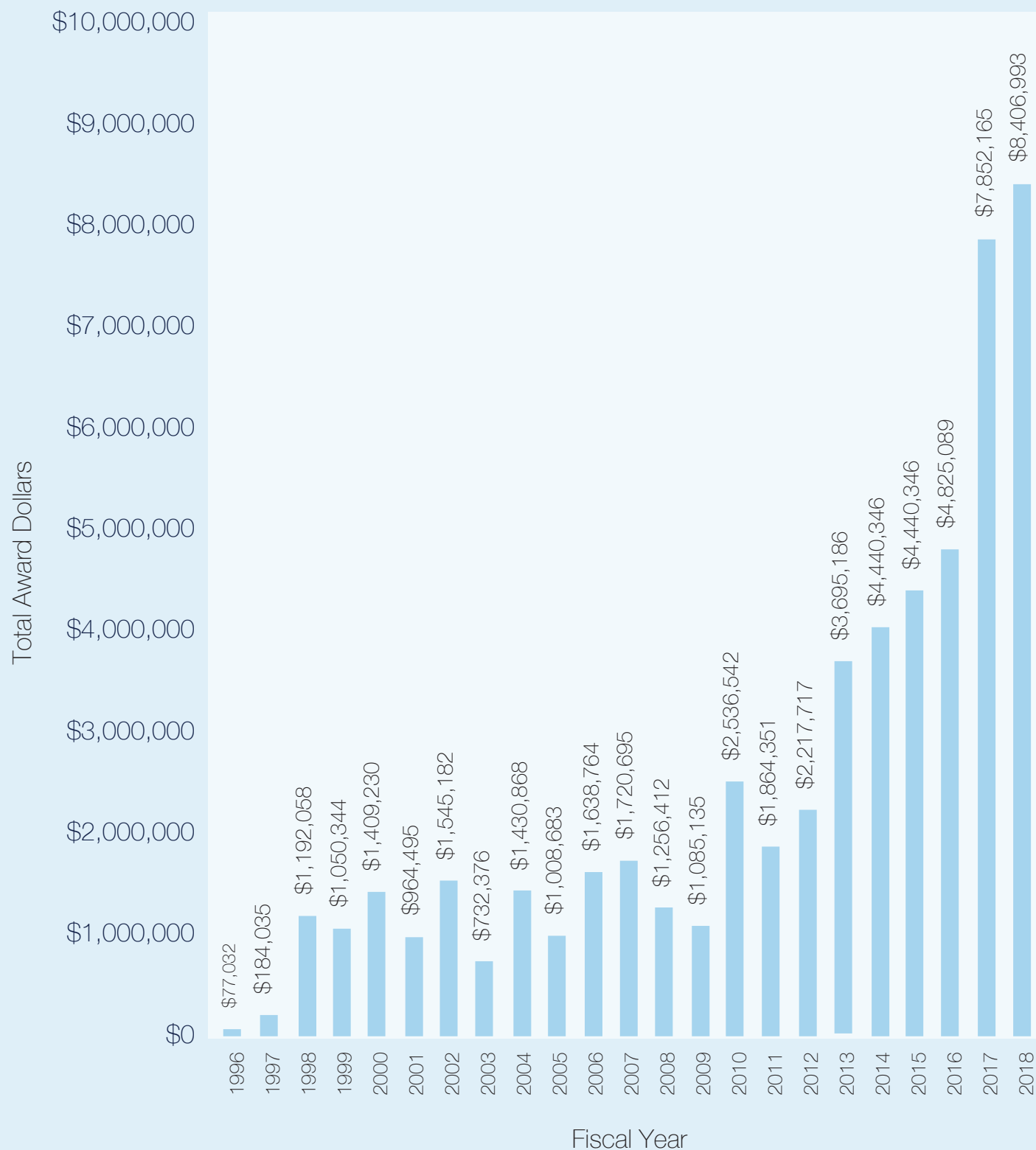
Best wishes,

A handwritten signature in black ink, appearing to read 'P. Vail'.

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



Mohamed Habib, PhD, performs musculoskeletal research in the Lotz Laboratory for Orthopaedic Tissue Engineering and Regeneration on 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), the 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 the American Academy of Orthopaedic Surgeons (AAOS), the Orthopaedic Research Society (ORS), the American Orthopaedic Society in Sports Medicine (AOSSM), the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS), the Hip and Knee Society, and the Orthopaedic Trauma Association (OTA), among other national and international meetings. For a full list of our departmental contributions to the 2019 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

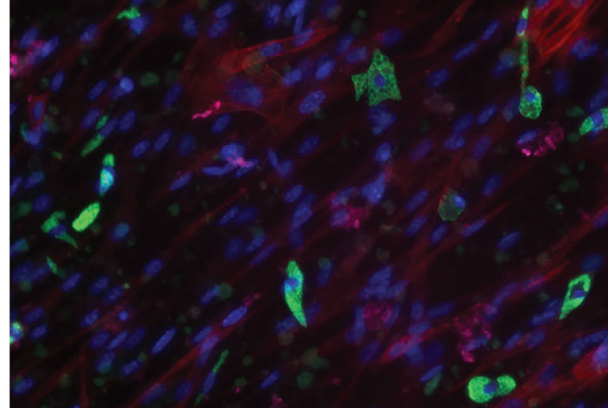
### UCSF VA Health Center, Research Facility at Mission Bay

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 3D printing of Precision Anatomic Models for surgical pre-operative planning and conducting the research to assess the efficacy and economics of the technology.

As a result of their work, **Alexis Dang, MD** and **Alan Dang, MD** won the San Francisco Federal Executive Board, Federal Employee of the Year award in **Science & Technology** related to 3D printing in orthopaedics. 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.

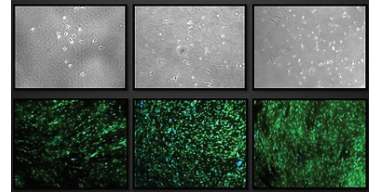


Edge Innovation Laboratory is led by **Aenor Sawyer, MD, MD**, **Alexis Dang, MD**, and **Alan Dang, MD**.

Additionally, this group has spearheaded a multidisciplinary initiative with the Pediatric Heart group 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 to date.

## Stem Cell Laboratory

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



Human muscle stem cells and regeneration (Brack Laboratory for Skeletal Muscle Regeneration and Aging)

The Stem Cell Laboratory is directed by **Andrew Brack, PhD** and focuses on the molecular pathways that control cell fate decisions of the adult muscle stem cell (the satellite cell) to effectively regenerate adult skeletal muscle.

In uninjured muscle, the rare satellite cells are in a functionally dormant, quiescent state. Upon an injury stimulus, these cells proliferate and their progeny will either differentiate to form new muscle fibers or undergo self-renewal to replenish the stem cell pool.

The Brack lab believes that the temporally coordinated cell fate decisions of the stem cell and its progeny are reliant on communication between the local environment (the muscle stem cell niche) and the stem cell itself. They are using cre/lox gene recombination and genetic knock in technology to deconstruct the communication between the niche and the muscle stem cell to investigate the cell fate decision making process during

regeneration. In the future, the Brack lab hopes this will lead to strategies that improve stem cell-based therapies targeting aging and muscle disease.

Additionally, **Andrew Brack, PhD** has developed collaborations with several clinical faculty including the sports medicine group. Active projects include studies of quiescence and self-renewal, stem cell niche (the microenvironment that maintains 'stemness'), satellite cell heterogeneity, aging, and human muscle stem cells and regeneration.

## Skeletal Mechanobiology

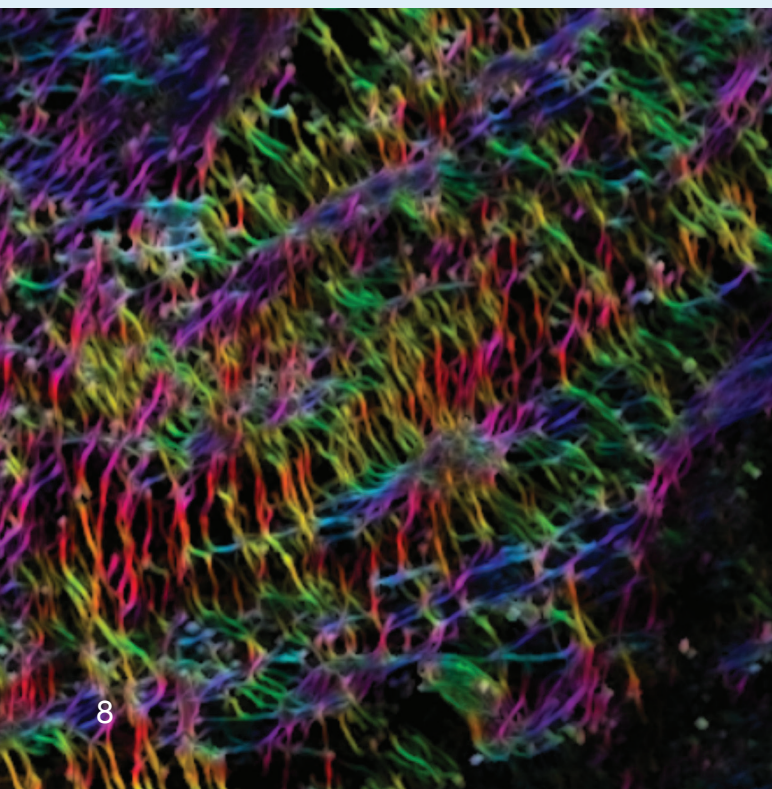
UCSF Parnassus Heights

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 disease.

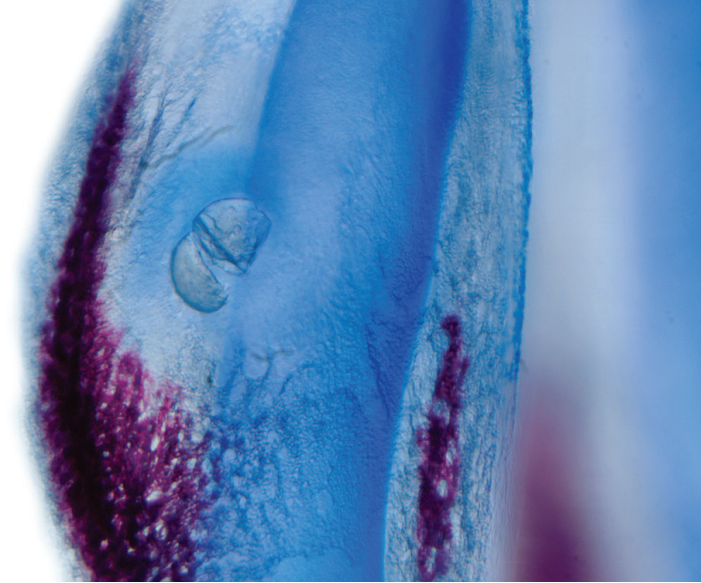
In particular, the research focuses on defining the function of TGF $\beta$  in synergistically coordinating physical and biochemical cues to regulate skeletal cell differentiation. To answer these questions they combine molecular, cellular, physiologic, and materials science approaches. Ultimately, this interdisciplinary approach will lead to the identification of targets to prevent skeletal disease or to improve skeletal repair.

TGF $\beta$  is a powerful regulator of homeostasis in skeletal cells and tissues. **Tamara Alliston, PhD** early work identified a transcriptional mechanism by which TGF $\beta$  inhibits osteoblast differentiation. Specifically, the TGF $\beta$  effector Smad3 recruits histone deacetylases to repress transactivation by the osteogenic transcription factor Runx2. This work provided a foundation for understanding mechanisms by which TGF $\beta$  regulates bone and cartilage development and homeostasis. In the clinical realm, they were the first to demonstrate the beneficial effects of pharmacologic TGF $\beta$  inhibition on bone mass and quality, which result from anabolic and anticatabolic effects. Similar molecules are currently in clinical trials for the treatment of bone fragility in osteogenesis imperfecta.



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





Developing skeleton (cartilage stained blue and bone stained red) of a paralyzed duck embryo showing induction of secondary cartilage following delivery of beads soaked in proteins from the Transforming Growth Factor Beta and Fibroblast Growth Factor families (Schneider Laboratory for Developmental and Evolutionary Skeletal Biology).

## Development and Evolutionary Skeletal Biology

UCSF Parnassus Heights

The 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 challenges 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 birth defects, disease, and injury. Work from the Schneider Lab has also helped elucidate the role of development in evolution.

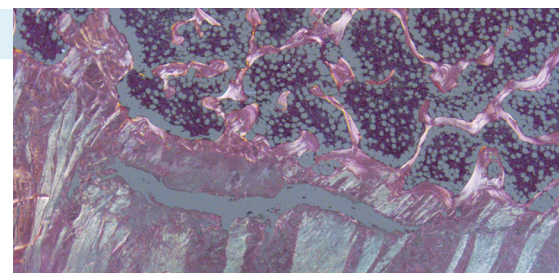
## Orthopaedic Tissue Engineering and Regeneration

UCSF Parnassus Heights

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

The major focus of the lab 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 functional performance of MSK patients.

Additionally, the lab 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 flight,

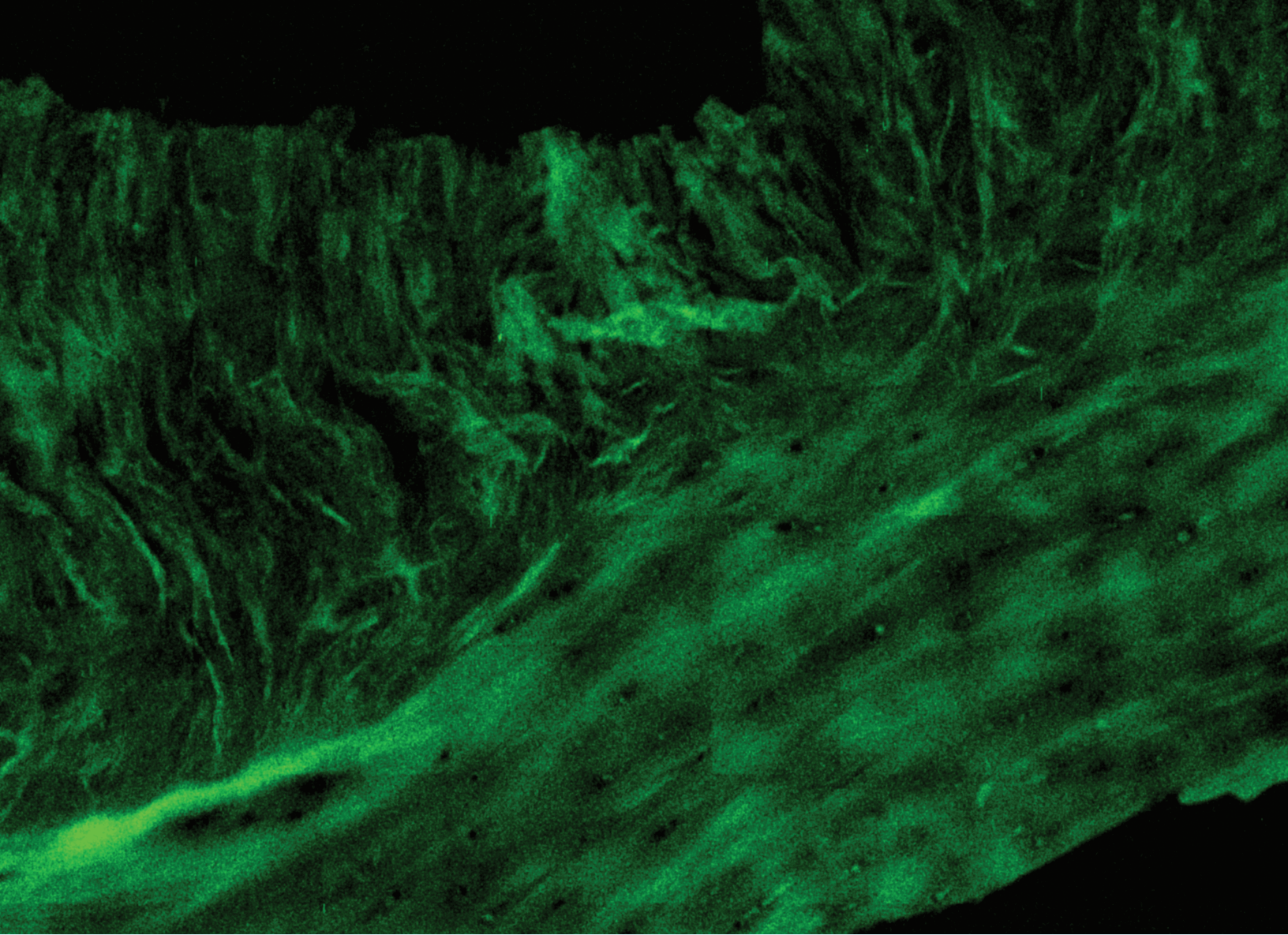


The Lotz Laboratory has pioneered biomechanical, anatomic, and imaging studies of the human disc/vertebra interface (Lotz Laboratory for Orthopaedic Tissue Engineering and Regeneration).

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 research involves 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

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

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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 microscale 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) discovering the nanoscale and microscale contributions to diabetic skeletal fragility; and (3) understanding the role of open muscle dissection in segmental kyphosis following adult spinal reconstruction in collaboration with **Lionel Metz, MD**.



## Skeletal Regeneration/Molecular and Cellular Biology

Zuckerberg San Francisco General Hospital (ZSFGH)

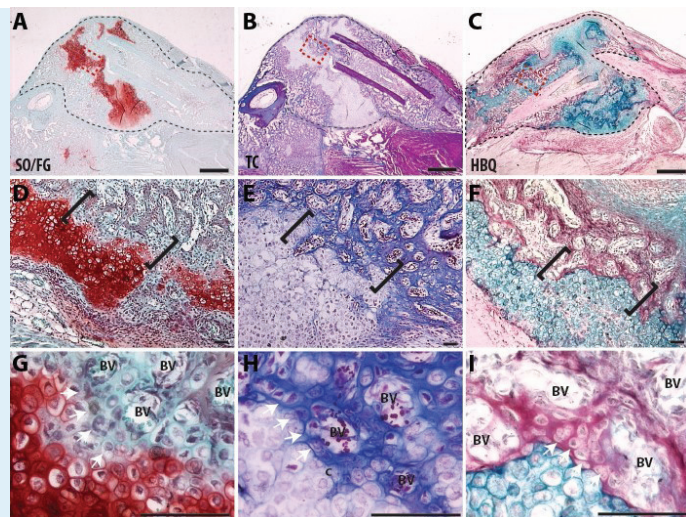
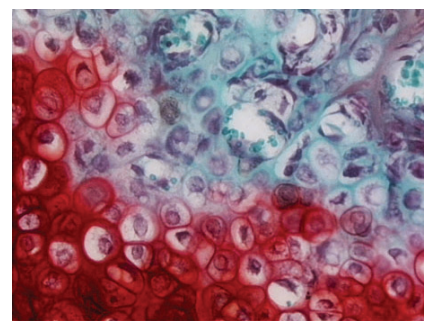
The Molecular and Cellular Biology Laboratory is directed by **Ralph Marcucio, PhD**, and **Ted Miclau, MD**.

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 percent 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 fracture callus (Bahney laboratory for 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.



Safa Herfat, PhD leads the testing facility at the Orthopaedic Trauma Institute (OTI) and the Orthotics and Prosthetics (O&P) clinic.

## 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.

Riley Knox, OTI Biomechanical Engineer, recently completed several studies including: (1) the mechanical evaluation of novel 3D printed spine cage designs using finite element analysis; (2) the biomechanical comparison of fiberglass casts and 3D printed ventilated casts; and (3) the influence of mini-fragment plates on the mechanical properties of long-bone fracture fixation.

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 also collaborates with other UCSF and UC Berkeley labs on an NSF grant funded project aiming to develop an implantable sensor to monitor fracture healing.

## Laboratory for Evolutionary Anatomy

Zuckerberg San Francisco General Hospital (ZSFGH)

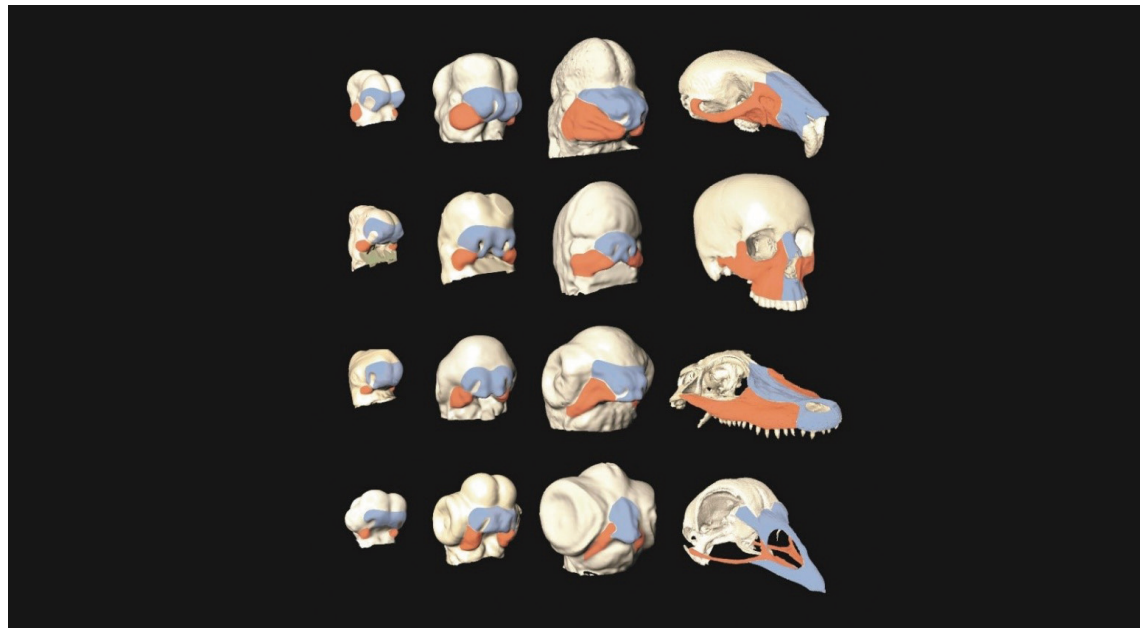
The Laboratory for Evolutionary Anatomy is directed by **Nathan Young, PhD.**

The Young Laboratory addresses biomedical basic 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 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. 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)





# **The Orthopaedic Trauma Institute (OTI) Clinical Research Center**

## **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 partnership. Led by David Shearer, MD, MPH and Saam Morshed, MD, MPH, PhD, the GRI is among the leading centers in the country actively conducting prospective research in the field of orthopaedic surgery in low-resource settings. The principal partners include academic centers in Tanzania, Malawi, Uganda, and Latin America.

IGOT global research sites include:

### **Tanzania- Intramedullary Nailing Versus External Fixation for Open Tibia Fractures Randomized Controlled Trial**

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 definitive treatment for open tibia fractures in Tanzania. The study has enrolled and randomized 240 patients and achieved greater than 90 percent 1 year follow up. The study is currently conducting final data analysis, and anticipate publication in the near future.

### **Tanzania - Cost-effectiveness of Prosthetics for Above Knee Amputees**

Many amputees in low-income countries do not receive a prosthesis due to the high cost and failure of most governments to fund prosthetic programs. As a result, they suffer from severe disability and are limited to use of crutches or a wheelchair in most cases. In collaboration with Legworks, a local prosthetics company ([www.Legworks.com](http://www.Legworks.com)), IGOT is conducting a prospective study to assess the cost and benefit of a prosthesis for above knee amputees. The belief is that this data will create a compelling case to advocate 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, titanium flexible 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 titanium flexible 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.

### **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 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 1 year of nearly 90 percent, 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 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 percent follow up at 16 weeks.

### **Latin America- ACTUAR Open Tibia Study**

Theodore Miclau, MD, Vice Chairman and Director of Orthopaedic Trauma of the Department of Orthopaedic Surgery at UCSF, fostered international partnerships in Latin America. There is 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 an 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.

## 2018 Research Programs and Activities

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

ACTUAR held its 2nd Annual Research Symposium on October 26-27 in Mérida, Mexico at the Federación Mexicana de Colegios de Ortopedia y Traumatología. ACTUAR is the product of a group of orthopaedic surgeons interested in a collaborative initiative focused on building research capacity across institutions. Theodore Miclau, MD Professor and Vice Chair, Director of Orthopaedic Trauma at UCSF, and organizing faculty, David Shearer MD, MPH and Nicolas Lee, MD travelled to Mexico to represent ACTUAR, IGOT, and OTI at the Federación Mexicana de Colegios de Ortopedia y Traumatología at the XXIX Congress.

### San Francisco SMART Course Research Symposium

IGOT's flagship course, the San Francisco SMART Course, wrapped up with a half-day clinical research symposium to 30 course participants, aimed to address research methods that are relevant to the attendees' local communities and that can be applied to their patient populations.

### Tanzanian Research Partner

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 award was presented to him by **Richard Coughlin MD**, Dr. Maily, and the OTA president, Dr. Dave Teague. In addition, IGOT sponsored 3 additional Tanzanian Research Coordinators to attend the Orthopaedic Trauma Association to provide exposure to additional research training.



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

### Cuba Clinical Research Symposium

IGOT partnered with the Cuban Ministry of Health to deliver a Cuba Clinical Research Symposium, which took place in Havana, Cuba. More than 140 attendees participated in the two-day symposium. Visiting faculty from the University of California, San Francisco, the University of Maryland, and McMaster University in Canada, led panel discussions and gave presentations to the group.

### Research Publications

The IGOT team and the Orthopaedic Trauma Institute (OTI) were awarded the opportunity to publish over ten articles in the high-impact Journal of Orthopaedic Trauma (JOT) Supplement. This publication, a product of contribution from over 160 people, builds collective knowledge in the field of global health to advance the global dialogue around strengthening health workforce capacity, promoting sustainable global partnerships, and supporting future research. <https://journals.lww.com/jorthotrauma/pages/default.aspx>

### Grants and Fellowships

The 2018-2019 IGOT Morgan and Madison McClellan International Research Fellow, Patrick Albright, is involved with multiple research projects with IGOT, including a randomized control trial in Tanzania and helping establish a prospective Open Tibia multi-center study across Latin America. Patrick chose to join the IGOT team because he "developed a strong interest in the important role that orthopaedics plays in global health. Through IGOT, I can focus my research efforts on identifying barriers to orthopaedic care in lower- and middle-income countries and developing sustainable solutions to building orthopaedic surgical capacity."





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

### 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.

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

For more information about various research opportunities, please contact the clinical research manager, Tigist Belaye ([tigist.belaye@ucsf.edu](mailto:tigist.belaye@ucsf.edu)).

#### 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 a 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. They 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 aims 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 post-operative deep 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

## **Hip Fracture Accelerated Surgical Treatment and Case Track (HIP ATTACK) Trial**

Site Co-Investigator: Meir Marmor, MD

This international multi-center randomized clinical trial aims to determine the effect of accelerated medical clearance and accelerated surgery compared to standard care on the 30-day risk of major perioperative complications in patients who have suffered a low-energy hip fracture. Total mortality and nonfatal complications will be assessed at 1 year after randomization.

Sponsor: Population Health Research Institute (PHRI)

## **The ‘Delta Well-Leg’ Compartment Pressure– A New Objective Measurement for the Diagnosis of Compartment Syndrome**

Principal Investigators: Krishn Khanna, MD and Saam Morshed MD, MPH, PhD

This is a prospective cross-sectional study designed to determine whether the difference between compartment pressures in the injured and uninjured leg (‘delta well-leg’) is a reliable diagnostic tool in diagnosing compartment syndrome in acute tibia fractures. This specifically aims to validate the ‘delta well-leg’ against the current standard ‘delta P’ as a diagnostic measure and develop threshold values for the “delta well-leg.”

Funder: Orthopaedic Research Education Foundation (OREF) and AO Trauma North America Foundation (AO Foundation)

## **3D Printed Cast vs Synthetic Cast in Non-operative Distal Radius Fractures**

Principal Investigator: Nicolas Lee, MD

This is a randomized controlled trial comparing patient satisfaction between 3D-printed casts and synthetic casts in patients with non-operative distal radius fractures. Patients randomized to the 3D group will be placed in a personalized printed cast designed by Standard Cyborg. Functional outcome will be assessed as a secondary outcome.

Funder: San Francisco Department of Public Health

## **Early Weight Bearing After Fixation of the Ankle Syndesmosis**

Principal Investigator: Meir Marmor, MD

Co-Investigator: Saam Morshed MD, MPH, PhD

In collaboration with the Hitchcock Research Group at the Department of Bioengineering, University of Utah, this group is conducting a prospective observational pilot study to evaluate the functional outcome of early-protected weight bearing after ankle syndesmosis fixation. In this study, patients will be fitted with a CAM boot along with a personalized Ambulatory Tibial Load Analysis System (ATLAS) sensor insole and will be allowed to weight bear as tolerated 2 weeks after surgery. The ATLAS device will record all weight bearing events up to 12 weeks after surgery to report the degree of patient self-modulation.

Funder: New Orthopaedic Vision Award (NOVA) Department of Orthopaedic Surgery, UCSF

## **Biological characterization of the cartilage fracture callus and evaluation of new therapies to treat recalcitrant fractures (Callus Study)**

Principal Investigator: Ralph Marcucio, PhD

Co-Investigator: Meir Marmor, MD

This is a study analyzing the mechanism of bone regeneration in humans. The objective is to compare the process of fracture healing in humans to that of laboratory mice to gain a better understanding of the biological mechanism of endochondral ossification. This specifically aims to validate the process of hypertrophic chondrocyte to osteoblast transdifferentiation and develop new therapies to improve bone-healing outcomes based on this mechanism.



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.



## Pediatric Orthopaedic Surgery, Clinical Research

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

The Pediatric Orthopaedic Surgery group strives to provide comprehensive care for all musculoskeletal conditions in children and young adults, to lead in medical education, and to advance the 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, some of which include research on fractures, scoliosis, sports medicine, limb deformity, health disparities, and musculoskeletal diseases at the global health level.

- 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 Patient Centered Clinical Outcomes Research

To better provide patient-centered treatments, active collection of patient reports outcomes measurements is paramount. To fulfill this mission, the UCSF Orthopaedic's Sports Medicine Group currently participates in multiple prospective clinical outcome registries.

UCSF is an active member of the Multicenter ACL Revision Study (MARS) group. This group is responsible for collecting outcomes of revision ACL reconstruction with over 30 other institutions across the United States. This is the largest cohort of revision ACL reconstruction patients (over 1,200) reported. Numerous research grants as well as awards have been given to this study. **Christina Allen, MD** serves as a member of the scientific advisory board for the MARS group, providing input into current and future directions for evaluating research proposals and manuscripts. The MARS study began its 10 year follow up program phase, and UCSF will likely be one of the sites for performing in-person follow up with patients.

UCSF is an active member of the Multi-Center Orthopaedic Outcome Network (MOON) shoulder group. Along with 12 other institutions across the United States, they actively follow patients undergoing surgery for shoulder instability and rotator cuff repairs. They have collected information on over 800 patients with shoulder instability which is the largest cohort reported.

Currently, **C. Benjamin Ma, MD**, 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 500 patients have been enrolled in this on-going study, yielding multiple research publications.

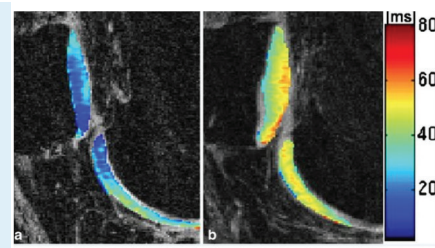


Image is from the Sports Medicine Clinical Trials in Knee and Shoulder Surgery group.

## Orthopaedic Clinical Research

### Sports Medicine Clinical Trials in Knee and Shoulder Surgery

The UCSF Sports Medicine Group is currently performing many prospective clinical trials focusing on the outcomes of shoulder arthroplasty, rotator cuff tears, shoulder instability, and cartilage injuries.

The sports group has enrolled over 1,000 patients in a prospective shoulder arthroplasty research study that has successfully published over 20 abstracts and scientific papers, led by **C. Benjamin Ma, MD**. With this database, they have 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 evaluation of sleep after shoulder replacement and factors that influence outcomes in shoulder replacement surgery.

Additionally, cartilage injuries are some of the most common problems facing patients with knee injuries. UCSF has been involved in many clinical trials evaluating techniques to improve cartilage health in patients. **C. Benjamin Ma, MD** leads the NeoCart clinical trial that treats isolated cartilage injury. **Brian Feeley, MD** leads the nSTRIDE clinical trial that involves evaluating techniques to improve cartilage health in patients with arthritis. Both trials are actively enrolling patients. To learn more about these cartilage restoration and early arthritis studies, please visit <https://clinicaltrials.ucsf.edu/trial/NCT02905240> or <https://clinicaltrials.ucsf.edu/trial/NCT01066702>.

Rotator cuff injuries are the most common injury to the upper extremity. The UCSF sports medicine group is part of a large, multi-center randomized controlled trial evaluating the outcomes of operative and non-operative treatment of rotator cuff tears (ARC Trial). This is a large, multi-center study that will help determine which patients would most benefit from rotator cuff repair, and which patients will benefit from non-operative management. The study is funded by the Patient Centered Outcomes Research Institute (PCORI) and is the largest randomized control trial on rotator cuff injuries in the country.

Several other prospective clinical trials are currently being performed including studies on patella instability, shoulder dislocations, drug and injection treatments for arthritis, and prehab for shoulder surgery recovery.

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





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



## 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 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.

## Orthopaedic Clinical Research

### 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 metabolo-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 Center

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 multi-center 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

The group is also using motion analysis technology to study normal and abnormal motion patterns with a mobile depth camera. This innovative work is designed to assess for lower extremity injury risk, 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. Yet, 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: 1) studies on patella instability; 2) shoulder dislocations; anterior cruciate ligament reconstructive techniques; and 3) revision surgery in the immature population.

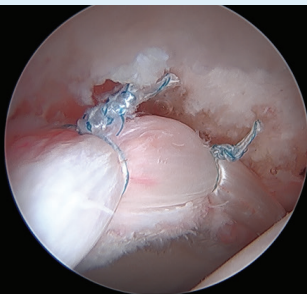
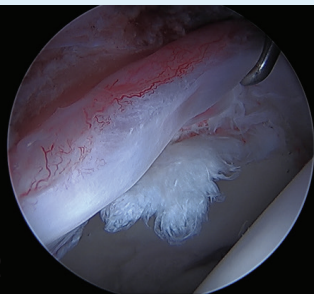
## Orthopaedic Clinical Research

### 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.

Alan Zhang, MD has prospectively collected clinical outcomes measurements on over 500 patients who have undergone hip arthroscopy at UCSF and 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 on-going research on whether early hip arthroscopy treatment for labral tears and femoroacetabular impingement can decrease risk for future arthritis in the hip.



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



Musa Zaid, MD with 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 aims to improve non-operative 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.

Currently, this group has numerous clinical investigations defining safety and efficacy of minimally-invasive (i.e. lateral and oblique interbody fusions) and complex operations (i.e. osteotomies) for adults with degenerative cervical and lumbar pathologies, including spinal deformity. Integral to these endeavors is assessing biomechanical new surgical techniques as well as clinical outcomes, and complications through robust 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 the group's goals to improve safety of spinal operations. This includes active ongoing collaborations with neurophysiologists involving human and animal trials that are focused on refining current and creating new neuromonitoring techniques to detect real-time changes in neural function intra-operatively. They also have very fruitful 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.

This Spine Center is also a leader in defining value-based care in spine surgery. Projects in this arena are diverse and focused on quantifying costs across episodes of care for a variety of spinal operations with the goal 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. They 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 sequences gives information on the structure of collagen in cartilage. Both sequences can detect 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. They have used an advanced MRI sequence, IDEAL, to measure the fat content in the shoulder muscles. This has shown that increasing fat content is seen in larger rotator cuff tears. Additionally, they have also studied how the fat content changes after surgical repair of a rotator cuff tear and demonstrated that lower fat content prior to surgical repair is associated with a higher chance of successful tendon repair.

#### Hip Imaging

In Hip Imaging, they 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 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.

For four decades, the Department has been at the forefront of the development of novel means of fixation for massive endoprosthetic implants for oncologic limb salvage reconstruction. Having pioneered the use of CompressO technology, this group is recognized as the world leaders in this field. In 2018, they were honored to receive the "Best Paper" Award at the Musculoskeletal Tumor Society (MSTS) Conference at the Memorial Sloan-Kettering Cancer Center in New York City for their paper entitled, "Distal femoral compressive osseointegration endoprostheses: A minimum 10-year follow-up study with functional results."

Building on this success with compressive osseointegration, the Oncology Service has taken the lead in studies of percutaneous titanium implants for patients with amputation. Directed by **Dr. O'Donnell**, Professor of Clinical Orthopaedic Surgery and Chief of the Orthopaedic Oncology Service, the UCSF international Center for Osseointegration Research, Education and Surgery (iCORES) offers the latest clinically available osseointegration treatment --- including the Osseoanchored Prosthesis for the Rehabilitation of Amputees (OPRA) --- in a translational research environment directed towards normalizing function in patients with limb loss.

As the first U.S. center to proceed with an OPRA surgical procedure, the implant is an alternative to traditional sockets in that the external prosthesis is secured directly to the patient's

remaining bone through a permanently implanted fixture that comes through the skin. Therefore, the prosthesis always attaches correctly, remaining firmly in place, free from pressure sores, pain, heat, chafing and general discomfort found with socket-based prosthetics.

The Center collaborates closely with physicians at the Walter Reed National Military Medical Center and with the Department of Defense Osseointegration Program to make the technology available not only to active duty military and veterans with combat-related injuries, but also as to patients who have limb loss secondary to tumors or civilian trauma. To date, the iCORES Program has received \$6 million in federal contracts and grants.

**Dr. Wustrack**, Associate Professor of Clinical Orthopaedic Surgery, has partnered with **Ross A. Okimoto, MD**, a medical oncologist, to develop a basic and translational science effort that aims to bring advances in precision medicine to bear on the treatment of patients with sarcoma. Together with colleagues from the UCSF Sarcoma Center, they have established the UCSF Sarcoma Program Tumor Bank, supported through a gift from Dr. and Mrs. Richard Stern. Leveraging progress in other areas of oncology, **Drs. Wustrack and Okimoto** are studying murine models to better understand how immunotherapy might be used to cure sarcoma. This important work is supported through the generosity of Dr. and Mrs. James O. Johnston.

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



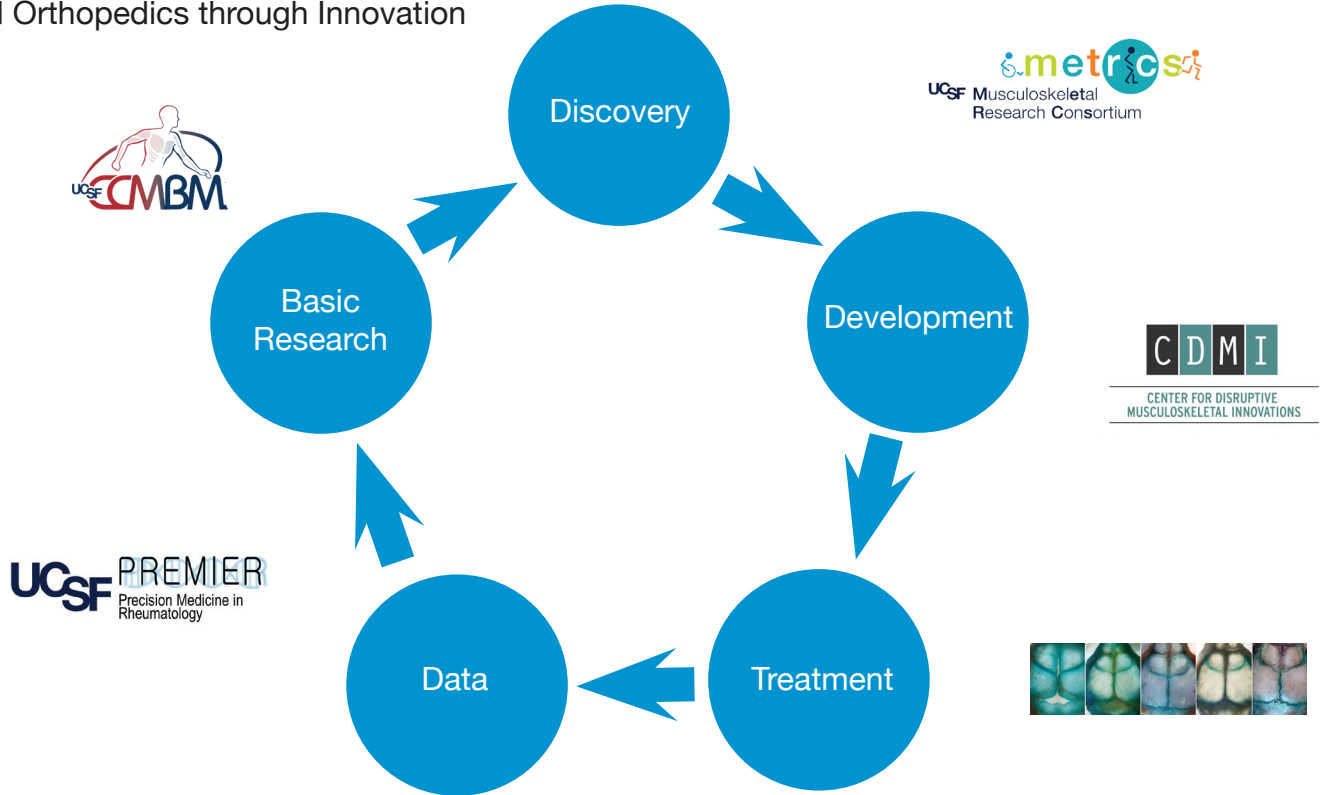


# MSK Innovation Centers

## UCSF Musculoskeletal Innovation Ecosystem

### UCSF ACTION

Advancing Care in Rheumatology  
and Orthopedics through Innovation



## UCSF Musculoskeletal Research Consortium (METRiCS)

### UCSF Parnassus Heights



Conceived as “the new way to research,” the UCSF Musculoskeletal Research Consortium, or METRiCS, seeks to bring together like-minded scientists from who are interested in collaborative solutions to problems across the spectrum of musculoskeletal health. Inherently inter-disciplinary, METRiCS is an outcomes-based approach that leverages talented basic, translational, and clinical researchers in a cross-school, inter-Departmental, multi-campus approach.

To date, the Consortium has members from the UCSF School of Dentistry and the UCSF School of Medicine, including the Departments of Orthopaedic Surgery, Physical Therapy, Radiology, Medicine, and Neurology. Seeking to serve as a model for the re-imagining of the Parnassus Heights complex, METRiCS plans to incorporate colleagues from throughout the UCSF system and the greater Bay Area, including UC Berkeley.

Directed by Richard J. O'Donnell, MD, METRiCS has already undertaken several research studies. Anchored by the UCSF international Center for Osseointegration Research Education and Surgery (iCORES) Program, which is supported \$6 million in federal contracts and grants, METRiCS is working with Research Scientists Jeannie Bailey, PhD and Robert Matthew, PhD to create in-clinic and at-home sensor and motion capture analytic tools for assessment of amputee rehabilitation that can be used to study gait in patients with a wide array of orthopaedic pathology.

The group also hopes to use these biomechanical studies to direct assistive device design and control. Utilizing progress in electronic osseointegrated implants that can enable bi-directional volitional motor control of, and sensory/proprioceptive feedback from, external prostheses, METRiCS is also developing Brain-Computer Interface (BCI) platform technology that can be applied to a broad range of motion disorders, including paralysis.



Athlete Kurt Wolfgang, at left, participates in a sleep study testing with Anthony Luke, MD, MPH at the Human Performance Center, Mission Bay.

## Human Performance Center

The UCSF Orthopaedic Institute

The Human Performance Center (HPC) is led by **Anthony Luke, MD, MPH**

The HPC serves primarily as a research facility, partnering with other research labs, scientists, and companies around UCSF, and the entire Bay Area. It carries out studies in the areas of biomechanics, exercise physiology, sleep and athletic performance. The state-of-the-art equipment, and staff expertise, enables the center to handle a diverse range of research opportunities, from knee osteoarthritis to prostate cancer, and more.

In addition to research the HPC also offers testing services to athletes of all levels. This includes analysis of a person's gait. Having your gait analyzed by a RunSafe team can help improve performance and reduce injury. Information from a performance evaluation can be used to tailor a heart rate-based training plan to a person's specific goals and needs.

## Center Level Activities

### Core Center for Musculoskeletal Biology & Medicine (CCMBM)

The NIH-supported 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 has grown a diverse membership of over 125 faculty and trainees that span over 3 Schools and 20 Departments. The center also provides services through its three cores in the areas

of imaging, biology and biomechanics, and epidemiology and biostatistics. Over the last 5 years, CCMBM has also funded 30 grants, over \$445,000 in directs and has leveraged an additional \$915,000 in directs grants for its members.

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

To learn more, visit [ccmbm.ucsf.edu](http://ccmbm.ucsf.edu).







CENTER FOR DISRUPTIVE  
MUSCULOSKELETAL INNOVATIONS

## Center Level Activities

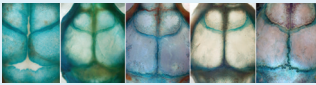
### Center for Disruptive Musculoskeletal Innovations (CDMI)

The Center for Disruptive Musculoskeletal Innovations (CDMI) is a National Science Foundation (NSF) funded Industry/University Cooperative Research Center. Representatives from the medical device field contribute to the center to support industry-inspired fundamental research and support graduate training. Projects span a range of areas that include healthcare economics, biomedical science, and clinical medicine.

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

Over the last 5 years, CDMI has received about \$1.8 million in industry membership fees and has leveraged it over 6 times in order to fund 52 projects across its university sites. These projects have led to \$4.5 million directs in additional extramural funding and \$1.1 million in enhancement projects with the industry members.

To learn more, visit [nsfcdmi.org](http://nsfcdmi.org).



## 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: UCSF, UC Berkeley, UC Davis, UCLA, 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 development and clinical implementation of innovative approaches for dental, oral, and craniofacial tissue regeneration. C-DOCTOR has awarded nearly \$3.4 million in directs to 17 Interdisciplinary Translational Project (ITP) teams across the US. Now in its final year, the C-DOCTOR is working with its advisors to determine the most commercially viable products that will be assisting in preparing for a pre-IND meeting with the FDA.

To learn more, visit [c-doctor.org](http://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, animal testing and project management support to faculty and residents in the Department of Orthopaedic Surgery.

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

# New Faculty

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



## Jeff Barry, MD

Dr. Jeff Barry is a board-eligible orthopaedic surgeon who specializes in adult reconstruction for hip and knee arthritis. He sees patients with all types of degenerative conditions of the hip and knee as well as patients with complications from prior joint replacement. Dr. Barry takes a comprehensive approach to the diagnosis and management of hip and knee pain, incorporating the latest advancements in perioperative pain management, surgical reconstruction and recovery, including the direct anterior approach to total hip replacement, partial knee replacement, and revision surgery.

Dr. Barry's research interests include: peri-operative management and risk assessment, revision surgery and the management of complications after total joint replacement, and educating the next generation of medical students and residents. His current projects include studying how to best manage infected total joint replacements as well as the implementation of technology to improve outcomes and enhance the patient care experience.

After growing up in San Jose, Dr. Barry graduated with a B.S.E. (*magna cum laude*) in Biomedical Engineering from Duke University. He attended medical school at the University of California, San Francisco, where he also completed his residency in the Department of Orthopaedic Surgery.

Following his residency at UCSF, Dr. Barry completed a fellowship in adult reconstruction at the OrthoCarolina Hip and Knee Center in Charlotte, N.C.





## Anthony Ding, MD

Anthony Ding, MD, is an Orthopedic Surgery specialist in Trauma.

He attended and graduated from Columbia University College of Physicians And Surgeons in 2010, having previously been a resident and intern at UCSF.

Dr. Ding joined the faculty at UCSF in 2018 and works primarily out of the UCSF/Zuckerberg San Francisco General Orthopaedic Trauma Institute (OTI). His clinical interests include Hand, Upper Extremity, and Microvascular. He is committed to high quality patient care and resident education.



## Elly LaRoque, MD

Dr. Elly LaRoque is a board-certified orthopaedic surgeon, who specializes in arthroscopy, rehabilitation of the knee and shoulder, and women's sports injuries in all age groups and all levels – from recreational to elite athletes.

Most recently, Dr. LaRoque has practiced at Golden Gate Sports Medicine and Orthopaedic Surgery. Dr. LaRoque also serves as team physician at both Dominican University and Academy of Art University.

Dr. LaRoque's clinical research interests include the study of gender differences in the patellofemoral joint before and after lateral retinacular release; testing cadaver knees on a custom loading jig and measured joint reactive forces, contact pressures, and contact areas; and performing geometric analysis of the patellofemoral joint using MRI.

Dr. Elly LaRoque completed her bachelor's degree in biology from Stanford University. She continued her medical education training at the University of California, Irvine, at which she received her M.D. degree. She next completed a General Surgery internship and her residency at Stanford University Hospital. Dr. LaRoque then completed her fellowship in sports medicine and arthroscopy with the Stanford University Medical School and Sports Orthopedic and Rehabilitation Medicine Associates (SOAR).

Dr. LaRoque is a Clinical Instructor at the Department of Orthopaedic Surgery at the University of California, San Francisco and she teaches at the San Francisco Veterans Administration Hospital.



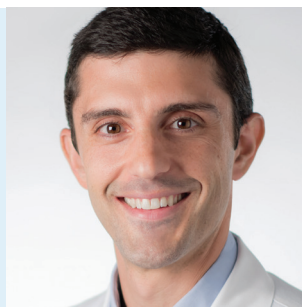
## Sanjeev Sabharwal, MD, MPH

Dr. Sanjeev Sabharwal is a pediatric orthopaedic surgeon who treats children and young adults with a wide spectrum of musculoskeletal problems, such as limb deformities, limb length discrepancy and injuries to bones and soft tissues and is an expert in complex limb reconstruction. Prior to joining UCSF, Dr. Sabharwal served as Chief of Pediatric Orthopaedics at the Rutgers-New Jersey Medical School, where he was a Professor of Orthopaedics and the Residency Program Director.

Fellowship-trained in pediatric orthopaedics at Children's Hospital of Los Angeles and Shriners' Hospital for Crippled Children at UCLA, Dr. Sabharwal continued additional fellowship training at the Maryland Center for Limb Lengthening and Reconstruction.

Dr. Sabharwal's clinical research interests include developing patient reported outcome measures for limb deformities and studying the motivations and impact of orthopedic volunteerism globally.

In addition to his full-time clinical practice, Dr. Sabharwal is the past president of the Limb Lengthening and Reconstruction Society, and he is an invited speaker at national and international orthopedic meetings on a regular basis. He is actively involved in global outreach in Orthopaedics and is an active member of several orthopaedic societies, such as the American Academy of Orthopaedic Surgeons, the Pediatric Orthopaedic Society of North America and the American Orthopedic Association. Dr. Sabharwal recently edited a comprehensive textbook on lower limb deformities in children and also serves as the Deputy Editor for two of the premier orthopaedic journals, The Journal of Bone and Joint Surgery and Clinical Orthopaedics and Related Research.



## Alekos Theologis, MD

As a member of the UCSF Spine Center, Dr. Alekos Theologis, MD, is a board-eligible orthopaedic surgeon who specializes in the treatment of a wide-range of complex primary and revision spinal disorders for both children and adults, which include cervical myelopathy, cervicothoracic kyphosis, adult scoliosis, lumbar stenosis, spondylolisthesis, failed back syndrome, and tumors. Providing passionate and comprehensive patient care, Dr. Theologis actively engages in the development of new technologies, clinical and biomechanical research, and the latest advancements in perioperative pain management and surgical reconstruction.

Dr. Theologis' research interests include: perioperative management and risk assessment, revision surgery and the management of complications after spine surgery, health policy, global health, and educating the next generation of medical students and residents.

Dr. Theologis graduated with a B.S. in Biological Sciences and Chemistry from Stanford University. He attended medical school at the University of California - San Francisco, where he also completed his residency in the Department of Orthopaedic Surgery, serving as chief resident in his final year.

Following his residency at UCSF, Dr. Theologis completed one of the most prestigious adult and pediatric clinical fellowships in spine surgery at Washington University in St. Louis during which he trained broadly and comprehensively under the tutelage of neurosurgeons and orthopaedic surgeons.





## Kristin Wingfield, MD

Dr. Kristin Wingfield is a board-certified primary care sports medicine specialist who sees all types of athletic injuries, including acute and overuse, in all age groups, children to masters. Her patients are weekend warriors, active people, recreational to elite athletes, and dancers/performing artists. She enjoys using her extensive experience in elite sports to help others quickly recover from their injuries and get back to the activities they love as quickly as possible.

Most recently, Dr. Wingfield has practiced primary care sports medicine at Golden Gate Sports Medicine and Orthopaedic Surgery.

Dr. Wingfield is also currently team physician for the San Francisco Ballet, Marin Academy High School, and Team TWENTY20 women's professional cycling team. In 2010, she worked at the medical clinic at the 2010 Winter Olympic Games caring for the Olympic athletes and staff on site in Whistler, British Columbia. She has traveled as a team physician for the Canadian Alpine ski team to World Cup ski races, as well as the Canadian Women's basketball team. She was the team physician for Canada at the FINA World championships in 2003 in Barcelona and worked with the Canadian medical team at the Sydney Olympic Games as a medical student.

Dr. Wingfield received her bachelor's degree from the University of Western Ontario, and continued with her medical training at University of British Columbia, Vancouver, at which she received her M.D. degree. She then completed her Family Medicine Residency at Saint Paul's Hospital Site at the University of British Columbia, Vancouver. In 2004, Dr. Wingfield then completed the Sports Medicine Fellowship Program at Stanford University.



## Peter Wu, MD

Dr. Peter Wu, a board-certified specialist in Physical Medicine and Rehabilitation (PM&R), joins the UCSF Spine Center's Non-Operative Spine Service, a team of providers who employ an evidence-based, multidisciplinary approach to managing spinal disorders.

With a focus on diagnostic and therapeutic interventions for the optimal management of patients with chronic back, neck, and joint pain, Dr. Wu specializes in using electromyogram and nerve conduction studies (EMG/NCS) to evaluate nerve or muscle injuries; he incorporates multidisciplinary therapies to manage pain; and he delivers an array of ultrasound and X-ray guided injections to alleviate pain and improve quality of life.

Dr. Wu is an active researcher with interests including regenerative medicines, such as platelet-rich plasma (PRP) therapy; clinical outcome studies for minimally invasive spine interventions; and development of novel therapies for musculoskeletal and pain conditions.

Dr. Wu grew up in Cerritos, Calif. He attended the University of California, Berkeley, where he received a B.S. degree in Mechanical Engineering. He then pursued both M.S. and Ph.D. degrees in Mechanical and Medical Engineering from the Harvard/Massachusetts Institute of Technology Division of Health Sciences and Technology. Dr. Wu returned to northern California to complete his M.D. at Stanford University School of Medicine. He completed his residency in Physical Medicine and Rehabilitation (PM&R) at Spaulding Rehabilitation Hospital / Harvard Medical School. Dr. Wu then completed an additional year of fellowship training at Massachusetts General Hospital, where he served as a Clinical Fellow in Pain Medicine in the Department of Anesthesia, Critical Care, and Pain Medicine.

# Residency Highlights

The year 2018 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 Dept. 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.



Patrick  
Curran, MD

- Is a co-Author for a paper that won the ISSLS Prize in bioengineering science: Biomechanical changes in dynamic sagittal balance and lower limb compensatory strategies following realignment surgery in adult spinal deformity patients. Jeannie F. Bailey, Robert P. Matthew, Sarah Seko, Patrick Curran, Leslie Chu, Sigurd Berven, Vedat Deviren, Shane Burch, Jeffrey C. Lotz.



Michael Davis, MD

- Wins 1st place for basic science paper at the OREF Southwest Region Resident Research Symposium



Erick Geiger, MD

- Wins Young Investigator Award at the American Society of Bone and Mineral Research meeting, October 2018



Gopal  
Lalchandani, MD

- Awarded the AFSH 2018 Fast Track Grant, \$5,000
- Awarded the UCSF JOJ Ortho Resident Grant, \$5,000, June 2018





Joseph  
Patterson, MD

- Emerging Leaders Program, American Orthopaedic Association, Boston, MA
- Wins the Western Orthopaedic Foundation Jeffrey E. Krygier Travel Grant, Snowmass, CO
- C. McCollister Everts Resident Leadership Forum Class of 2018, American Orthopaedic Association, Boston, MA
- Wins the Outstanding Resident Research Award, UCSF Clinical and Translational Science Training Program, San Francisco, CA
- Wins the Resident Research Paper Award, Inman Abbott Orthopaedic Society
- Wins the American Journal of Orthopaedics Resident Writer's Award, Johnson & Johnson Institute, New Orleans, LA.



Heather  
Roberts, MD

- Wins the 7 Long/7 East Clinician of the Year 2018



Nicholas Satariano,  
MD

- Wins the 7 Long/7 East Clinician of the Year 2017



Stephanie  
Wong, MD

- Awarded best clinical paper, ORS Southwest Regional Resident meeting

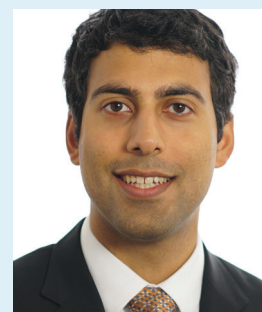
### Congratulations to the following OREF Recipients



Patrick F. Curran, MD



Krishn Khanna, MD



Gopal R. Lalchandani, MD



Joseph T. Patterson, MD



Caitlin Rugg, MD

# Trainee Highlights

The UCSF Dept. of Orthopaedic Surgery Laboratories have had another successful year in terms of musculoskeletal research. For example, our Parnassus Heights Labs continue to grow in size and extramural funding. In 2018, the Parnassus Heights Labs welcomed more than 23 new employees to its research enterprise. The Labs currently have more than 50 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 Dept. 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.



Gaby Baylon,  
Postdoc  
**Alliston Laboratory**

- Awarded an NIH Diversity Supplement Award, July 2018
- Predocctoral Fellowship, April 2018



Neha Dole,  
Professional  
Researcher,  
**Alliston Laboratory**

- Awarded an OREF grant through August of 2018



Susan Eliazer,  
Postdoc  
**Brack Laboratory**

- Awarded the American Federation for Aging Research (AFAR) award, September 2018
- Awarded an NIH NIAMS F32 award through August 2018



Devante Horne,  
Graduate Student  
**Lotz Laboratory**

- Awarded Best Rapid-Fire Talk, Low-intensity Pulsed Ultrasound Increases Collagen Production in Bovine Annulus Fibrosus Cell. UC Systemwide Bioengineering Symposium, June 2018, Riverside, CA
- Awarded Funding through the Center for Disruptive Musculoskeletal Disorders (CDMI), September 2018

- Presented at the Focused Ultrasound International Symposium

- Development of a custom LIPUS system for uniform far-field exposure and demonstration of LIPUS-induced increase in collagen synthesis in intervertebral disc cells, October 2018, Reston, VA

- Completed a Proposal Pitch for the Center for Disruptive Musculoskeletal Disorders (CDMI). Titled: Low-intensity Pulsed Ultrasound as a

Novel Therapy for Disc Repair and Reduction of Disc Degeneration, September 2018, San Francisco, CA

- Completed a Rapid-Fire Talk and Poster, UC System wide Bioengineering Symposium. Titled: Low-intensity Pulsed Ultrasound Increases Collagen Production in Bovine Annulus Fibrosus Cells, June 2018, Riverside, CA





Justin Lopez,  
PhD Candidate  
**Alliston Laboratory**

- Awarded an NIH F31



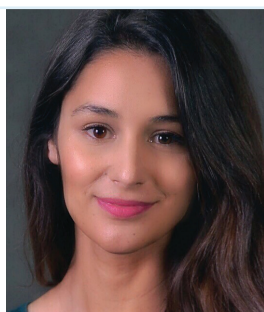
Courtney Mazur,  
Graduate Student  
**Alliston Laboratory**

- Presented at the Gordon Research Seminar, Seminar. Title: Musculoskeletal Biology and Bioengineering, Talk Title: Osteocytic MMP13 Regulates Perilacunar/Canalicular Remodeling, Bone Quality and Joint Disease, August 2018
- Sean Alemi, Courtney Mazur, et al: manuscript accepted at Bone Reports



An Nguyen,  
PhD Candidate  
**Schneider Laboratory**

- Awarded an NIH F30 research grant through August of 2021



Heather A.  
Richbourg  
**Marcucio Laboratory**

- Awarded an NIH NIDCR F32, September 2018



Charles Schurman,  
PhD Candidate  
**Alliston Laboratory**

- Wins the William K. Bowes J. and Ute Bowes Discovery Fellowship
- Neville Smith Student Poster Award, 2018 Advanced Light Source User's Meeting, October 2018



Spenser Smith,  
Postdoc  
**Schneider Laboratory**

- Awarded an NIH F32 research grant, September 2018

# News and Media

## 2018 Department NOVA Award Recipients

Igor Immerman, MD



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

Award amount:

**\$5,000**

Chelsea Bahney, PhD



Project Title:  
Preclinical Validation  
of Collagen X Bioassay  
to Monitor Fracture  
Progression

Award amount:

**\$5,000**

Kristin Livingston, MD



Project Title: Using Digital  
Tomosynthesis to Characterize  
Elbow Anatomy and Common  
Pediatric Elbow Fractures in  
Cadavers

Award amount:

**\$5,000**

Patricia Zheng, MD



Project Title: Application to  
Track Longitudinal Outcomes  
After Spine Interventions  
(ATLAS)

Award amount:

**\$5,000**



The Skeletal Mechanobiology Laboratory led by Tamara Alliston, PhD is awarded a DOD Expansion Grant from the Orthopaedic Research Program.

The grant was awarded in order to identify osteocyte-regulatory therapies to prevent and treat PTOA.



San Francisco Bay Area  
FEDERAL EXECUTIVE BOARD



Alexis Dang, MD and Alan Dang, MD win the San Francisco Federal Executive Board “Federal Employee of the Year” award in Science & Technology related to 3D printing in orthopaedics.





## ORS Award Recipient: 2019 NIRA Recipients

### Drew Lansdown, MD is a NIRA recipient at ORS

ACL Graft Signal Characteristics Measured by Quantitative MRI Are Significantly Correlated with Patient Reported Outcomes Two Years after Hamstring Autograft ACL Reconstruction.

**Co-Authors:** Weiyuan Xiao; Alan L. Zhang, MD; Christina R. Allen, MD; Brian T. Feeley, MD; Xiaojuan Li; Sharmila Majumdar; C. Benjamin Ma, MD



### Tamara Alliston, PhD, to be honored by ORS for excellence in musculoskeletal research

The honor – the ORS Women's Leadership Forum Award -- recognizes a female biologist, clinician, or engineer who has made significant contributions to the understanding of the musculoskeletal system and musculoskeletal diseases and injuries.

## Digital Orthopaedics Conference San Francisco (DOCSF)

The Digital Orthopaedics Conference San Francisco (DOCSF) was created to bridge the worlds of digital health and clinical orthopaedics and thereby catalyze the adoption of technology in musculoskeletal care. The program was founded and is chaired by **Stefano Bini, MD**. In 2018, the Conference was held in San Francisco and took place on Sunday, January 7, 2018.







## **Inman Abbott Society Conference**

The 51st Annual Verne T. Inman Lectureship and the 64th Annual LeRoy C. Abbott Scientific Program took place on May 10 and 11, 2018 at the UCSF Mission Bay Conference Center in San Francisco. The programs bring together members of the Abbott

Orthopaedic Society and faculty and residents of the UCSF Dept. of Orthopaedics in a collaborative presentation of recent advances in orthopaedic surgery.

To learn more, visit: <https://orthosurgery.ucsf.edu/education/abbott-society/>





## Dr. Carlin Senter featured on ‘Curbsiders’ discussion on shoulder pain

UCSF Dept. of Orthopaedic Surgery’s, **Carlin Senter, MD** a primary care sports medicine specialist, was recently featured in The Curbsiders podcast #124 The Shoulder – Simplify Your Approach. In this podcast, Dr. Senter discusses her simplified approach to the basic shoulder exam, including when and how to do special tests, high yield exam maneuvers, when to refer shoulder pain patients to orthopedic surgery, and who can be managed conservatively.



## Bringing artificial limbs to patients who need them

The UCSF School of Pharmacy featured a story on **Leslie Wilson, PhD**, a faculty member in the Department of Clinical Pharmacy, UCSF School of Pharmacy, and **Matthew Garibaldi, MS**, director of the Orthotic and Prosthetic Center in the UCSF Department of Orthopaedic Surgery, on how they are creating hard data on patient preferences for artificial limbs.



## 3D-Printed Bones are Helping Doctors Prepare for Surgeries

UCSF News recently featured a story on 3D printing and how 3D printed bones help doctors better prepare for surgery. Members of the UCSF Department of Orthopaedic Surgery that were featured included: **Alan Dang, MD**, **Alexis Dang, MD**, **Aenor Sawyer, MD**, **Shane Burch, MD**, **Sigurd Berven, MD**, **Safa Herfat, PhD** and **Musa Zaid, MD**.



## Stefano Bini, MD, recognized by AAHKS

The annual meeting of the American Association of Hip and Knee Surgeons (AAHKS) in Dallas, **Stefano Bini, MD**, a surgeon who specializes in arthritis and joint replacement at the UCSF Department of Orthopaedic Surgery, received the 2018 AAHKS Presidential Award, an honor presented to a member who exemplifies the organization’s mission: to advance hip and knee patient care through education, advocacy and research.





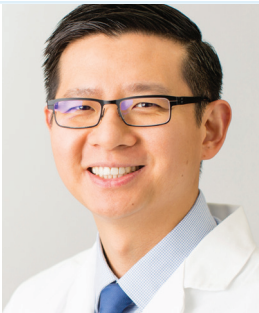
## Jeffrey Lotz, PhD, recognized for outstanding contributions in spine-related basic science research

During its 33rd annual meeting in Los Angeles last month, Jeffrey Lotz, Ph.D., the David S. Bradford M.D. Endowed Chair in Orthopaedic Surgery and Vice Chair of Research at UCSF, was honored by the North American Spine Society (NASS) with the Henry Farfan Award recognizing his outstanding contributions in spine-related basic science research.



## Aaron Fields, PhD, receives young investigator's award from North American Spine Society

During its 33rd annual meeting this year, Aaron Fields, PhD, an Assistant Professor in the UCSF Dept. of Orthopaedic Surgery, received the Young Investigator award by the North American Spine Society (NASS), a multidisciplinary medical organization of more than 8,000 members dedicated to fostering evidenced-based and ethical spine care.



## When Do Patients Improve After Hip Arthroscopy for Femoro-acetabular Impingement?

Alan Zhang, MD, an orthopaedic surgeon and sports medicine specialist in the UCSF Dept. of Orthopaedic Surgery and Director of the UCSF Hip Preservation Center, recently published research on patient outcomes after hip arthroscopy surgery at UCSF. Dr. Zhang's research shows a 96-percent success rate for patients' sports improvement following surgery; and a 94-percent overall improvement in quality of life.



## Playing multiple sports can help prevent injuries for sporty kids

UCSF's Nirav Pandya, MD, a pediatric orthopedic surgeon who specializes in pediatric sports medicine and trauma, was recently featured on NBC to discuss how playing multiple sports can prevent injuries for sporty kids.



## Nicole Schroeder, MD receives endowed chair for education initiatives

The UCSF Dept. of Orthopaedic Surgery congratulates Nicole Schroeder, MD, on becoming the new chair holder of the Haile Debas Academy Chair in Orthopaedic Surgery. Dr. Schroeder succeeds Mohammad Diab, MD, as the new chair holder.

Over the next five years, Dr. Schroeder's endowed chair work will be to develop and enhance an integrated curriculum in musculoskeletal education across the Bridges Curriculum with increased collaboration and faculty participation between all departments that are involved in this education.



## Rosanna Wustrack, MD, receives teaching award

Rosanna Wustrack, MD, an orthopaedic surgeon in the UCSF Dept. of Orthopaedic Surgery, was recently honored by the University with a 2018 Excellence in Teaching Award. The peer-nominated awards for teaching faculty highlight outstanding front-line teachers of medical students, residents, and fellows at all UCSF teaching sites who often go unrecognized.



## UCSF Dept. of Orthopaedic Surgery launches Research Administration Portal

The UCSF Dept. of Orthopaedic Surgery Research Committee is pleased to announce the launch of a new, online research administration portal. The purpose of this portal is to provide researchers with tools needed to manage their research projects.



## The 2018-2019 IGOT's Morgan and Madison McClellan Inter- national Research Fellow, Patrick Albright, is involved with multiple research projects.

These projects include a randomized control trial in Tanzania and a prospective open tibia multi-center study across Latin America. Patrick chose to join the IGOT team because he "developed a strong interest in the important role that orthopaedics plays in global health and through IGOT, can focus research efforts on identifying barriers to orthopaedic care in lower and middle income countries and developing sustainable solutions to building orthopaedic surgical capacity."



## Chelsea Bahney, PhD is awarded the UCSF New Orthopaedic Vision Award (NOVA)

Chelsea Bahney, PhD research project will focus on looking for a biomarker that could detect the stages of fracture healing before they can be seen on an x-ray. This project is being done in collaboration with Dr. Bill Horton at Shriners and OTI Trauma Fellow Dr. Zach Working.



**Sarah A. Wong from ZSFGH was spotlighted as an ORS ISFR Member**



## **IGOT's Tanzanian partners attended the Orthopaedic Trauma Association in Orlando, Florida.**

At the conference, they presented their research findings from a recent publication between IGOT and MOI leadership.



## **IGOT's Tanzanian partner and recipient of the 2018 Orthopaedic Trauma Association (OTA) Humanitarian Award, Dr. Billy Haonga, presented his recently published paper.**

Dr. Haonga's paper is titled 'Intramedullary Nailing Vs. External Fixation in the Treatment of Open Tibia Fractures in Tanzania'. The award was presented to him by Drs. Coughlin, Mailly, and the OTA president, Dave Teague.



## **IGOT partnered with the Cuban Ministry of Health to deliver a Cuba Clinical Research Symposium, which took place in Havana, Cuba.**

More than 140 attendees participated in the two-day symposium. Visiting faculty from the University of California, San Francisco, the University of Maryland, and McMaster University in Canada, led panel discussions and gave presentations to the group.





## IGOT's flagship course, the San Francisco SMART Course, wrapped up with a half-day clinical research symposium

The symposium included 30 course participants, aimed to address research methods that are relevant to the attendees' local communities and that can be applied to their patient populations.



## Research at the Muhimbili Orthopaedic Institute

UCSF's Prosthetist, Alex Hetherington, and IGOT's 2018-2019 Doris Duke Research Fellow, Syed Ali, work together to conduct research at the Muhimbili Orthopaedic Institute in Dar es Salaam, Tanzania.



## Research Funding Received

Ralph Marcucio, PhD, Tamara Alliston, PhD received some funding to assess morphogenesis of the primary palate using Atomic Force Microscopy and analysis of cell shape/migration/autonomous force generation.



## Society for Craniofacial Genetics

Ralph Marcucio, PhD, President of the 41st Annual Meeting of the Society for Craniofacial Genetics and Developmental Biology presented at the Sanford Consortium for Regenerative Medicine and Rich Schneider, PhD, introduced Drew Noden.



## NIH-funded Collaboration

Tamara Alliston, PhD and Ralph Marcucio, PhD have begun an NIH-funded collaboration to begin to understand how molecular signals and biophysical forces interact to shape parts of the developing embryo. This work is part of a larger body of study aimed at understanding how structural birth defects arise during development.

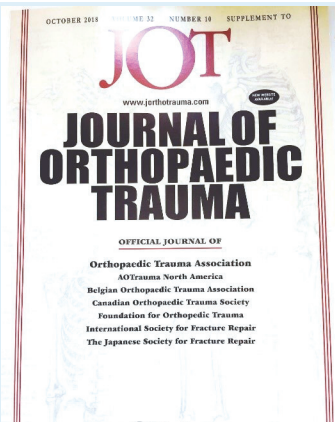


## IGOT's Latin American Research Consortium, Asociación de Cirujanos Traumatólogos de las Americas (ACTUAR)

Held its 2nd Annual Research Symposium on October 26-27 in Mérida, Mexico at the Federación Mexicana de Colegios de Ortopedia y Traumatología. ACTUAR is the product of a group of orthopaedic surgeons interested in a collaborative initiative focused on building research capacity across institutions.

Theodore Miclau, MD Professor and Vice Chair, Director of Orthopaedic Trauma at UCSF, and organizing faculty, David Shearer, MD, MPH and Nicolas Lee, MD travelled to Mexico to represent ACTUAR, IGOT, and OTI at the Federación Mexicana de Colegios de Ortopedia y Traumatología at the XXIX Congress.





## **The IGOT team and the Orthopaedic Trauma Institute (OTI) were awarded the opportunity to publish over ten articles in the high-impact Journal of Orthopaedic Trauma (JOT) Supplement.**

This publication, a product of contribution from over 160 people, builds our collective knowledge in the field of global health to advance the global dialogue around strengthening health workforce capacity, promoting sustainable global partnerships, and supporting future research.



## **Laboratory for Evolutionary Anatomy: Nathan Young, PhD Research through the Leakey Foundation.**

Nathan Young, PhD is an assistant professor in the Department of Orthopaedic Surgery, and Director of the Oral & Craniofacial Sciences Master's Program at UCSF.

Through the Leakey Foundation Dr. Young explores the connection between long-distance precision throwing and our evolutionary split from other primates.



## **Eric Meinberg, MD explores the steps to prevent osteoporosis.**

There are 1.5 million osteoporosis fractures per year in the US. Eric Meinberg, MD explores the steps to prevent osteoporosis, calculating your risk and treatment of various types of fractures. Then, Ralph Marcucio, PhD explores what the research shows about age and orthopaedic healing.



# 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 TGFβ

8/1/2014-7/31/2019

\$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

8/1/2017-7/31/2019

\$383,570

- New Frontier Award, Program for Breakthrough Biomedical Research

Mechanisms of Mitochondrial Transfer in Spatially Confined Cells: Osteocytes

06/15/2018 – 06/14/2019

\$150,000

- NIH NIAMS, R13 AR073652-01

2018 Musculoskeletal Biology and Bioengineering Gordon Research Conference and Gordon Research Seminar

03/28/2018 – 03/27/2019

\$15,000



## 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

- AO Foundation S-14-1148, A125370

Promoting Vascularized Bone Regeneration with Endochondral Cartilage Grafts

6/1/2015-5/1/2018

\$132,348

- NOVA Department of Orthopaedic Surgery, UCSF
- Preclinical Validation of Collagen X Bioassay to Monitor Fracture Progression

1/1/17-2/1/18

\$5,000



## Gaby Baylon, PhD

- NIH Diversity Supplement Award

Pairing of Osteocyte Tension and Perilacunar Material Properties via Perilacunar/Canalicular Remodeling

7/1/18-7/31/19

\$104,941



## Sigurd H. Berven, MD

- AO Foundation

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

7/1/2014-12/31/2021

\$27,645

- Empirical Spine Inc. LSS17001

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

9/26/2017-9/19/2022

\$334,393



## Andrew S. Brack, PhD

- NIH NIAMS, R56 A131831

Muscle Stem Cell Heterogeneity

9/1/2018-8/31/2019

\$438,603

- NIH NIAMS, R01 AR061002

Quiescence of Muscle Stem Cells during Growth and Repair

4/3/2015-3/31/2018

\$423,610



### Shane Burch, MD

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

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

- Eli Lilly Inc., A117193

Application of Forteo in Spinal Fusions. A double blinded randomized control study

Assessment of the Efficacy of Forteo (Teriparatide) in Patients

Undergoing Posterolateral Lumbar Spinal Fusion, Clinical Trial

07/01/11-12/31/18

\$468,978



### Patrick F. Curran, MD

- OREF, A129158

Intramedullary Kirschner Wire versus Flexible Nail Fixation for Pediatric Femur Fractures

7/1/2017-6/30/2019

\$30,000



### Alan Dang

- UCSF School of Medicine Initiative Grant

Center for Advanced 3D+Technologies, Co-PI with Alexis Dang, MD, and Aenor Sawyer MD, MS

7/1/18 - 6/30/21

\$1,420,300



### Alexis Dang

- UCSF School of Medicine Initiative Grant

Center for Advanced 3D+Technologies, Co-PI with Alan Dang, MD, and Aenor Sawyer MD, MS

7/1/18 - 6/30/21

\$1,420,300



### Sibel Demir-Deviren, MD

- Pfizer, B3451002

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.

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



### Neha S. Dole, PhD

- OREF

The Role of TGFB in Regulating Perilacunar Remodeling in Diabetes

7/1/2017-6/30/2018

\$50,000



### Susan T. Eliazer, PhD

- American Federation for Aging Research (AFAR)

Wnt4 as a Novel Therapeutic for Rejuvenating Muscle Stem Cell Function During Aging

9/1/2018-8/31/2019

\$60,000

- NIH NIAMS, F32 AR067594

Determining the Role of Notch Ligands in Regulating Adult

Satellite Cell Fate

8/15/2015-8/14/2018

\$173,186



### Brian T. Feeley, MD

- Zimmer Biomet Holdings Inc., 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

- OMeGA Medical Grants Association Fellowship

8/1/2017-7/31/2018

\$12,650

- NIH NIAMS, R01 (AR072669)

Utilizing Beige fat to Improve Muscle Function after Rotator Cuff Repair

9/1/18-6/30/23

\$ 1,770,500

- NIH P30

Evaluation of Human Rotator Cuff Stem Cells

\$50,000

12/30/18-12/31/19



### Aaron J. Fields, PhD

- North American Spine Society

Does Cartilage Endplate Permeability Impact Nucleus Pulposus Cell Function?

1/1/2017-12/31/2018

\$25,000

- NIH NIAMS, R01 AR070198

Role of the Cartilage Endplate in Spinal Disc Degeneration

4/1/2017-1/31/2022

\$2,092,200



### Erik N. Hansen, MD

- OREF

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,1/70 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

- NOVA Department of Orthopaedic Surgery, UCSF

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

1/1/17-2/1/18

\$5,000



### Krishn Khanna, MD

- OREF

The Delta Well-Leg Compartment Pressure

2/1/2017- 1/31/2018

\$5,000





## Hubert Kim, MD, PhD

- Medical Device Business Services Inc.

AO Basic Principles of Fracture Management

3/1/2018- 3/4/2018

\$ 5,568

- Medical Device Business Services Inc.

AO Trauma Advanced Principles of Fracture Management

9/13/2018- 9/16/2018

\$ 1,993



## Gopal R. Lalchandani, MD

- American Foundation for Surgery of the Hand

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

1/1/2018-12/31/2018

\$5,000



## Justin Lopez, PhD Candidate

- NIH NIDCR, F31 A131183  
Mechanosensitive Membrane Organization of TGFb Receptors

6/1/2018- 5/31/2022

\$ 136,099



## Kristin Livingston, MD

- NOVA Department of Orthopaedic Surgery, UCSF

Using Digital Tomosynthesis to Characterize Elbow Anatomy and Common Pediatric Elbow Fractures in Cadavers

1/1/17-2/1/18

\$5,000



## Jeffrey C. Lotz, PhD

- NSF

Orthopaedic Sensing, Measuring, and Advanced Reporting Technology (SMART) Devices Workshop

4/15/2018- 9/30/2018

\$ 19,185

- US Dept of Veterans Affairs  
Custom Built Mechanical Test System

9/21/2018- 12/17/2018

\$ 186,885

- NIH NIAMS, R01  
AR063705

Phenotypes of Pathologic Vertebral Endplate Degeneration

6/1/2016-5/31/2019

\$1,358,994

- NIH NIAMS Bioniks LLC,  
AR068202

A Clinical 3D Movement Analysis System for Assessing Lower Extremity Injury Risk and Recovery in Athletes

12/1/2016-1/31/2018

\$70,745

- NIH NIDCR U24  
DE026914

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

3/1/2017-2/29/2020

\$11,961,481

- K2M Inc.

Potential Mechanisms of Pain in the SI Joint

11/9/2016-12/30/2018

\$59,672

- NIH NIAMS, P30  
AR066262

Core Center for Musculoskeletal Biology and Medicine

7/1/2014-6/30/2019

\$ 2,993,910

- National Science Foundation, IIP-1361975

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

4/15/2014-3/31/2019

\$520,500

- NASA Shared Services Center, NNX13AM89G

Risk of Intervertebral Disc Damage after Prolonged Space Flight

7/11/2013-7/10/2019

\$435,000



## C. Benjamin Ma, MD

- Samumed LLC, SM04690-OA-08

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.

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 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

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

4/25/2015-4/25/2019

\$25,000

- Patient-Centered Outcomes Research Institute, VUMC63087

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

\$ 442,877



## Ralph S. Marcucio, PhD

- Regents of the University of Michigan, R01 P0505057

Regulators of Ischemic Fracture Healing

8/1/2017- 4/30/2020

\$445,104

- NIH NIDCR, R21

Understanding the Forces that Shape the Face

9/15/2018- 8/31/2020

\$ 442,105

- NIH NIAMS, R01 AR066028

Regulators of Ischemic Fracture Healing

9/15/2015-7/31/2020

\$750,748

- NIH NIDCR, R01 DE019638

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

1/1/2016-12/31/2020

\$ 2,819,022

- NIH NIA, R01 AG046282

Effects of Aging on Macrophages and Bone Regeneration

6/1/2016-5/31/2018

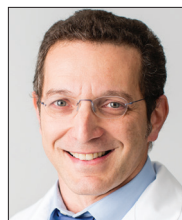
\$212,605

- NIH NIDCR, R01 DE018234

Molecular Basis of Tissue Interactions that Regulate Craniofacial Development

7/1/2016-6/30/2018

\$997,275



## 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

- DOD US Army Med. Res. Acq. Activity, 2002015246

METRC 2

9/29/2012-9/28/2018

\$135,550

- NIH NIAMS

Streamlining Trauma Research Evaluation with Advanced Measurement (STREAM Study)

11/1/2013- 8/31/2018

\$10,000

- NIH NIAMS, 1R0 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)

9/30/2014-9/29/2019

\$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



## An Nguyen, PhD

- NIH NIDCR, F30 DE027616

Mesenchyme-Dependent Epithelial Signals that Promote Osteogenesis in the Jaw

9/1/2017-8/31/2021

\$169,787



## Richard J. O'Donnell, MD

- DARPA 15-05-OpenBAA-FP-014

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

11/13/2017- 7/24/2019

\$389,314

- DARPA W911NF-17-2-0043

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

3/15/2017-3/14/2020

\$1,114,218

- DoD USAMRMC W81XWH-17-2-0060

Transfemoral Amputee Osseointegration Study (TFAOS)

10/1/2017-9/30/2022

\$4,087,367



## Nirav Pandya, MD

- Pediatric Orthopaedic Society of Northern America

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

6/1/2018- 5/31/2019

\$1,000



## Joseph T. Patterson, MD

- OREF

Implants, Morbidity, and Costs in AO/OTA 31-A2 Hip Fractures Among Veterans

2/1/2017-1/31/2018

\$4,950



## 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



## Caitlin Rugg, MD

- OREF

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

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

6/1/2016-12/31/2018

\$30,000



## Aenor J. Sawyer, MD, MS

- Australian Academy of Tech & Engineering

Design and Validation of 3D-printable Prostheses for Spine Surgery

7/31/2017- 12/31/2018

\$16,597

- Baylor/NASA Cooperative Agreement

UCSF Space Health Innovation Program, Chief Health Innovation Officer for TRISH

10/1/2018- 9/30/2021

\$2,014,313

- UCSF School of Medicine Initiative Grant

Center for Advanced 3D+Technologies, Co-PI with Alexis Dang, MD and Aenor Sawyer MD, MS

7/1/18 - 6/30/21

\$1,420,300



## Richard A. Schneider, PhD

- NIH NIDCR, R01 DE016402

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

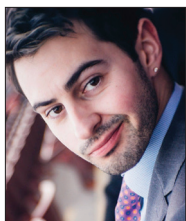
- NIH NIDCR, R01 DE025668

Mechanisms of Secondary Cartilage Induction and Maintenance in the Jaw

7/5/2016-6/30/2021

\$1,981,250





### Charles Schurman, PhD Candidate

- Bowes Discovery Fellowship Award  
9/12/2018 – 6/16/2021  
\$6,000



### Spenser Smith, PhD

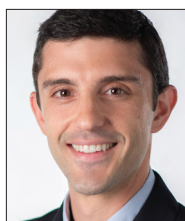
- NIH NIDCR, F32 DE027283  
The Role of TGF-Beta Signaling and Mmps in Neural Crest Mediated Jaw Bone Remodeling  
9/15/2018- 9/14/2021  
\$185,646



### Bobby Tay, MD

- NuVasive Inc.  
NuVasive Fellowship Program in the Area of Spine Medicine  
7/1/2017-8/31/2018  
\$40,000

- NuVasive Inc.  
NuVasive Spine Fellowship  
8/1/2018-7/31/2019  
\$40,000
- Globus Medical Inc.  
Globus Medical Fellowship  
8/1/2017-8/31/2018  
\$75,000
- OMeGA Medical Grants Association  
OMeGA Spine Fellowship  
8/1/2018-7/31/2019  
\$21,500
- AOSpine North America Inc.  
AOSpine North America Fellowship Committee (AOSNAFC)  
8/1/2017-7/31/2019  
\$150,000



### Alexos Theologis, MD

- Innovasis Inc.  
A Multi-center, Patient Outcome Registry for a Hydroxyapatite infused PEEK Interbody Fusion Device  
9/1/2018- 8/31/2019  
\$20,000



### Rosanna L. Wustrack, MD

- Canadian Institutes of Health Research SITE 36  
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



### 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



### Alan L. Zhang, MD

- American Orthopaedic Society for Sports Med YIG-2016-1  
Quantitative Magnetic Resonance Imaging for Femoroacetabular Impingement of the Hip  
4/1/2016-3/31/2018  
\$50,000



### Patricia Zheng, MD

- NOVA Department of Orthopaedic Surgery, UCSF  
Application to Track Longitudinal Outcomes After Spine Interventions (ATLAS)  
1/1/17-2/1/18  
\$5,000
- The Spine Intervention Society  
ATLAS - Application to Track Longitudinal outcomes After Spine interventions  
8/1/2018- 7/31/2019  
\$24,978
- Allergan Foundation  
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 2018

- Acevedo, C., Sylvia, M., Schaible, E., Graham, J. L., Stanhope, K. L., **Metz, L. N., Alliston, T.,...Fields, A. J.** (2018). Contributions of Material Properties and Structure to Increased Bone Fragility for a Given Bone Mass in the UCD-T2DM Rat Model of Type 2 Diabetes. *J Bone Miner Res*, 33(6), 1066-1075.
- Alemi, A. S., **Mazur, C. M., Fowler, T. W., Woo, J. J., Knott, P. D., & Alliston, T.** (2018). Glucocorticoids Cause Mandibular Bone Fragility and suppress osteocyte perilacunar-canalicular remodeling. *Bone Rep*, 9, 145-153.
- Alliston, T.**, Hernandez, C. J., Findlay, D. M., Felson, D. T., & Kennedy, O. D. (2018). Bone marrow lesions in osteoarthritis: What lies beneath. *J Orthop Res*, 36(7), 1818-1825.
- Alves, K., Godwin, C. L., Chen, A., Akellot, D., Katz, J. N., & **Sabatini, C. S.** (2018). Gluteal fibrosis, post-injection paralysis, and related injection practices in Uganda: a qualitative analysis. *Bmc Health Services Research*, 18.
- Alves, K., Penny, N., Ekure, J., Olupot, R., Kobusingye, O., Katz, J. N., & **Sabatini, C. S.** (2018). Burden of gluteal fibrosis and post-injection paralysis in the children of Kumi District in Uganda. *Bmc Musculoskeletal Disorders*, 19.
- Alves, K., Penny, N., Kobusingye, O., Olupot, R., Katz, J. N., & **Sabatini, C. S.** (2018). Paediatric musculoskeletal disease in Kumi District, Uganda: a cross-sectional survey. *International Orthopaedics*, 42(8), 1967-1973.
- Arutyunyan, G. G., Angevine, P. D., & **Berven, S.** (2018). Cost-Effectiveness in Adult Spinal Deformity Surgery. *Neurosurgery*, 83(4), 597-601.
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