

Research Report

Highlights in Musculoskeletal Research 2021



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Cover: At top, resident Ryan Halvorson, MD and clinical researcher Luana Leal work with novel markerless motion-capture technology to track patient biomechanical function developed from the Musculoskeletal Research Consortium (METRICS) lab led by Jeannie Bailey, PhD. At middle, resident Michael Davies, MD performs research experiments on muscle tissue quality and its impact on common orthopaedic problems. (Photos: UCSF Department of Orthopaedic Surgery).

UCSF Orthopaedic
Surgery
School of Medicine

May 12, 2022



Message from the Chair of the UCSF Department of Orthopaedic Surgery

Dear colleagues and friends,

Since 1930, we have been dedicated to pioneering musculoskeletal care to transform lives.

It was in that year that Dr. LeRoy C. Abbott (1890-1965) took on the role as the Department's first Chair. After serving as Military Director of Orthopaedic Surgery for the U.S. Army in Europe during World War I, "Roy" Abbott returned to the Pacific Coast, where he would build an orthopaedic department at UCSF unique to its time – but not without its struggles. His "Division" consisted of an outpatient clinic, a few beds in the University Hospital, a small unit at San Francisco Hospital, and a tight annual budget of \$2,200. At the time, there was no salary for him or his assistants, there was no office space, and a clinical staff of 12 quickly dwindled to seven that year.

Despite these challenges, the Department persevered: Dr. Abbott opened UCSF's first brace shop the following year in 1931. By the 1940s, Dr. Abbott and his team became one of the first orthopaedic practices to recognize the importance of motion pictures by creating training materials for the next generation of orthopaedic surgeons (In fact, his two short reels on fundamentals of the knee joint were eventually used by the U.S. Navy to train military surgeons during World War II.).

During this time, orthopaedic research was already a pillar of our developing Department, and in 1940, organized research finally began with the Department's first grant awarded by the National Foundation for Infantile Paralysis for the purpose studying rehabilitation of paralyzed children.

Looking back at our 92-year history, we have seen decades of change and challenge, growth and loss, resilience and achievement. Our core objectives -- answering the most fundamental questions using evidence-based data from all disciplines of musculoskeletal research -- continue to endure even during the roughest times.

In the wake of the last two years' uncertainty -- from the pandemic to world affairs disrupting the normalcy of our day-to-day lives -- we continue to embrace our purpose. In 2021, we slowly and carefully re-opened basic science research labs, conducted clinical research trials and proceeded with plans to expand our research facilities and develop new projects. Thanks to very generous funding, we are continuing to build a sustainable model to further innovative research.

Please enjoy learning about our research endeavors over the past year. We are very proud of our researchers and look forward to another enterprising 92 years!

Thomas Parker Vail, MD
The Michael and Antoinette Pappas Endowed Chair
James L. Young Professor
Department of Orthopaedic Surgery
University of California, San Francisco

Our Vision

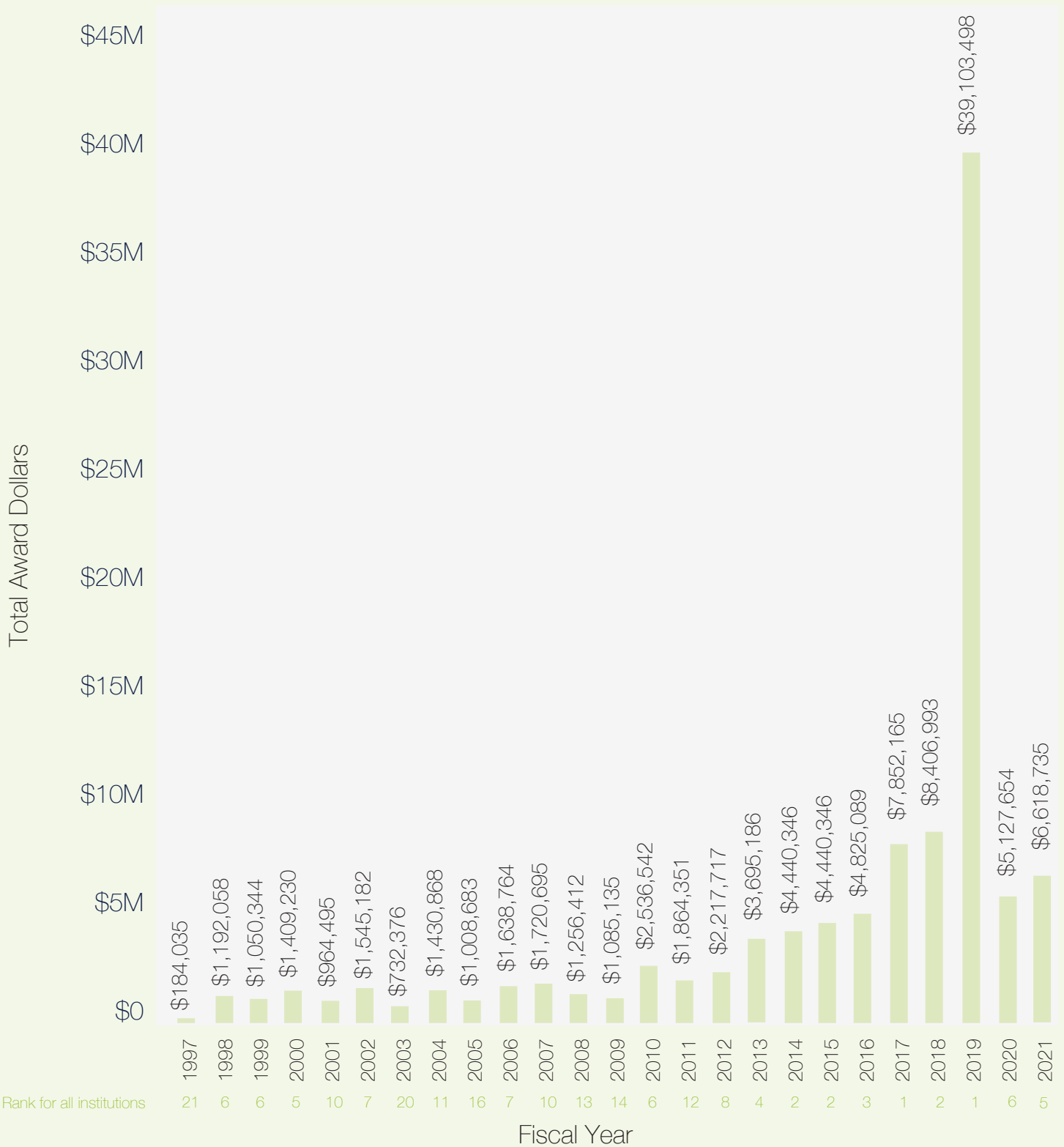
Pioneering musculoskeletal discovery and innovative care to transform lives.

Associate Specialist Mohamed Habib, a member of the Fields Laboratory for Orthopaedic Biomechanics and Biotransport, performs an intradiscal treatment delivery under fluoroscopic guidance related to structure-function relationships in musculoskeletal tissues research, with a particular focus on the effect of matrix modification of the cartilage endplate for improving solute transport and disc nutrition.



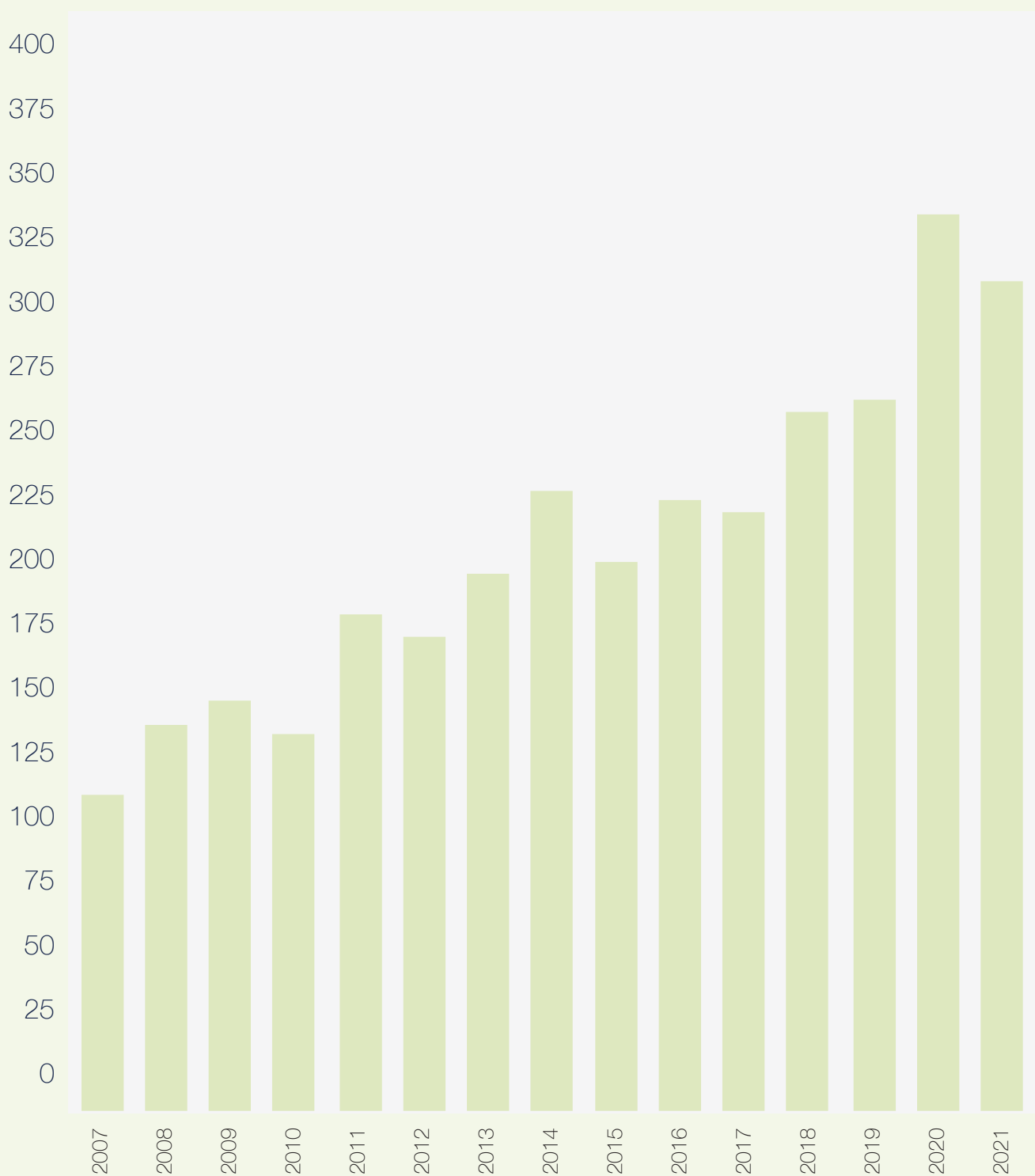
NIH Ranking

NIH Research Grants for UCSF Department of Orthopaedic Surgery

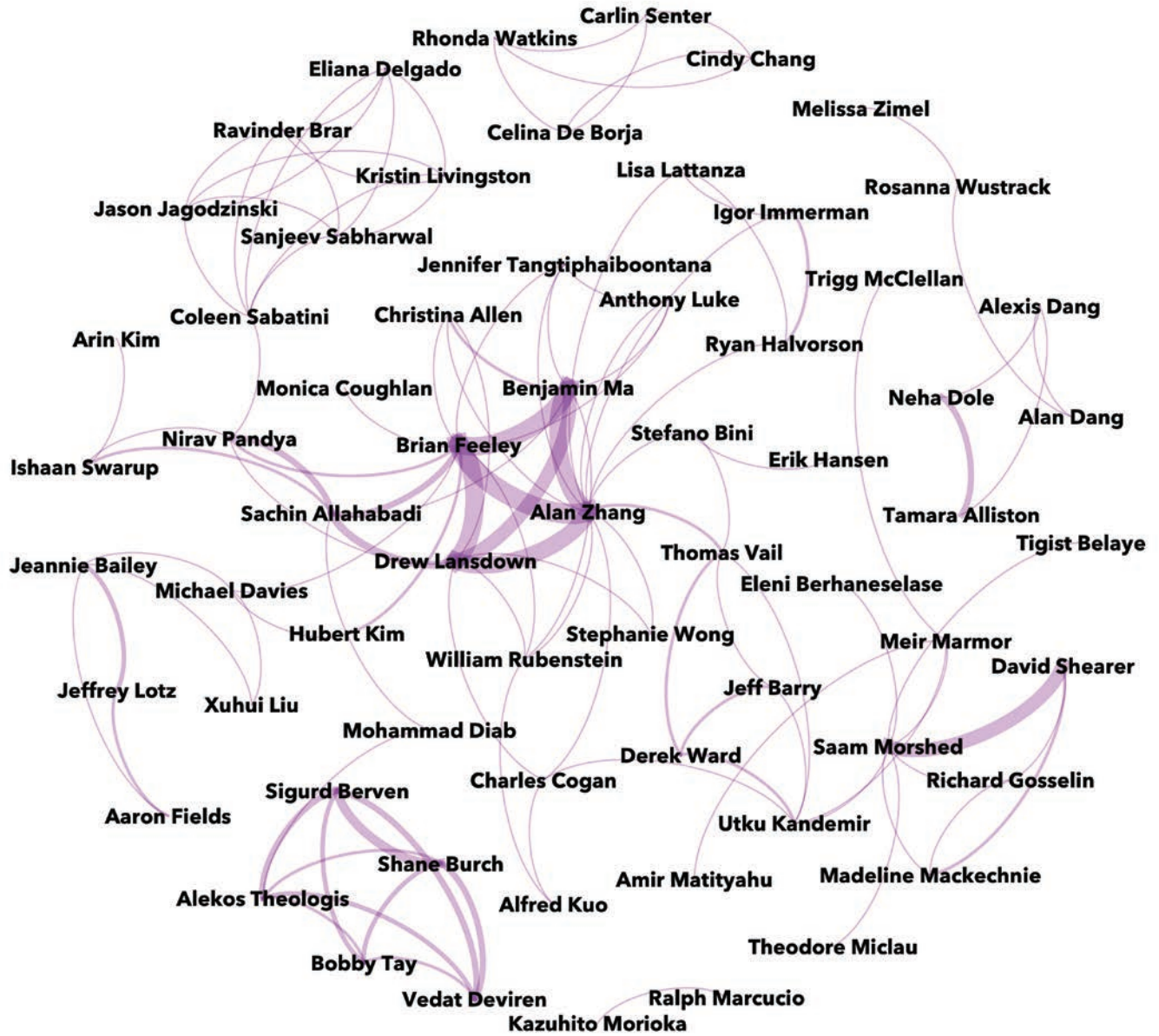


Research: UCSF Publications

Research: UCSF Publications



Co-authorships within Department



2021 Grants and Fellowships



Jeannie Bailey, PhD

DOD US Army Med. Res. Acq. Activity W81

Assessing biomechanical function and hip stabilizing muscle quality associated with transfemoral osseointegration

7/1/2021-6/30/2022

\$349,634

NSF CDMI (Center for Disruptive Musculoskeletal Innovations) funded project

Paraspinal muscle phenotypes that associate with response to treatment for chronic low back pain

12/01/2021 – 11/30/2022

\$40,000

NSF CDMI (Center for Disruptive Musculoskeletal Innovations) funded project

Transcutaneous spinal cord stimulation as a novel non-invasive therapeutic approach for treatment of chronic low back pain

11/01/2021 – 10/31/2022

\$40,000



Jeffrey Barry, MD

OMeGA Medical Grants Association

UCSF Adult Reconstruction OMEGA Grant

8/1/2021-7/31/2022

\$44,000



Andrew Brack, PhD

NIH Natl Inst Arthr, Musculoskel & Skin R01

The role of P16Ink4a in adult skeletal muscle stem cells

8/17/2021-5/31/2026

\$2,191,190



Shane Burch, MD

Medtronic, Inc. - Fellowship

Spine Robotics Direct Fellowship

8/1/2021-7/31/2022

\$75,000



Cindy Chang, MD

Ossur Americas - Fellowship

Ossur Fellowship

7/1/2021-6/30/2022

\$20,000

Restore Medical, Inc. - Fellowship

Primary Care Sports Medicine Fellowship Corporate Grant

7/1/2021-6/30/2022

\$1,000



Michael Davies, MD

Orthoregeneration Network Foundation

Hydrogel-Based Delivery of Human Beige Fibroadipogenic Progenitors as a Novel Treatment Strategy to Promote Muscle Regeneration Following Rotator Cuff Tears

2/1/2021 – 2/1/2023

\$26,729



Leah Demetri, MD

J. Robert Gladden Orthopaedic Society A137035

Health Disparities and Constriction Band Syndrome - Medical Student / Resident Research Grant

6/1/2021-5/31/2022

\$2,500



Neha Dole

NIH Natl Inst Diabetes & Digest & Kidney K01

Unraveling the role of osteocytes in metabolic dysfunction associated with obesity

9/15/2021-7/31/2026

\$705,995



Brian Feeley, MD

Tornier, Inc.

Treatments In Shoulder Arthritis (TRISHA)

9/23/21-9/23/2026

\$81,723



Aaron Fields PhD

NIH NIAMS UH3

Novel imaging of endplate biomarkers in chronic low back pain

9/1/2021-8/31/2024

\$1,931,981

Role of the gut microbiome in the progression of vertebral endplate bone marrow lesions (Modic changes) in chronic low back pain

REACH ancillary project

05/01/2021 – 04/30/2022

\$47,684



Erik Hansen, MD

American Orthotic & Prosthetic Assoc

The Effects of osteoarthritis bracing on community involvement, a pilot study

1/1/2021-12/31/2021

\$15,000



Safa Herfat, PhD

DOD US Army Med. Res. Acq. Activity

Development of a Handheld Ultrasound-based System to Assist in Clinical Diagnosis of Acute Compartment Syndrome

8/15/2021-8/14/2023

\$1,497,881



Tiffany Liu, MD

American Foundation for Surgery of the Hand

Correlation between visual appearance and histology of peripheral nerve sections

1/31/2021-12/31/2021

\$5,000



Jeffrey Lotz, PhD

NIH Natl Inst Arthritis, Musculoskeletal & Skin

ComeBACK Study - addition of BACPAC Treatment Categorization Questionnaire

1/1/2021-12/31/2023

\$175,055

REACH Participant Diversity Program

NIH HEAL Administrative Supplement to Support Strategies to Increase Participant Diversity, Inclusion and Engagement in Clinical Studies

08/01/2021 - 05/31/2024

\$605,502



C. Benjamin Ma, MD

Patient-Centered Outcomes Research Institute

Operative versus Non-Operative Treatment for Atraumatic Rotator Cuff Tears: A Multicenter Randomized Controlled Pragmatic Trial - (SubK from transfer of A130300 VUMC to UTSW)

7/1/2021-6/30/2023

\$21,606



Ralph Marcucio, PhD

NIH Natl Inst Dental & Craniofacial Research

The role of continuous phenotypic variation in structural defects of the face

12/1/2021-11/30/2026

\$2,883,085

NSF CDMI (Center for Disruptive Musculoskeletal Innovations) funded project

Anti-bacterial properties of wires

05/01/2021 – 04/30/2022

\$40,000



Saam Morshed, MD, PhD, MPH

DOD US Army Med. Res. Acq. Activity

Master A134521 Task Order - Evaluation of a New Strategy for Protocolized Antibiotic Care for Severe Open Fractures: SEXTANT - A Multicenter Randomized Control Trial

7/1/2021-9/29/2021

\$10,850



Aenor Sawyer, MD, MS

Murdoch Childrens Research Institute

Grant to support collaborative activities

10/1/2021-10/1/2022

\$116,455

National Science Foundation CDMI (Center for Disruptive Musculoskeletal Innovations) funded project

Feasibility and utility of Point of Care Ultrasound-based bone density and lumbar muscle assessment in preoperative planning for reconstructive spine surgery

11/01/2021 – 10/31/2022

\$40,000



David Shearer, MD

NIH Natl Inst Arthr, Musculoskel & Skin K23

A Pilot Masked, Randomized Controlled Trial Evaluating Locally-applied Gentamicin versus Saline in Open Tibia Fractures (pGO-Tibia)

4/15/2021-3/31/2026

\$803,708



Ishaan Swarup, MD

Scoliosis Research Society

Preoperative Patient Expectations in Patients Undergoing Spinal Deformity Surgery for Adolescent Idiopathic Scoliosis (AIS)

9/1/2021-8/31/2023

\$30,000



Bobby Tay, MD

AO North America, Inc

AOSpineNA 2021-2023

8/1/2021-7/31/2023

\$130,000

OMeGA Medical Grants Association

2021-2022 Omega Spine Fellowship

8/1/2021-7/31/2022

\$40,050

NuVasive, Inc.

Orthopaedic Spine Fellowship 2021-2022

8/1/2021-7/31/2022

\$24,000



Jihee Yoon

NIH Natl Inst Dental & Craniofacial Research Fellowship

microRNA regulation of osteocyte metabolism in bone remodeling

7/1/2021-6/30/2026

\$233,364



Alan Zhang, MD

Arthroscopy Association of North America Fellowship

ARTHROSCOPY/SPORTS FELLOWSHIP 2020-2021

8/1/2021-7/31/2022

\$10,452

Department Grants

\$5,000 NOVA Grant Recipients



Stephanie Wong, MD

“Understanding sex differences in surgical utilization in hip, knee, and shoulder arthroplasty”



Neha Dole, PhD

“Studying the role of ghrelin in obesity-induced osteocyte energetics and senescence”

\$25,000 Seed Grant Recipients



Brian Feeley, MD

“Utilizing Exosomes from FAPs for Muscle Regeneration”



Jeannie Bailey, PhD

“Transcutaneous spinal cord stimulation: a novel diagnostic and rehabilitation approach in chronic low back pain”

\$33,333 Bridge Funding



Richard Schneider, PhD

“Mesenchymal Regulation of Osteogenesis”

\$5,000 OREF Resident Research Grant



Steven Garcia, MD

Mentor: Brian Feeley, MD

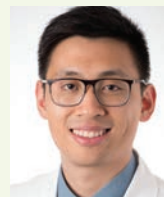
“Functionally Heterogeneous Human Fibroadipogenic Progenitor Cells”



Sarah Stroud, MD

Mentor: Rosie Wustrack, MD

“Analysis of Prognostic Factors for Adults with Primary Extremity Sarcomas”



Favian Su, MD

Mentors: Alexis Dang, MD/Alan Dang, MD

“Effect of Blue and Red Light Phototherapy on the Colonization of Cutibacterium acnes of the Shoulder”



Alejandro Gazzulino, MD

Mentor: Ishaan Swarup, MD

“Development and Validation of the Adolescent Idiopathic Scoliosis Preoperative Expectations Survey”

Research Programs and Activities



Basic Science and Translational Research

The UCSF Department of Orthopaedic Surgery has a diverse and broad basic and translational research program in musculoskeletal biology. Areas of focus include molecular and cell biology, developmental and stem cell biology, tissue regeneration, and biomechanics and biomaterials. 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.

Last year, our basic, translational, and clinical research was published in many high impact journals such as *Bone*, *eLife*, *FASEB Journal*, the *Journal of Bone and Mineral Research*, *PNAS*, as well as all major orthopaedic surgery journals including the *Journal of Bone & Joint Surgery (JBJS)*, *Journal of Shoulder*

and *Elbow Surgery (JSES)*, *Journal of Orthopaedic Trauma (JOT)*, *Spine journal*, *Journal of Pediatric Orthopaedics (JPO)*, *Clinical Orthopaedics and Related Research (CORR)*, and the *American Journal of Sports Medicine (AJSM)*.

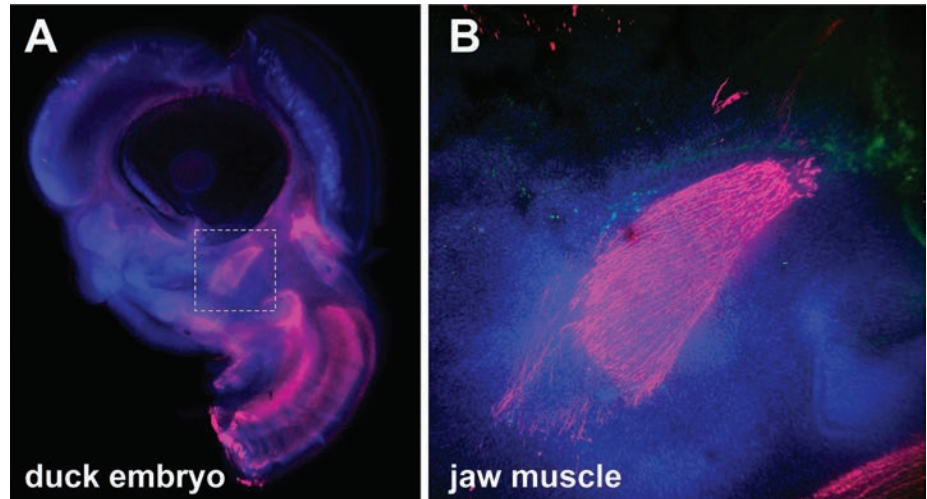
Our faculty, fellows, and residents have been invited to present at numerous national and international conferences such as those held by the American Academy of Orthopaedic Surgeons (AAOS); American Association for Anatomy (AAA), Orthopaedic Research Society (ORS); the American Orthopaedic Society in Sports Medicine (AOSSM); the American Society for Bone and Mineral Research (ASBMR); the Gordon Research Conferences (GRC), International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS); the Hip and Knee Society; and the Orthopaedic Trauma Association (OTA). For a full list of our departmental contributions to the 2021 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.

UCSF Orthopaedic Research Laboratory at Parnassus Heights



At Parnassus Heights, our basic science laboratories collaborate to investigate mechanisms underlying different orthopaedic conditions ranging between skeletal deformity, osteoporosis, and joint degeneration.



(A) Skeletal muscle from a duck embryo showing muscles of the head and neck (stained pink with an anti-myosin antibody). (B) At higher magnification (dashed inset box), striated fibers of the jaw closing muscles and their insertions points within skeletal precursor cells can be observed (Schneider Laboratory for Developmental and Evolutionary Skeletal Biology, confocal images by Dr. Jessye Aggleton).

Development and Evolutionary Skeletal Biology

UCSF Parnassus Heights

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

Dr. Richard A. Schneider, PhD, directs the Laboratory for Developmental and Evolutionary Skeletal Biology. Dr. Schneider and his lab investigates how the developing musculoskeletal system achieves its structural and functional integration. His 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 functional 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.

Skeletal Mechanobiology

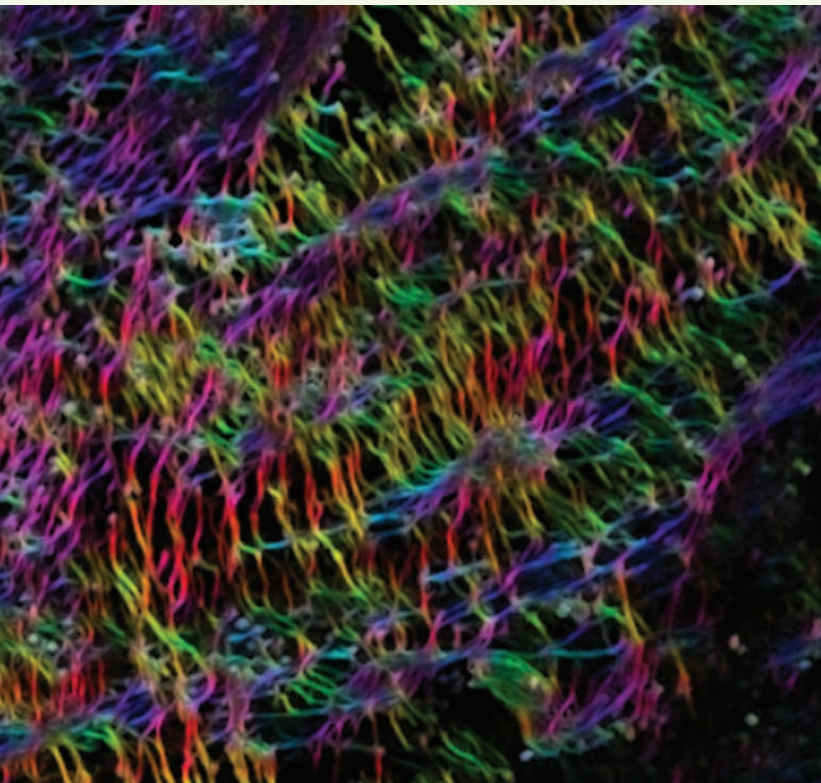
UCSF Parnassus Heights

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

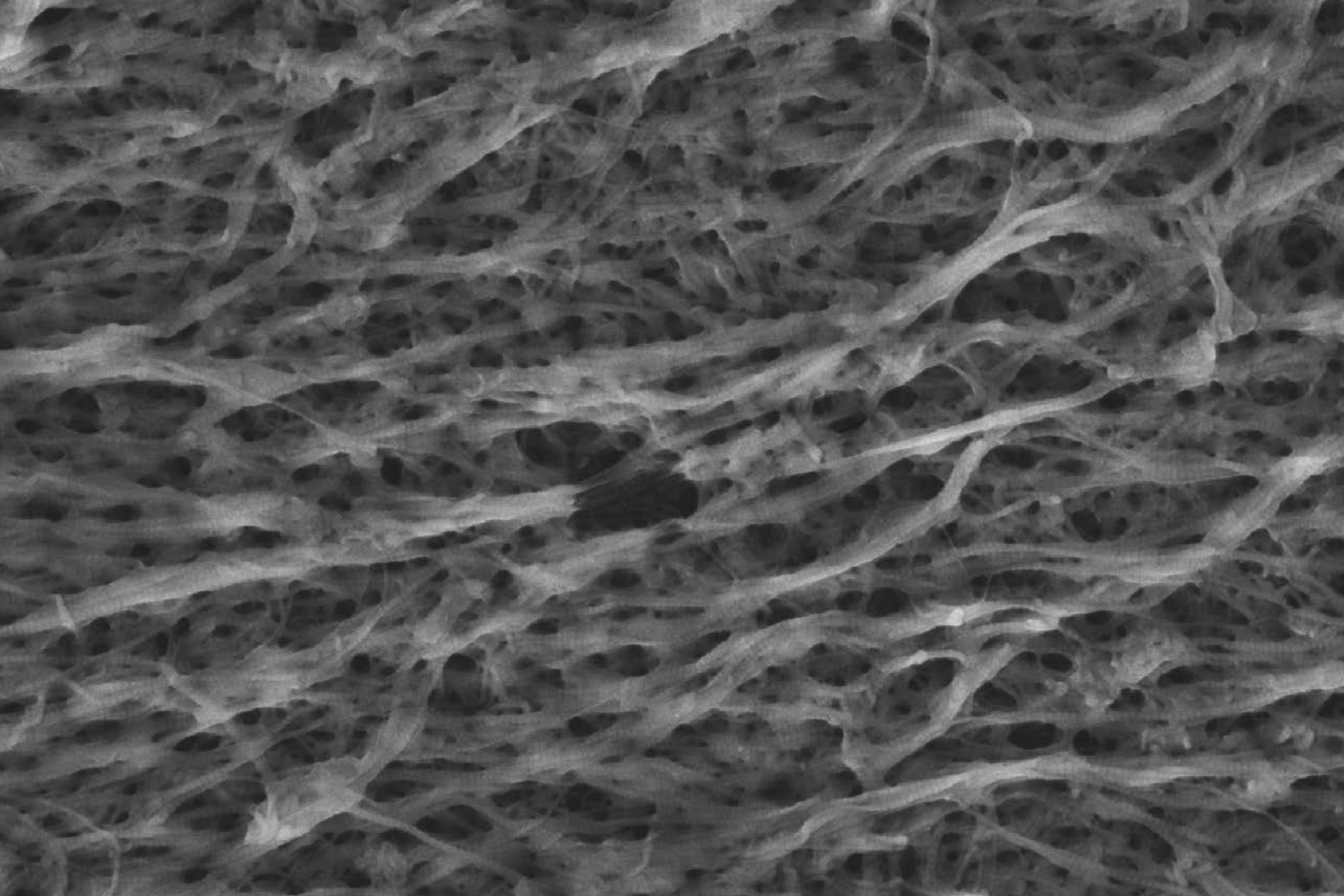
Dr. Tamara Alliston, PhD, directs the Laboratory for Skeletal Mechanobiology. Dr. Alliston and her lab investigate the molecular pathways controlling skeletal cell behavior, how these pathways coordinate with physical cues to influence mechanical integrity of healthy bone and cartilage, and how they can be harnessed

to repair tissue damaged in degenerative skeletal diseases like osteoporosis and osteoarthritis. To answer these questions they combine molecular, cellular, physiologic, and materials science approaches. In particular, they seek to define the function of TGF β in synergistically coordinating physical and biochemical cues in bone and cartilage cells. Since TGF β is a powerful regulator of homeostasis throughout the skeleton, understanding this signaling pathway has helped their team uncover fundamental new cellular mechanisms that participate in skeletal health and disease.

This research has provided important new insight on factors that cause common musculoskeletal problems, like joint injuries, osteoarthritis, and bone fragility in aging men and women. Now the research team is building on what they have learned in the laboratory to discover new therapeutic strategies to prevent skeletal disease and to improve skeletal repair.



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



Fields Laboratory for Orthopaedic Biomechanics and Biotransport

Orthopaedic Biomechanics and Biotransport

UCSF Parnassus Heights

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

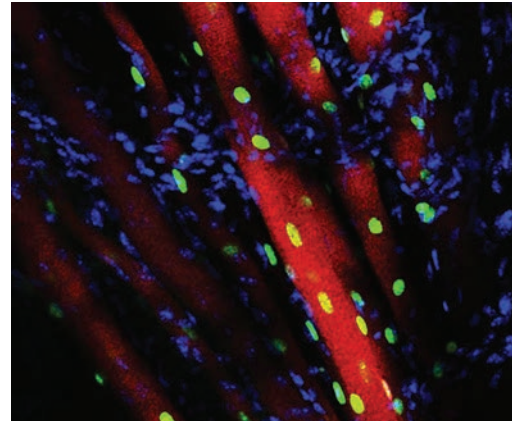
Dr. Aaron J. Fields, Ph.D, directs the Orthopaedic Biomechanics and Biotransport Laboratory. Dr. Fields and his lab investigate structure-function relationships in musculoskeletal tissues, with a particular focus on discovering the mechanisms of nutrient transport in cartilage and bone, and developing strategies that harness nutrient transport to improve tissue repair and regeneration. The lab combines engineering and biology approaches for: (1) understanding the effects of aging and disease on structure-transport relationships, and (2) developing translatable diagnostic and therapeutic strategies. An overall theme of this research is the use of advanced experimental

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

A primary focus of the lab's current research is the role of the cartilage endplate (CEP) in spinal disc degeneration and low back pain. The CEP forms a semi-permeable barrier that separates nutrient-rich vertebrae from the cells living inside the avascular discs. Research from the Fields lab has demonstrated how poor nutrient transport through the CEP impacts disc cell survival and function. Now the research team is using this knowledge to enhance the translation of disc regenerative therapies to the clinic.

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

Image by Annarita Scaramozza, PhD



Stem Cell Laboratory

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

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

Andrew Brack, PhD, directs the Stem Cell Laboratory and has developed collaborations with clinical faculty, including sports medicine and oncology. Active studies include studies on muscle aging and muscle recovery after radiotherapy. This effort uses state of the art machine learning and molecular biology to determine the causes of muscle dysfunction and identify strategies to rejuvenate the regenerative potential of skeletal

muscle. During aging or in response to radiotherapy, the capacity for muscle repair is diminished, leading to reduced mobility and strength. In the future, the Brack Lab hopes that current projects will lead to strategies that reverse aging and improve recovery after radiotherapy.

Skeletal Regeneration/Molecular and Cellular Biology

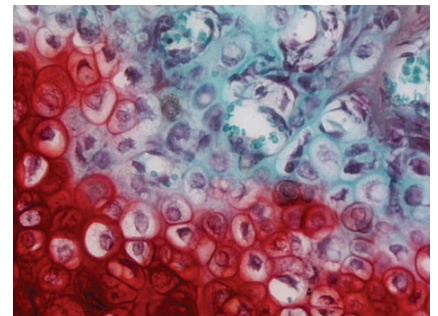
Zuckerberg San Francisco General Hospital (ZSFGH)

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

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

The research utilizes a murine tibia fracture model that was developed by members of the laboratory and is used in other laboratories throughout the national and international orthopaedic Skeletal Regeneration/Molecular and Cellular Biology.

Image is from the Molecular and Cellular
Biology Laboratory.



Laboratory for Evolutionary Anatomy

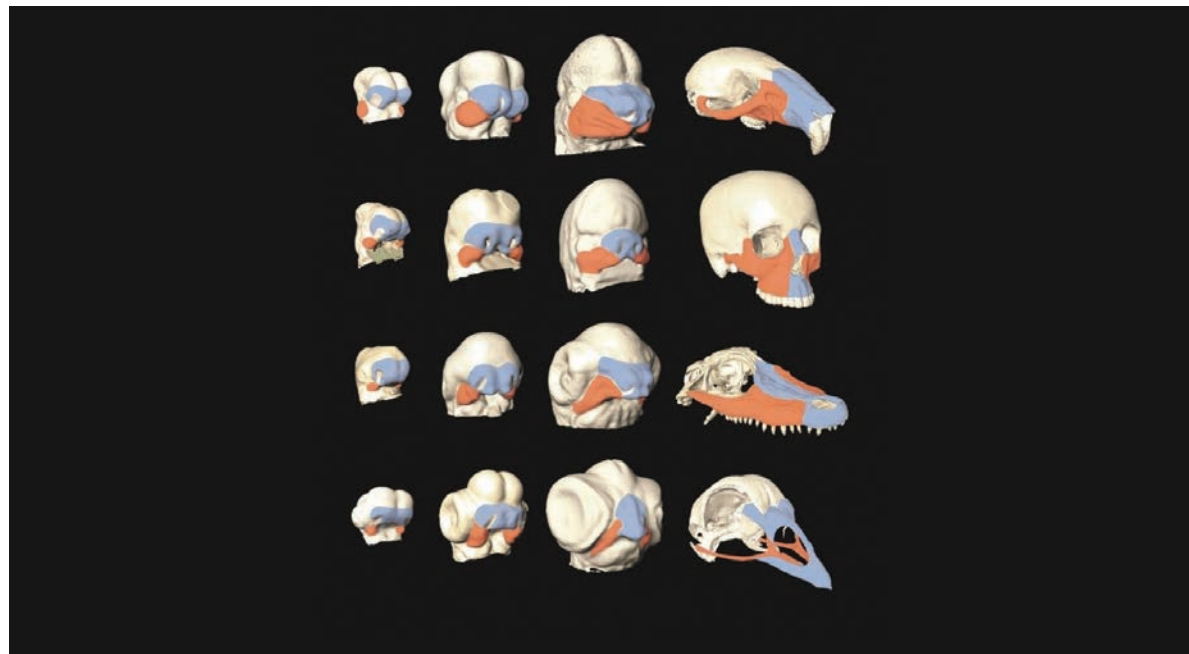
Zuckerberg San Francisco General Hospital (ZSFGH)

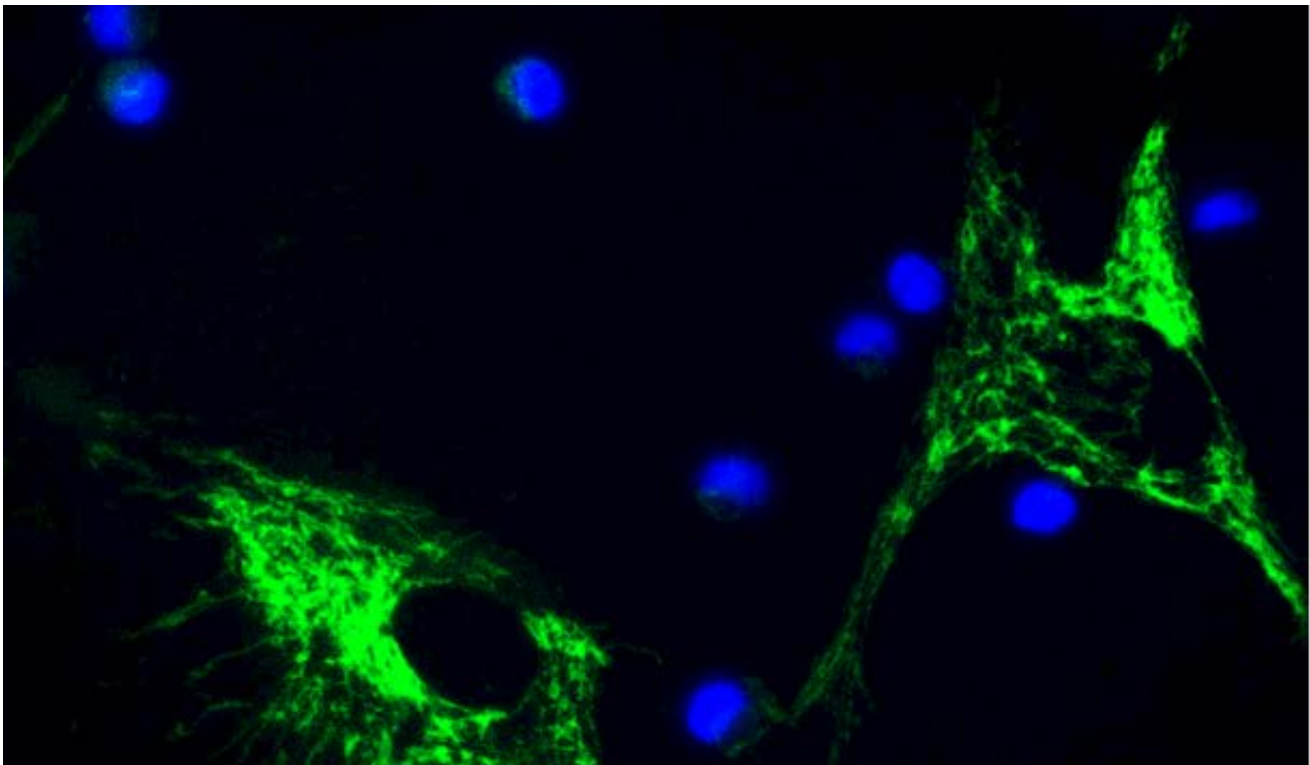
The Laboratory for Evolutionary Anatomy is directed by **Nathan Young, PhD**.

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 research

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

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





FAP stem cells (green) transferring mitochondrial through nanotubes to muscle stem cells (blue).

Orthopaedic Translation Research

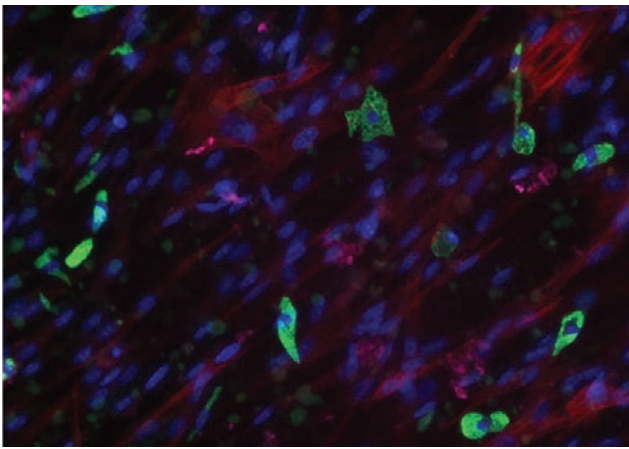
UCSF VA Research Facility at Mission Bay

The Muscle Regeneration Laboratory is co-directed by **Brian Feeley, MD** and **Xuhui Liu, MD** at the UCSF Research Facility at Mission Bay.

Drs. Brian Feeley, MD, and Xuhui Liu, PhD co-direct the Muscle Regeneration lab (feeleylab.ucsf.edu), performing research on muscle tissue quality and its impact on common problems, including rotator cuff tears, knee pain, limb immobilization, joint contractures, and low back pain. They collaborate with Hubert Kim, MD and other researchers at the UCSF/VA Mission Bay campus to develop models for studying the molecular and cellular mechanisms responsible for muscle degeneration—and regeneration. This stem cell research is funded by the NIH, the VA, UCSF, and private donations. Members of the lab have won awards and research grants from the American Academy of Orthopaedic Surgeons (AAOS), the American Orthopaedic Society for Sports Medicine (AOSSM), and the Orthopaedic Research Society (ORS). Most recently, the research team has won the ASES Neer Award (2020) (Carlin Lee) and the AOSSM Excellence in Research Award (2021) (Michael Davies). Steven Garcia was awarded an NIH Diversity Supplement Grant as well (2021).

The group focuses on specific changes within muscle that occur across disease pathologies. Our central hypothesis is that some

stem cells within muscle may have the ability to help promote a regenerative phenotype and help muscle recover from injuries. Certain cells (called fibroadipoprogenitors or FAPs), can turn into white fat, which may be energy stores for the muscle. They can also become brown fat or beige fat. As it turns out, beige fat plays an important role in energy balance, and it may produce local growth factors, such as IGF-1, that promote a regenerative environment for muscle, as well as secrete factors within exosomes to promote muscle growth and differentiation. In other words, with the right stimulus, these cells might be available to help muscle get healthy again. In 2021, we focused on expanding our work by evaluating the transcriptomic profiles of these cells in human and mouse cell lines, evaluating how these cells may influence changes in the spinal cord and pain perception in degenerative spine conditions, and expanded our work into muscular dystrophy and ALS.



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)

Orthopaedic Translational Research

Multi-campus Laboratory

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.

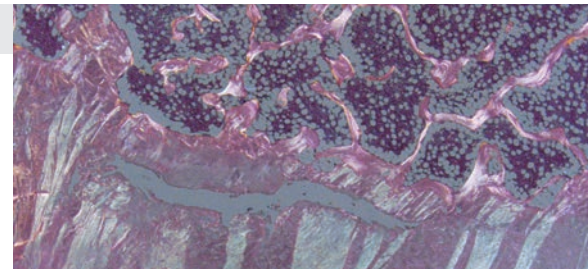
Drs. Hubert Kim, MD, PhD, and Alfred Kuo, MD, PhD, co-direct the Laboratory for Orthopaedic Translational Research. The focus of their team's research effort is to examine the molecular and cellular mechanisms responsible for secondary injury cascades that are set in motion after trauma. There is particular 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. In addition, the laboratory evaluates new diagnostics and therapeutics for musculoskeletal conditions, including the use of ultrasound and powered knee braces for patients with knee osteoarthritis, and a novel implant for hip arthroplasty.

Orthopaedic Tissue Engineering and Regeneration

UCSF Parnassus Heights

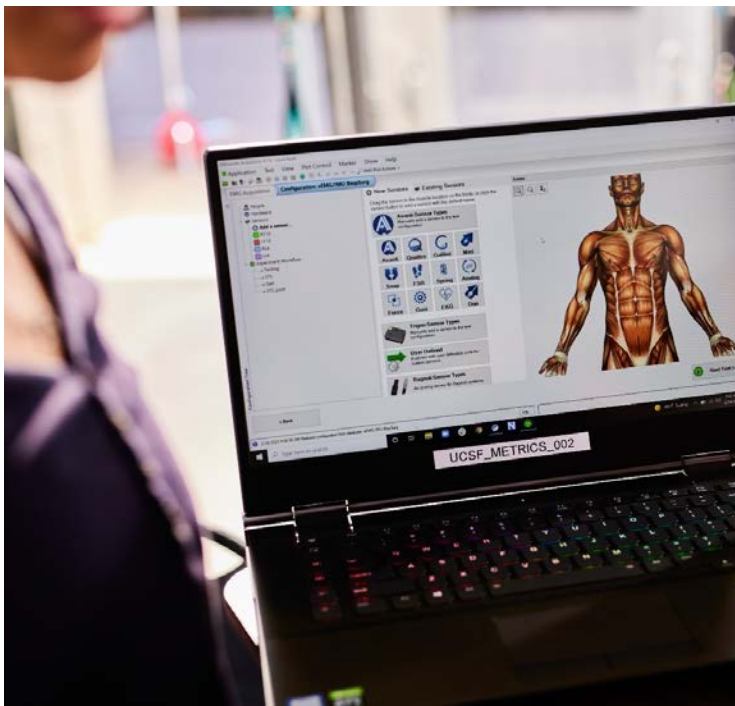
The Orthopaedic Tissue Engineering and Regeneration Laboratory is directed by **Jeffrey C. Lotz, PhD**.

Dr. Jeffrey C. Lotz, PhD, is the David S. Bradford M.D. Endowed Chair in Orthopaedic Surgery and Vice Chair of Orthopaedic Research at UCSF. Dr. Lotz has led the Orthopaedic Tissue Engineering Laboratory at UCSF since 1992, and his research focuses on identifying mechanisms of disc degeneration, developing novel diagnostics and therapies for low back pain, and the biomechanics of spinal instrumentation. He is bringing his multifaceted expertise to bear on the development of precision medicine approaches for chronic low back pain as principal investigator of one of the three Mechanistic Research Centers funded through the NIH Back Pain Consortium (BACPAC) Research Program (under NIH HEAL). BACPAC is a translational, patient-centered effort to combine state-of-the-art diagnostic



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

tools and artificial intelligence approaches to personalize therapies for chronic low back pain. Dr. Lotz is also director of two other research centers, including the NIDCR-funded Center for Dental, Oral and Craniofacial Tissue and Organ Regeneration (C-DOCTOR), and the NSF-funded Industry/University Cooperative Research Center (CDMI). Dr. Lotz earned a doctorate degree in Medical Engineering from the Harvard/MIT Division of Health Sciences and Technology, a Master of Science Degree in Mechanical Engineering Design from Stanford University, and Bachelor of Science Degree in Mechanical Engineering from UC Berkeley.



Data science and Technology Development for Enhancing Clinical Research

UCSF VA Health Center, Research Facility at Mission Bay

Dr. Jeannie F. Bailey, PhD, co-directs the Musculoskeletal Research Consortium (METRiCS) lab alongside Drs. Richard O'Donnell, MD, and Robert Matthew, PhD.

Dr. Jeannie F. Bailey, PhD, co-directs the Musculoskeletal Research Consortium (METRiCS) lab alongside Drs. Richard O'Donnell, MD, and Robert Matthew, PhD. Her research focuses using advanced technology and data science approaches for creating and analyzing novel patient outcomes for predicting response to treatment. She has numerous studies tracking patient-specific biomechanical and muscle health in astronauts, amputees, and joint replacement patients. Using these approaches, her research seeks to clarify the role of muscle health on predicting post-treatment biomechanical and pain-related outcomes for orthopaedic surgery patients. She is also actively developing and testing digital tools for enhancing patient-engagement with care and recovery, as well as safe and non-invasive digital therapeutics. With collaborators in Neurosurgery, she is developing wearable neuromodulating devices to treat chronic orthopaedic pain and was awarded a 2021 Catalyst Innovation Award to enhance this work.

Data science and Technology Development for Enhancing Clinical Research

Multi-Campus Laboratory

Dr. Thomas Peterson PhD is Director of the Informatics Core for the UCSF REACH Center for Chronic Low Back Pain

Dr. Thomas Peterson, PhD's Laboratory for Digital and Computational Health Science works in close coordination with experts and trainees in the clinical domain to advance computational health sciences by leveraging advanced statistical techniques and artificial intelligence / machine learning (AI/ML) models. As director of the analytics core for the UCSF Core Center for Patient-centric Mechanistic Phenotyping for Chronic Low Back Pain (REACH for cLBP), Peterson's team provides cutting-edge tools for studying multimodal data including electronic health records (EHRs), clinical images, biomechanical sensors, and free-text clinical notes. This year, Dr. Peterson published a book chapter describing AI/ML techniques applied to the management of spinal disorders [1]. Additionally, using his expertise in EHRs in his work with UC Health in 2021, Dr. Peterson published the first research paper to study the combined EHRs of five major UC academic medical institutions (UCSF, UCLA, UCD, UCI, and UCSD) [2]. Such expertise from the Peterson Lab in a variety of computational health science domains promises innovations for the advancement of precision medicine in orthopaedic surgery for the future.



Clinical Research

The UCSF Department of Orthopaedic Surgery has continued to foster clinical research programs to study treatments that can optimize patient outcomes. The following section will highlight clinical research initiatives from each of our subspecialty sections.

Arthroplasty

Led by Drs. Thomas Vail, MD; Erik Hansen, MD; Stefano Bini, MD; Jeff Barry, MD; Derek Ward, MD. UCSF's Arthroplasty Group participates in, and designs research studies, that are on the cutting edge of digital health and technology. Projects include longitudinal studies utilizing the post-surgical follow-up to gauge the effectiveness of advancing techniques and knowledge of arthroplasty surgeries, such as the prevention and treatment of periprosthetic joint infections (PJIs).

Project Highlights

American Joint Replacement Registry

In their commitment to research, the Arthroplasty Section has submitted surgical data to the AAOS' nation-wide American Joint Replacement Registry (AJRR), the world's largest hip and knee replacement registry. Since the creation of the registry in 2006, over 2 million procedures have been submitted from institutions across all 50 states, allowing for benchmarking and collaborative research projects.

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

Site Co-Investigators: Jeff Barry, MD; Stefano Bini, MD; Erik Hansen, MD; Thomas Vail, MD; Derek Ward, MD. Sponsored by OrthoCarolina Research Institute

Surgeons are looking to improve upon irrigation and debridement (I&D) procedures for periprosthetic joint infections (PJIs) by utilizing intraosseous regional administration of antibiotics at the time of I&D as a deterrent for future PJI.

Rejuvenating Aged Hematopoietic Stem Cells with Pluripotent Stem Cell-Secretome

Site Co-Investigators: Jeff Barry, MD; Derek Ward, MD.

In collaboration with the Gladstone Institutes

This study looks to investigate the ability of hPSC-secretomes to reverse aspects of aged hematopoietic stem cells (HSCs) found in the bone marrow of patients undergoing total knee arthroplasty (TKA).

A Randomized Controlled Trial of Acute Open Reduction Internal Fixation versus Distal Femur Replacement

Site Co-Investigators: Thomas Vail, MD; Erik Hansen, MD; Stefano Bini, MD; Jeff Barry, MD; Derek Ward, MD.

Sponsored by Toronto Orthopaedics

This study seeks to assess outcomes for treatment of distal femur fractures by performing a large randomized controlled trial comparing distal femur replacement with ORIF for distal femur fractures in elderly patients (65 years of age and older).

A validation study using gait analysis to test the accuracy of wearable sensor data in post-surgical patients

Site Investigator: Stefano Bini, MD

In collaboration with the UCSF Human Performance Center (HPC)

If a strong association can be demonstrated between wearable sensor data and clinical outcomes, wearables could quickly become the reference point for objectively evaluating clinical results with greater accuracy than ever before.

One Stage versus Two Stage or Periprosthetic Hip and Knee Infection

Site Co-Investigators: Thomas Vail, MD; Erik Hansen, MD; Stefano Bini, MD; Jeff Barry, MD; Derek Ward, MD.

Sponsored by OrthoCarolina Research Institute

This clinical trial intends to investigate the outcomes of one-stage and two-stage exchange arthroplasty for the management of patients with chronic periprosthetic joint infections (PJIs).

The Use of Venlafaxine in Reducing Post-Surgical Pain and Opioid Consumption after Primary Total Knee Arthroplasty

Site Co-Investigators: Jeff Barry, MD; Stefano Bini, MD; Erik Hansen, MD; Thomas Vail, MD; Derek Ward, MD.

In collaboration with the UCSF Department of Anesthesia

We propose a prospective randomized clinical trial to evaluate the efficacy of venlafaxine in reducing pain intensity and opioid consumption at post-operative day 1 and one week after surgery, and as well as examine whether the use of venlafaxine will reduce the incidents of chronic postsurgical pain in TKR patients at 3 months

Biodistribution of ¹¹C D-methionine Positron Emission Tomography In Normal Subjects and Those with Suspected Infection

Site Co-Investigators: Jeff Barry, MD; Stefano Bini, MD; Erik Hansen, MD; Thomas Vail, MD; Derek Ward, MD.

In collaboration with the UCSF Department of Radiology and Biomedical Imaging

The goal of this project is to assess the ability of a positron-emitting topography (PET) agent in directly detecting bacterial infection in human subjects, which localize to bacteria but not mammalian cells.

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

Site Co-Investigators: Jeff Barry, MD; Stefano Bini, MD; Erik Hansen, MD; Thomas Vail, MD; Derek Ward, MD.

Sponsored by Duke University

This open-label trial is designed to identify the comparative effectiveness of various perioperative strategies for antibiotic delivery as prophylaxis against PJI and SSIs in elective TKAs.





A 3-D print of a human foot and ankle joint is on display in a light box at the Makers Lab, in the Kalmanovitz Library, at the Parnassus campus. (Photo Courtesy of UCSF)

Foot and Ankle

Dr. Kirstina Olson, Dr. Daniel Thuillier and Dr. Lan Chen have continued to build the research infrastructure for the Foot and Ankle Section. Dr. Chen is currently working on large administrative database research evaluating complication rates in outpatient total ankle arthroplasty. Dr Olson is coordinating a study evaluating post-operative pain control in foot and ankle patients utilizing pain catheters and long-acting nerve blocks. Dr Thuillier is assessing timing of Achilles tendon rupture repairs and early return of strength and higher levels of activity. Dr Thuillier is evaluating lower extremity atrophy and clinical function after surgical repair for chronically torn tendons.

Hand and Upper Extremity

The hand and upper extremity division has multiple on-going projects assessing upper extremity pathologies through the lens of race/ethnicity. For example one study to highlight evaluates differences in the prevalence of amyloidosis by race. Other studies include healthcare disparities in upper extremity surgery such as the impact of language and race/ethnicity on outcomes. Finally, the group is evaluating factors that lead to goal concordance between patient/surgeon and surgical outcomes and return to work time by treatment type for metacarpal fractures.

Dr. Nichole Schroeder exams a patient's hand at the UCSF Orthopaedic Institute on the Mission Bay Campus in San Francisco. (Photo courtesy of the UCSF Department of Orthopaedic Surgery)



Dr. Rosanna Wustrack reviews a radiology report with a medical student at the UCSF Mission Bay Hospital in San Francisco. (Photo Courtesy of the UCSF Department of Orthopaedic Surgery)



Orthopaedic Oncology

The Oncology Section is a world leader in the use of osteointegration techniques and continues to advance innovation in this field through clinical care as well as research. Our sarcoma center is also engaged in clinical research to assess outcomes of treatment with a focus on health disparities. Dr. Rosie Wustrack and Dr. Melissa Zimel are working with the California Cancer registry to assess Health disparities in adult primary bone sarcoma treatment.

Current On-going Studies:

Lost to Follow-Up: Soft Tissue Sarcoma

Principal Investigator: Dr. Rosanna Wustrack, MD

The study aims to evaluate the sarcoma practice overall loss to follow-up rate and whether patients from low socio-economic status backgrounds, non-English speakers and those with poor insurance are more likely to be lost to follow-up after surgery for a soft tissue sarcoma.

OPRA Implant System Premarket Approval and Related Studies

Principal Investigator: Dr. Rosanna Wustrack, MD

The Osseointegration Prostheses for the Rehabilitation of Amputees (OPRATM) Implant System (Intregum, AB, Mölndal, SE) is a bone-anchored percutaneous device that allows for the direct attachment of an external prosthesis to an amputee's residual limb, without the use of a socket. This study will assist patients in the PMA process, as well as provide for completion of clinical outcome measures.

A 2-year follow-up, multidisciplinary study focused on outcomes and experience with the OPRA Axor II coupling unit.

Principle Investigator: Matthew Garibaldi

This is a collaborative effort with the Orthopaedic Surgery Orthotic and Prosthetic Section aiming to determine patient satisfaction and prosthetic-related outcomes while using a novel coupling device that serves as both a prosthetic suspension and fail-safe release to prevent femoral fracture or implant damage.

Phantom limb pain multimodal imaging

Principal Investigator: Dr. Richard O'Donnell, MD

This study will test the hypothesis that phantom limb pain and phantom auditory pain share parallel distinguishing features identifiable by multimodal neuroimaging. The study will evaluate differences in cortical and corticostriatal functional connectivity in patients with and without PLP, and their relationships with pain severity.

Osseointegration Quality Registry

This registry aims to ensure that UCSF stays abreast of implant design modifications, as well as identify early failures of the Osseointegration implant. In addition, by examining functional outcomes and complications of bone anchored percutaneous implants physicians can better define their role, and refine patient selection recommendations.

ASSIST: Amputee Smart Safe Implant Sensor Technology

Principal Investigator: Dr. Richard O'Donnell, MD

Sponsored by Henry M. Jackson Foundation for the Advancement of Military Medicine

The purpose of this study is to better understand the biomechanics of activities of daily living in patients with amputation. Outcomes analyzed include activity patterns and joint specific biomechanics. These measures will be derived from sensors that are adherent to the body and part of the external prosthesis. We aim to establish normative movement patterns in these populations so as to guide rehabilitation in a safe fashion and to proactively monitor and avoid potential complications so as to improve overall outcomes.

Patient Preferences for Attributes of Risk and Benefit of Prosthetic Devices for Upper Limb Loss

Co-Principal Investigator: Dr. Richard O'Donnell, MD

Sponsored By The Burroughs Wellcome Fund

The primary objective of the FDA's Patient Preference Initiative (PPI) is "to develop a systematic way of eliciting, measuring and incorporating patient preference information, where appropriate, into the medical device total product life cycle." This study aims to develop the methods for integrating patient voice into device benefit-risk determinations.

Orthotics and Prosthetics

The UCSF Orthotics and Prosthetics Center lead by Matthew Garibaldi MS, CPO is currently engaged in a multicenter, multidisciplinary study focused on outcomes and experience with the new OPRA Axor II coupling unit in collaboration with the

Oncology section. In addition, Chrysta Irolla and Emily Nelson were winners of the Thranhardt Lecture Award for the American Orthotic and Prosthetic Association's National Assembly.

Matthew Garibaldi examines a patient at the UCSF Orthopaedic Institute on the Mission Bay Campus in San Francisco. (Photo courtesy of UCSF Department of Orthopaedic Surgery)



Pediatric Orthopaedic Clinical Research

Led by surgeons Drs Sanjeev Sabharwal, Nirav Pandya, Ravinder Brar, Celina de Borja, Eliana Delgado, Mohammad Diab, Jason Jagodzinski, Kristin Livingston, Coleen Sabatini, Ishaan Swarup and Rhonda Watkins, UCSF's Pediatric Orthopaedic research team designs and facilitates clinical research on pediatric orthopaedic care, global health, public policy, and technology.

Project Highlights (Prospective, Multi-Center/Multi-Faculty Studies)

Efficacy of Patient Education in Pediatric Orthopaedic Trauma
Investigators: Drs. Ishaan Swarup (lead investigator), Celina De Borja, Rhonda Watkins

The purpose of this study is to determine the readability, understandability, and actionability of the Pediatric Orthopaedic Society of North America (POSNA) OrthoKids' website (orthokids.org) educational material regarding ankle fractures, elbow fractures, femur fractures, and forearm fractures.

A Video-Based Intervention to Improve Pediatric Orthopaedic Patient Education and Informed Consent

Investigators: Drs. Sabatini (lead investigator), Swarup, Pandya, Watkins, Brar, Jagodzinski, Sabharwal

For this study, we are assessing the efficacy of a novel, video-based educational intervention to improve guardians' comprehension of supracondylar humerus fracture surgery and idiopathy clubfoot treatment.

SCFE Longitudinal International Prospective Registry (SLIP)

Investigators: Dr. Ishaan Swarup (lead investigator), Dr. Jason Jagodzinski

This study involves the development of a comprehensive patient log and the initiation of a study examining patients' conditions prior to surgery for Slipped capital femoral epiphysis and their long-term outcomes across multiple participating centers will provide valuable insight into the treatment and management of this condition.

The Pediatric Spine Registry Study (PSSG)

Investigators: Dr. Ishaan Swarup (lead investigator), Dr. Mohammad Diab

The Pediatric Spine Registry (PS Registry) will serve as a hypothesis-generating database of prospectively collected outcomes.

Function After Adolescent Clavicle Trauma and Surgery (FACTS) Study Group:

Site Investigators: Dr. Nirav Pandya and Dr. Coleen Sabatini

This is a prospective, multi-center adolescent clavicle registry, with designs for standardized radiographic assessment and prospective collection of validated outcome measures, complications data, and direct and indirect cost statistics for all patients, ages 10-18, treated for clavicle shaft fractures, operatively and non-operatively.

Effectiveness of Electronic Sports Medicine Handbook to Improve Pediatric Resident Confidence in Caring for Patients with Sports-Related Injuries

Principal Investigator: Dr. Celina de Borja

Prospective cohort study of pediatric residents at an academic tertiary care center to assess resident confidence in the presentation, diagnosis, and management of sports-related injuries, and to evaluate whether a new electronic sports medicine educational resource improves resident confidence.

Accessing the Electronic Health Record Pediatric Orthopaedics: Preferences and Experiences of Teens versus Parents

Principal Investigator: Dr. Mohammad Diab

Our goal is to understand the preferences and experiences of adolescents and their parents when accessing the teen's EHR from two orthopaedic subpopulations: 1) patients with adolescent idiopathic scoliosis and 2) patients with an ACL tear.

Multi-Center Pin Site Infection Study (MPSIS) Group:

Site Investigator: Dr. Sanjeev Sabharwal

This multi-center study is working to measure and document pin site infection rate and pin site care among pediatric patients across Canada, US, and UK through a multicenter pin site infection database.

Children's ORthopedic Trauma and Infection Consortium for Evidence based Studies (CORTICES)

Site Investigator: Dr. Ishaan Swarup

CORTICES is a collaboration of pediatric orthopedic surgeons dedicated to improving the Quality, Safety, and Value in the management of emergent orthopaedic conditions (trauma and infection).

The Pediatric ALL Evaluation and Trial (PALLET): A Randomized, Controlled Trial

Site Investigator: Dr. Nirav Pandya

The purpose of the study is to investigate whether adding anterolateral ligament (ALL) reconstruction to anterior cruciate ligament (ACL) reconstruction in children will result in a lower rate of ACL re-tear than just ACL reconstruction alone.

Psychometric properties of the Gait Outcomes Assessment List for children with Limb Deformities (GOAL-LD)

Site Investigator: Dr. Sanjeev Sabharwal

This study aims to create a (validated) specialized tool for assessing the physical and psychosocial function of children with lower limb abnormalities pre- and/or postoperatively, despite improved function being a major aim of surgery.

International Legg-Calvé-Perthes Study Group (IPSG)

Site Investigator: Dr. Ishaan Swarup

The present study will establish a database of prospectively identified patients with Legg-Calvé-Perthes (LCP) Disease and collect information regarding their presentation, treatment, and outcomes while receiving currently available treatments.

Pediatric Musculoskeletal Research Program in Uganda

Principal Investigator: Dr. Coleen Sabatini

Dr. Sabatini collaborates with orthopaedic colleagues in Uganda conducting a range of pediatric musculoskeletal research focused on neglected surgical conditions and the care of children in low-resource settings.

Patient Expectations in Patients with Adolescent Idiopathic Scoliosis

Principal Investigator: Dr. Ishaan Swarup

Dr. Swarup is leading a prospective study exploring preoperative patient expectations in patients with adolescent idiopathic scoliosis (AIS).

Host perspectives of high-income orthopedic resident rotations in low- and middle- income countries

Principal Investigator: Dr. Sanjeev Sabharwal

With collaboration from host faculty in low- and middle- income countries (LMICs), a semi-structured interview guide was designed. UCSF resident Heather Roberts interviewed 20 LMIC surgeons and trainees who had hosted orthopedic residents from high-income countries (HICs) within the past 10 years. This qualitative study explores the perspectives of LMIC surgeons and trainees who host visiting residents from HICs.

Orthopaedic Observership Opportunities in North America for International Trauma Surgeons: Perceived Barriers and Impact

Principal Investigator: Dr. Sanjeev Sabharwal

This study was performed in collaboration with members from the Consortium of Orthopaedic Academic Traumatologists (COACT) and was adapted from a similar study we conducted among international orthopaedic surgeons who previously participated in a pediatric orthopaedic observership at a North American institution. The goal of this study was to study the international surgeons' perception of the impact and barriers faced in the clinical observership program that they attended in a North American orthopaedic practice.

Dr. Nirav Pandya examines a patient at the UCSF Benioff Children's Hospital in Oakland (Photo courtesy of UCSF).



Spine

The UCSF Spine Service was recognized for excellence in research by the Scoliosis Research Society in 2021. Members of our team led the Hibbs Award winning papers for both Clinical Research (Dr. Sigurd Berven) and Basic Science Research (Dr. Christopher Ames) at the 2021 SRS annual meeting.

In the past 5 years, UCSF Spine surgeons and scientists have been recognized for 6 of the major spine society awards in clinical and basic science research including the Hibbs Awards, the ISSLS prize and the Whitecloud Award. In addition, during that period our spine surgeons have edited 3 major spine textbooks and authored over 200 peer reviewed articles.

Below are highlighted research initiatives from 2021.

American Spine Registry

In a collaborative effort with the Department of Neurosurgery, the Spine Section is an active member of the AAOS American Spine Registry. The aim of this registry is to provide benchmarking and research data from institutions across the nation for specific spine surgery populations, specifically lumbar, cervical and deformity procedures.

Prospective Evaluation of Elderly Deformity Surgeries (PEEDS) Study

Principal Investigator: Sigurd H Berven, MD.

Co-Investigators: Christopher Ames, MD., Shane Burch, MD., Dean Chou, MD., Vedat Deviren, MD., Praveen Mummaneni, MD., and Bobby Tay, MD.

Sponsor: AO Foundation

As the population continues to age, the prevalence of spinal deformity surgery for older patients is increasing. Questions still remain regarding the suitability of these patients to undergo large spinal procedures and whether the outcomes merit the variable risks involved. In this international multicenter study, sought to determine the value of surgery in spinal deformity patients, age 60 or older treated with major spinal reconstruction. The primary object of this research is to determine the value of surgery in spinal deformity patients as shown through improvement, from baseline to 60 months, in the Scoliosis Research Society-22r Questionnaire (SRS-22r) total score, with secondary outcome measurement data collected from the Oswestry Disability Index (ODI), numeric rating scale for pain (NRS), EQ-5D, and animal fluency test.

Spinal Deformity Intraoperative Monitoring (SDIM) Study

Principal Investigator: Sigurd H Berven, MD.

Co-Investigators: Shane Burch, MD., Dean Chou, MD., Aaron Clark, John P Clark, MD., Lionel Metz, MD., Vedat Deviren, MD., Praveen Mummaneni, MD., Tan Lee, MD., Bobby Tay, MD., and Alexander Theologis, MD.

Sponsor: AO Foundation

Multimodality monitoring has become a key component of osteotomy procedures. The ability to both accurately recognize and interpret intraoperative neuromonitoring changes, can allow for surgeons to best navigate the necessary operative maneuvers to prevent serious neurological injury and lead to successful outcomes. The objective of this multicenter and international study is to prospectively collect real-time data eliciting the contributing factors associated with such changes and report the actions taken. The information collected will improve upon the current knowledge gaps and further educate spinal surgeons to recognize relevant intraoperative neuromonitoring changes to mitigate the risks during complex spinal surgeries.



Pictured above is a 3D printed spine created from a clinical CT scan of a patient with a spinal deformity. The UCSF Spine Center is using additive manufacturing (3D printing) for rapid prototyping of novel spinal implants as well as for creating anatomic models for surgical planning in complex cases. (Photo courtesy of UCSF)

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

Principal Investigator: Sigurd H Berven, MD

Co-Investigators: Dean Chou, MD., Aaron Clark, MD., Vedat Deviren, MD and Praveen Mummaneni, MD.

Sponsor: Empirical Spine, Inc

The standard of care surgical option for degenerative spondylolisthesis includes decompression with instrumented fusion. Although this allows for treatment of presenting symptoms, patients could also benefit by application of a stabilizing device. Implantation of a paraspinous tension band can provide a biomechanical advantage, by preventing excessive segmental postoperative flexion range of motion, while increasing both flexion stiffness and facet engagement. The aim of this multi-center, prospective, concurrently controlled clinical study is to compare the clinical outcomes of patients with lumbar degenerative spondylolisthesis and stenosis, treated with a decompression and the LimiFlex™ Paraspinous Tension Band to those of control patients treated with the current surgical standard, a decompression and transforaminal lumbar interbody fusion (TLIF) with concomitant posterolateral fusion (PLF) and pedicle screw instrumentation.

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

Principal Investigator: Alexander Theologis, MD.

Co-Investigators: Sigurd H Berven, MD., Dean Chou, MD., Aaron Clark, MD., Vedat Deviren, MD., Praveen Mummaneni, MD., and Bobby Tay, MD.

The aim of this study is to collect patient reported outcomes and radiographic

assessment data in patients undergoing cervical interbody fusion procedures using a device comprised of a PEEK/HA composite material.

Sports Medicine and Shoulder Service

The UCSF Sports Medicine and Shoulder Service continues to lead the country in basic science, translation and clinical research. This group's research efforts are led by Dr. Brian Feeley, Dr. Alan Zhang, Dr. C. Benjamin Ma, and Dr. Drew Lansdown. The team participates in numerous clinical research initiatives and collaborates with institutions from across the country.

In 2021, the group published 129 peer-reviewed studies and received over \$800,000 in grant funding and sponsored study funding.

Project Highlights

Prospective Data Collections

To better provide patient-centered treatments, active collection of patient-reported outcomes measurements is paramount. To fulfill this mission, the group currently participates in multiple prospective clinical outcome registries.

UCSF is an active member of the Multicenter Orthopaedic Outcomes 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 1400 patients with shoulder instability, which is the largest cohort reported.

The UCSF Shoulder arthroplasty database has enrolled over 1,500 patients in a prospective collection and successfully published over 75 abstracts and scientific papers.

The UCSF Hip Arthroscopy database is actively collecting outcomes measurements on patients undergoing hip arthroscopy surgery. Over 1000 patients have been enrolled in this on-going study, yielding over 50 abstracts and research publications.

Sports Medicine Clinical Trials

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

- A Phase 3 Prospective, Randomized, Partially Blinded Multi-Center Study to Measure the Safety and Efficacy of NOVOCART® 3D, Compared to Microfracture in the Treatment of Articular Cartilage Defects

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

Sponsor: Aesculap Biologics

This prospective, randomized, partially-blinded multi-center study is being conducted to compare NOVOCART® 3D relative to Microfracture for the treatment of knee cartilage defects.

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

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

Sponsor: Samumed LLC.

This study investigates the safety and efficacy of SM04690, an injectable small-molecule inhibitor of the Wnt pathway, in driving progenitor cells resident in the joint to become chondrocytes and potentially enhance cartilage formation.

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

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

Funding: Patient-Centered Outcomes Research Institute (PCORI)

The Arthroscopic Rotator Cuff (ARC) Trial is a large, multicenter, randomized clinical trial comparing operative and non-operative treatment for rotator cuff tears that develop over time. T

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

Site Co-Investigators: Brian Feeley, MD (PI), C. Benjamin Ma, MD, Alan Zhang, MD and Drew Lansdown, MD

Sponsor: Orthofix Medical Inc.

Using a non-invasive therapeutic device, this study aims to evaluate the safety and efficacy of applying pulsed electromagnetic fields (PEMF) to rotator cuff repairs and determine whether this treatment reduces retear rates.

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

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

Funding: NIH, VA Merit

This study aims to evaluate the cellular plasticity, differentiation capability, and functional role of human fibro-adipocyte precursor cells (hFAPs) harvested from patients with musculoskeletal injuries.

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

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

Sponsor: Zimmer Biomet Inc.

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

- Comparison of Outcomes Utilizing Blood Flow Restriction Training as a Rehabilitative Protocol in Post-operative Meniscus Repair Patients

Principal Investigators: Sachin Allahabadi, MD, Brian Feeley, MD, and Drew Lansdown, MD

This study seeks to understand whether blood flow restriction is a useful rehabilitation tool in patients undergoing meniscus repair. BFR is a unique and promising strategy for surgical patients, as it is low-load and can be used in early phases of rehabilitation, including non-weight bearing periods.

- Montelukast as a potential chondroprotective treatment following Anterior cruciate ligament reconstruction (MOCHA Trial)

Site Co-Investigators: Drew Lansdown, MD (Co-PI), Sharmila Majumdar, PhD (Co-PI), C. Benjamin Ma, MD, Brian Feeley, MD, Alan Zhang, MD, Nicholas Colyvas, MD, Elly LaRoque, MD, Sara Edwards, MD and Stephanie Wong, MD

Sponsor: Arthritis Foundation

This is a multicenter randomized, placebo-controlled trial to assess whether a 6-month course of oral montelukast after anterior cruciate ligament (ACL) reconstruction reduces systemic markers of inflammation and biochemical and imaging biomarkers of cartilage degradation.

Sports Subspecialty Research Centers

- 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.

- 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. Stephanie Wong, MD has joined the center and furthered clinical research initiatives.

The Hip Preservation Center has prospectively collected clinical outcomes measurements on over 1000 patients who have undergone hip arthroscopy at UCSF and published numerous abstracts and 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.

- 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. The Sports Medicine group closely collaborates with the UCSF Department of Radiology and the MQIR (Musculoskeletal Quantitative Imaging Research) group to leverage these technologies to better evaluate patients and the effects of non-surgical and surgical treatment.



Trauma

The Institute for Global Orthopaedics and Traumatology (IGOT) is Celebrating its 15-Year Anniversary.

Founded in 2006 by the UCSF Department of Orthopaedic Surgery faculty and residents, IGOT is celebrating 15 years of addressing global disparities in orthopaedic trauma care. Validating IGOT's global impact, the Wyss Medical Foundation, a long-time supporter of IGOT, renewed its commitment to our organization in 2021 with a five-year grant.

The goal of IGOT's Global Research Initiative is to enable orthopaedic surgeons from low-and-middle-income countries (LMICs) to conduct high-quality studies on how to reduce the burden of musculoskeletal disease in resource-poor environments. To achieve this goal, IGOT hosts the annual "International Research Symposium," provides guidance on study design and data management for partner institutions, and supports the year-long Morgan and Madison McClellan International Research Fellowship for one 3rd/4th year medical student. Since 2006, IGOT has worked with 65 global leaders across 10 countries on 45 research projects and facilitated the travel of 50 IGOT ambassadors and scholars to and from our partner institutions.

Highlighted awards and publications:

Dr. David Shearer was awarded the NIH K-23 award for the "A Pilot Masked, Randomized Controlled Trial Evaluating Locally-applied Gentamicin versus Saline in Open Tibia Fractures (pGO-Tibia)" study. This study is a masked randomized-controlled trial in Tanzania, partnered with Muhimbili Orthopaedic Institute (MOI). This grant is the first NIH grant for IGOT. Dr. David Shearer was also awarded the OREF Career Development Grant (\$300,000) for this study.

Dr. Saam Morshed was a co-author for the study "Definite Flap Coverage Within 48 Hours of Definitive Fixation Reduces Deep Infection Rate in Open Tibial Shaft Fractures Requiring

Flap Coverage" which was given the Bovill Award for the most outstanding OTA Annual Meeting scientific paper.

Dr. Theodor Miclau was named for Alfred R. Shands, Jr., MD. This award is presented each year to a United States or Canadian citizen who has made significant contributions to orthopaedics. This award recognizes the devotion of a significant portion of the professional lifetime to furthering knowledge in the fields of musculoskeletal disease. The Alfred R. Shands, Jr., MD Award is sponsored by the Orthopaedic Research Society. Dr. Richard Coughlin, recently co-authored an article entitled "COVID-19 and Orthopaedic International Humanitarianism" in the Journal of the American Academy of Orthopaedic Surgeons (JAAOS).

Ongoing Research

Below are highlighted on-going studies-

IM Nail vs. External Fixator for Open Tibia Fracture Long-term Follow Up

Tanzania
Dr. Saam Morshed

A Pilot Masked, Randomized Controlled Trial Evaluating Locally-applied Gentamicin versus Saline in Open Tibia Fractures (pGO-Tibia)

Tanzania
Dr. David Shearer

Above-Knee Amputation Cost-Effective Analysis

Below-Knee Amputation Cost-Effective Analysis

K-Wire vs. Flexible Nail for Pediatric Femur Fractures

Total Joint Replacement Registry

Tanzania
Dr. David Shearer and Dr. Saam Morshed

Flaps Follow Up Registry

Tanzania
Dr. Michael Terry, Dr. David Shearer and Dr. Saam Morshed

Trauma Observership Study

North America
Dr. Sanjeev Sabharwal, Dr. David Shearer and Dr. Saam Morshed

SIGN Database Study

Open Tibial Shaft Fracture Treatment Practices in Africa
Africa
Dr. David Shearer

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

Ghana
Dr. David Shearer

Surgical Outcomes of Children Treated for Gluteal Fibrosis in Uganda

Epidemiology and Clinical Outcomes for Pediatric Patients with Post-Injection Paralysis

Injection Risk Analysis for Gluteal Fibrosis and Flaccid Paralysis

Outcomes of Vascularised Free Fibula Flaps

Validation of Outcome Instrument for Gluteal Fibrosis

TB Osteomyelitis in Children and Adolescents

Uganda
Dr. Coleen Sabatini

Quality of Life and Outcomes after Open Tibia Fractures

Research Priorities in Latin America Delphi Study

Soft-Tissue Management and Wound Vacuum Survey

Latin America
Dr. Ted Miclau

COACT: Motivations and Impact of Resident Rotations Qualitative Follow-Up

International
Dr. Sanjeev Sabharwal, Dr. David Shearer



Dr. Saam Morshed examines a patient at the UCSF Orthopaedic Institute on the Mission Bay Campus in San Francisco. (Photo courtesy of the UCSF Department of Orthopaedic Surgery).

UCSF Human Performance Center

The Human Performance Center (HPC) is the key center for exercise related science serving the Department of Orthopaedic Surgery and the UCSF community. The HPC optimizes people's function and performance, emphasizing multidisciplinary solutions to advance discovery. The state-of-the-art equipment and expert staff enable the center to handle a diverse range of research projects, from knee osteoarthritis to prostate cancer to Parkinson's disease and other conditions that plague human function as people age.

Anthony Luke MD, MPH is the Director of the HPC and Benioff Distinguished Professor in Sports Medicine. The Human Performance Center is managed by Brooke Schultz, MS, who also serves as the full time Biomechanist for the Vicon Motion Capture system and AMTI force plates. Neil Panchal, MS, ACSM-CPT, serves as the exercise physiologist of the lab. Richard Souza, PT, PhD, is the HPC Director of Research.

Osteoarthritis

The HPC continues to support Dr. Souza with his research on osteoarthritis progression in the lower extremities. With the closing of 2021, Dr. Souza's Progression of Hip Osteoarthritis (PHO) R01 concluded after tracking participants over a period of three years. His continued collaboration with the Department of Radiology on joint osteoarthritis was rewarded by securing funding for two R01 projects: (1) evaluating the interconnectivity of the knee and hip joints and (2) investigating the interaction of bone and cartilage in the patellofemoral joint.

The Department of Orthopaedic's Chief Technology Officer and Professor of Clinical Orthopaedics, Dr. Stefano Bini, received funding in 2021 from Google, Inc.'s ATAP division, to investigate the use of the Jacquard wearable sensor as a tool for remote monitoring of movement and patient function after Total Knee Arthroplasty. Dr. Anthony Luke received philanthropic funding from the Lynne and Marc Benioff Foundation to research the underlying mechanism's around platelet rich plasma (PRP) injections and their effects on knee osteoarthritis. The funding goes to the Human Performance Center and the Saul Villeda Lab in the UCSF Neuroscience Aging department who is looking at the effects of platelet rich plasma on cognitive aging in mice. Dr. Villeda's work has been published in Nature and Science.

HPC Seed Grant – Biomechanical Analysis of Foot Health in Diabetic Neuropathy and Chronic Kidney Disease

The Human Performance Center awarded its first ever Seed Grant to Victor Cheuy, PhD, Assistant Professor in the Department of Physical Therapy and Rehabilitation Sciences. Dr. Cheuy is currently funded through the RAP program to investigate lower extremity biomechanics of people with diabetic neuropathy of the foot. The Seed Grant will fund the biomechanical analysis of a new cohort of individuals; those with diabetic neuropathy who also have end-stage chronic kidney disease (DNKD). In addition, Dr. Cheuy was funded a RAP shared technology award (co-PI: Dr. Souza) which brings a new electromechanical dynamometer to the HPC: CSMi Humac Norm which arrived in the summer of 2021.

Parkinson's Syndrome

The Michael J. Fox Foundation has funded Neurology's Dr. Doris Wang, MD PhD's investigation into decoding the neural control of normal and abnormal gait patterns in Parkinson's disease using adaptive neurostimulation to understand and improve circuit mechanisms of human gait control.

The HPC continues to partner with Neurology by way of the SPARX3 program led by Nijee Luthra, MD PhD. The HPC team implements a treadmill-based exercise training program utilizing Heart Rate Zones for early-stage Parkinson's patients.

2021 Highlights

- The 1st HPC Seed grant to support early projects worth \$5000 was awarded to study diabetic neuropathy with end-stage chronic kidney disease.
- RAP Shared Equipment grant with supplement for \$37,000 was awarded for functional strength testing.
- The KICK R01 funded for \$2.5 M (over 5yrs) will utilize the HPC to study hip and knee osteoarthritis.
- The PFJOA R01 for \$2.5M (over 5yrs), the R56 for \$437,535 were awarded to patellofemoral joint osteoarthritis at the HPC.
- Philanthropic funding was secured for \$1 M (over 2 yrs) to study platelet rich plasma for knee osteoarthritis.
- A Google, Inc. ATAP Research Fund for \$250k was given to study movement analysis with wearable sensors at the HPC.



Prostate Cancer

The HPC continues to work with the Department of Urology to conduct the exercise interventions of their large studies, including VO2max fitness testing and remote exercise monitoring of patients with prostate cancer. June Chan, ScD Professor of Epidemiology & Urology, is working to determine the effect of aerobic training on prostate genomic signatures that predict risk of prostate cancer progression or aggressive disease in men on active surveillance. With the addition of a collaboration between Dr. Chan, Dr. Luke, and Dr. Villeda, this project expanded in 2021 to include proteomics and metabolomics so that we can have a more in-depth understanding of the effects of a 16-week exercise program on patients and now includes a control cohort who are without cancer.

Similarly, Stacey Kenfield ScD, Associate Professor in Urology received funding through the Movember Foundation and has begun a new longitudinal study, GAP4. This will be a multicenter investigation to determine if supervised high intensity aerobic and resistance training can increase overall survival and reduce disease progression, skeletal-related events and pain among men with advanced metastatic prostate cancer. Fitness levels, including muscular strength (1RM), aerobic (VO2max) and functional capacity will be evaluated in the HPC, in addition to regularly providing exercise coaching for the patients and monitoring the safety and feasibility of the exercise programs. Finally, the HPC assists Dr. Kenfield with exercise interventions and one-on-one coaching performed solely via remote web-based communication for the Department of Urology's Prostate 8 research program.



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

The EDGE Lab (3D printing)

UCSF Orthopaedic Surgery faculty continue to expand innovative deployment of “Advanced Visualization and Manufacturing” capabilities on the frontlines of healthcare.

The EDGE Innovations Lab was founded in 2018 by Aenor Sawyer, MD,MS, Alexis Dang, MD and Alan Dang, MD with a focus on Engineering, Designing, and Growth Enabling digital (EDGE) and manufacturing technologies.

This initiative provided 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. The EDGE team successfully enabled frontline 3D printing of Precision Anatomic Models for surgical pre-operative planning and continues to conduct research to assess the efficacy and economics of the technology.

This foundational initiative of EDGE served as the springboard for 2 larger exciting programs in advanced visualization and manufacturing technologies at UCSF.

1. In 2019 Dr. Aenor Sawyer, Dr. Alexis Dang and Dr. Alan Dang spearheaded a multidisciplinary initiative, in collaboration with the Pediatric Cardiac and Radiology Departments, to obtain a 3 year grant and launch the UCSF Center for Advanced 3D+ Technologies (CA3D+). The “+” includes augmented reality, virtual reality, and 4D imaging (3D-imaging with a time component). This Center has produced hundreds of 3D printed models and 4D visualizations for UCSF Departments including Orthopaedic Surgery, Pediatric Cardiology, ENT, Neurosurgery, and Interventional Radiology, serving clinical care, research and educational needs. During the COVID-19 Pandemic, the CA3D+ team collaborated with the UCSF Maker Lab to produce face shields and safe door handles to minimize transmission of COVID-19. CA3D+ was initially awarded \$1.4 million in funding. has recently been invited to apply for renewal of institutional funding and expansion across all disciplines.

2. At the San Francisco VA, Dr Alexis Dang and Dr Alan Dang successfully developed the TRST-3D (Translational Radiology and Surgical Technologies) program. This was initially funded through a 1.4 million dollar grant over 3 years starting in 2018. This was followed up with an additional 1.4million dollars starting fiscal year 2023. We were able to leverage prior technology resources and know-how that was funded through CCMB funds as well as departmental research funds to achieve these grants that have expanded use of clinical 3D technologies beyond Orthopaedic surgery, into dental, other surgical subspecialties as well as other VA centers, as far away as Hawaii. In addition, this is now considered the flagship medical 3D printing program within the Veterans Administration nationally.

The VA initiative is the result of a strong collaboration between the department of surgery and radiology. These resources have supported research and development projects throughout the health care system, for COVID related projects, educational and simulation projects, as well as implant development.

As a result of their work in the 3D imaging arena, 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. <https://gsablogs.gsa.gov/febsanfrancisco/programs/public-service-recognition/>. The Board represents approximately 70,000 federal, postal and military employees throughout the nine bay area counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma), as well as agencies in the Sacramento area.

UC Space Health

“Out of This World” MSK Research and HealthTech Innovation

BACKGROUND:

The Spaceflight environment provides unique opportunities to accelerate basic science in areas of aging, immunology, tissue engineering, organs on a chip, and effects of radiation – all of which are highly relevant to advancing Musculoskeletal research. In addition, technology to ensure “inflight” crew health and safety in Space environments has greatly advanced our remote medical capabilities on Earth.

UC Space Health (<https://spacehealth.ucsf.edu>), a cross-campus and cross-discipline initiative was “launched” by Dr Aenor Sawyer, and by December 2021 we had engaged over 100 UC Space faculty and trainee researchers as well as over 20 external academic, government and industry partners. Dr. Stephen Robinson, Professor of Engineering (UC Davis) and Retired NASA Astronaut is the Co-Director of UC Space Health with Dr. Sawyer. In Oct 2021, the UC Space Health team successfully completed the deliverables of a 3 year, \$2M grant from NASA’s Translational Research Space Health Institute. These included: service as the Chief Health Innovation Officer of TRISH (Dr Sawyer); generation of Space Health POCs and computational models; and completion of a 200 pg Guidance Document for developing the “Health Sense Matrix for Space” (HSMS) to fuel Precision Space Health. The Precision Space Health team consists of UCSF faculty and learners from the Departments of Orthopaedic Surgery, General Surgery, Radiology, Ophthalmology, Anesthesiology, Biomedical Engineering, Computational Health Sciences, Health Economics, and Global Health.

In 2021 the UC Space Health lab team undertook 3 additional research projects at the intersection of Space Health and MSK research which include:

- a. ASTRO 3DO goes to Antarctica - a test of longitudinal remote body composition monitoring in Antarctica, a Space Analog.
- b. Health Sensing Technologies to keep Antarctic Expeditioners safe- feasibility, tolerability and utility of remote surveillance with minimally intrusive, multiparametric health sensors in the extreme and remote environment of Antarctica, a Space Analog.
- c. “Omni-BUS” - a novel but FDA approved, Ultrasound-based mobile assessment of bone mineral density, bone quality and fracture risk utilizing Radiofrequency Echographic Multi Spectrometry (REMS) is being piloted in the Spine Surgery Clinics.

CODE Technology and the BRIDGE Lab

The Department of Orthopaedic Surgery has made the collection of patient reported outcome measures (PROMs) a top priority over the last few years, partnering with CODE Technology in order to collect data from all surgical cases. CODE Technology is a technology company specializing in PROM collection and has streamlined our ability collect data without disruption to clinical flow while also increasing our long-term PROM capture rate on patients who undergo surgery. This has allowed the department to develop a rich data asset that has applications in both research and quality of care improvement initiatives. Since 2019 CODE has collected PROM on 24,544 procedures from the Department of Orthopaedic Surgery with an overall average follow-up rate of 67%.

In an effort to bring PROM data to the point of care, the Department has also partnered with the BRIDGE Lab, led by Dr. Riley Bove, MD, integrating this data into our electronic medical record. This effort is supported by both the Department, as well as by a private contribution from the Guzik Foundation to Dr. Bobby Tay, MD. The primary aim of this collaboration is to bring research data to the point of care in real time, allowing for dynamic decision-making and improved care planning for each surgical candidate.

Resident Highlights

The year 2021 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.



Heather Roberts
PGY-5

Awards

2021 John Charnley Award from the Hip Society“

A protocol based strategy when using hemiarthroplasty or total hip arthroplasty for femoral neck fractures decreases mortality, length of stay, and complications”



Hao-Hua Wu
PGY-5

Awards

2021 Cervical Spine Research Society (CSRS) Resident & Fellow Annual Meeting Scholarship (\$2000), Atlanta, GA

2021 Resident Research Travel Grant (\$600), San Francisco, CA

2021 James O. Johnston Resident Research Award (\$5000), San Francisco, CA

2021 NASS Value Abstract Award (\$500), Boston, MA



Sachin Allahabadi
PGY-5

Grants

2021 James O. Johnston Resident Research Grant -\$5,000 -Outcomes of Blood Flow Restriction Training in Post-operative Rehabilitation After Meniscus Repair Surgery



Erika Roddy
PGY-5

2021 James O. Johnston Resident Research Grant -\$5,000

Does Virtual Reality Training Improve Resident Performance in Slipped Capital Femoral Epiphysis In Situ Screw Fixation?



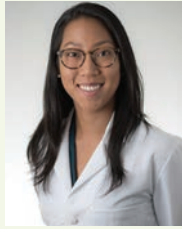
**Michael Davies
PGY-4**

Awards

Orthoregeneration Network Foundation Hydrogel-Based Delivery of Human Beige Fibroadipogenic Progenitors as a Novel Treatment Strategy to Promote Muscle Regeneration Following Rotator Cuff Tears \$26,729

American Orthopaedic Society for Sports Medicine-Young Investigator Award The role of age in fibroadipogenic progenitor-mediated muscle degeneration following rotator cuff tears

\$40,000



**Tiffany Liu
PGY-4**

Awards

American Foundation for Surgery of the Hand (\$5000)

Correlation between visual appearance and histology of peripheral nerve sections



**Leah Demetri
PGY-4**

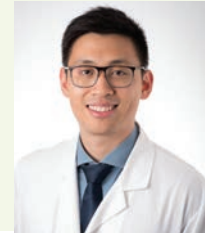
Awards

James O. Johnston Resident Research Award (\$5000)

Health Disparities and Constriction Band Syndrome

J. Robert Gladden Orthopaedic Society (\$2500)

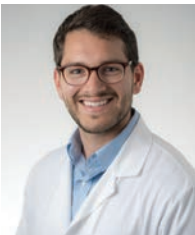
Health Disparities and Constriction Band Syndrome -Medical Student / Resident Research Grant



**Favian Su
PGY-3**

Awards

OREF Resident Research Award \$5000: Effect of Blue and Red Light on Cutibacterium acnes Colonization Rates of the Shoulder



**Steven Garcia
PGY-3**

Awards

OREF Resident Research Grant for \$5000

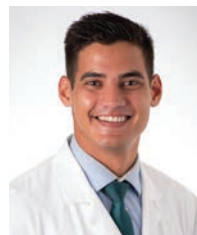
“Functionally Heterogeneous Human Fibroadipogenic Progenitor Cells”



**Sarah Stroud
PGY-3**

Awards

OREF Resident Research Grant for \$5000 “Analysis of Prognostic Factors for Adults with Primary Extremity Sarcomas”



**Hunter Warwick
PGY-3**

2021 James O. Johnston Resident Research Grant -\$5,000

Telehealth Physical Therapy Following Total Shoulder Arthroplasty



**Alejandro Cazzulino
PGY-2**

OREF Resident Research Grant for \$5000 for “Preoperative Patient Expectations for Adolescent Idiopathic Scoliosis”

Scoliosis Research Society New Investigator Research Grant for \$25,000 for “Preoperative Patient Expectations for Adolescent Idiopathic Scoliosis”

New Faculty



**Lauren Shapiro,
MD, MS**

Lauren Shapiro, MD MS, is an Assistant Professor in the Hand, Elbow and Upper Extremity Division of the UCSF Department of Orthopaedic Surgery.

Dr. Shapiro completed her undergraduate degree at Stanford University while a member of the varsity women's soccer team. She completed residency in Orthopaedic Surgery at Stanford University, serving as a chief resident during her final year. She then completed a fellowship in Hand, Upper Extremity, and Microvascular Surgery at Duke University. She also completed a Master's Degree in Health Analytics from the Duke Fuqua School of Business.

Dr. Shapiro has clinical expertise in conditions of the upper extremity, including the hand, wrist, and elbow. Her clinical interests include traumatic hand and forearm injuries stemming from sports-related injuries to acute

Assistant Professor
Hand, Elbow and Upper
Extremity

traumas as well as common issues such as arthritis, carpal tunnel, and ligament and tendon injuries.

Dr. Shapiro's research interests span multiple disciplines with projects rooted in providing high-quality and patient-centered care. She conducts research on patient preferences, shared-decision making, and empowering patients to understand their treatment options. She is a member of the Hand Surgery Quality Consortium, a consortium of hand surgery experts studying quality in hand surgery; and she chairs the Global Quality in Upper Extremity Surgery and Training consortium, a consortium of global health and hand surgery experts interested in promoting the delivery of safe and high-quality care in low- and middle-income countries. She has presented her research nationally and internationally and has published more than 65 peer-reviewed manuscripts and seven book chapters.



**Lauren Santiesteban,
MD**

Lauren G. Santiesteban, MD is an orthopedic surgeon with specialty training in hand and upper extremity surgery. Treating all conditions of the upper extremity, from the simple to the complex, Dr. Santiesteban's philosophy of care is that each patient should be treated as a unique person and not by a cookie-cutter, protocol-only approach. She spends time getting to know each patient, and works with the patient to choose the right treatment, whether surgical or nonsurgical, that is best for his/her specific situation.

Dr. Santiesteban graduated with honors with a B.A. degree in Anthropology and Biochemistry from Indiana University, and she then

Assistant Professor of
Clinical Orthopaedic
Surgery

Hand, Elbow and Upper
Extremity

received her M.D. degree from the New York University School of Medicine. After medical school, she completed residency in Orthopedic Surgery at New York University Langone Health Department of Orthopedic Surgery. Most recently, Dr. Santiesteban completed her fellowship at UCSF in Hand, Elbow and Upper Extremity in the Department of Orthopaedic Surgery.

Dr. Santiesteban will be seeing patients at the Orthopaedic Institute in San Francisco and the MarinHealth Orthopedic | a UCSF Health Clinic in San Rafael, Marin County.

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



Assistant Clinical Professor
Physical Medicine and
Rehabilitation
MarinHealth | UCSF Health
Orthopedic Care Clinics in
Marin County

Lyndly Tamura, MD

Dr. Lyndly Tamura is a board-certified specialist in Physical Medicine and Rehabilitation (PM & R) focused on providing non-operative care for patients with acute and chronic spine pain, musculoskeletal disorders, and pain conditions. Dr. Tamura is fellowship-trained in Interventional Pain, and she is board-eligible in Pain Medicine.

To alleviate pain and improve her patients' quality of life, Dr. Tamura specializes in diagnostic and therapeutic interventional procedures, which include fluoroscopy-guided spine injections (cervical, thoracic, lumbar, sacrum), fluoroscopy-guided intra-articular injections, ultrasound-guided injections, and nerve conduction studies/electromyography.

An active researcher, Dr. Tamura's interests involve the safety and efficacy of regenerative medicine to treat spine related pain, reviewing practice patterns for certain spinal interventions, developing novel injection techniques for musculoskeletal and pain conditions, monitoring the efficacy of tele-nutrition in spinal cord injury patients, and quality improvement projects involving two-way smartphone messaging between physicians and nurses.

Dr. Tamura grew up in Huntington Beach, Calif. She earned her Bachelor's degree in General Biology from the University of California, San Diego, and completed her Medical degree from the University of Toledo College of Medicine and Life Sciences. Dr. Tamura then completed a one-year internship in

Internal Medicine at California Pacific Medical Center in San Francisco; she subsequently completed her residency in Physical Medicine and Rehabilitation at Stanford University; and most recently, she completed fellowship training in Interventional Pain Medicine at Hudson Medical in New York City.

Dr. Tamura was a competitive gymnast and a collegiate pole vaulter. She continues to enjoy leading an active lifestyle of running, hiking, and teaching group exercise. She also enjoys spending time with family, traveling, and exploring diverse cuisines.

Dr. Tamura sees patients at the UCSF Spine Center on the Parnassus Campus in San Francisco and the the MarinHealth | UCSF Health Orthopedic Care Clinics in Marin County.



David Gendelberg, MD

Assistant Professor
Trauma & Problem Fractures,
Spine
Zuckerberg San Francisco
General Hospital



Courtney Sagar, MD

Assistant Clinical Professor
Pediatric Orthopaedics
Rehabilitation
UCSF Benioff Children's
Hospital Oakland



Coleen Sabatini, MD, MPH appointed Vice Chair of Health Equity and Academic Affairs

SAN FRANCISCO (Feb. 10, 2021) – The UCSF Dept. of Orthopaedic Surgery is pleased to announce that Coleen Sabatini, MD, MPH has been appointed as the Vice Chair of Health Equity and Academic Affairs.

“There is much work to be done to increase access to high-quality musculoskeletal care for all people -- both locally and globally” said Dr. Sabatini, who is a pediatric orthopaedic surgeon and a champion of global health and health equity at UCSF. “Inequities exist in so many facets of our society and healthcare systems that impact the quality of life for patients with musculoskeletal conditions. I am honored to be given this opportunity to lead the Department’s efforts to address musculoskeletal health disparities with the goal of improving the musculoskeletal health of all people, particularly those from vulnerable populations,” Dr. Sabatini added.

“At UCSF, we strive to promote justice, equity, and diversity,” said Dr. Thomas P. Vail, chair of the Department. “We recognize that educational excellence and diversity are linked, and Dr. Sabatini will support the further development of our community that is culturally competent, socially responsible and appreciative of global perspectives.”



Dr. Tamara Alliston to be inducted into medical and biological engineering elite

WASHINGTON, D.C. (Feb. 15, 2021) — The American Institute for Medical and Biological Engineering (AIMBE) has announced the election of Tamara Alliston, Ph.D., Professor, Department of Orthopaedic Surgery, University of California, San Francisco to its College of Fellows. Dr. Alliston was nominated, reviewed, and elected by peers and members of the College of Fellows for fundamental advances in understanding the mechanoregulation of bone mass and quality as well as professional leadership in musculoskeletal bioengineering. The College of Fellows is comprised of the top two percent of medical and biological engineers in the country. The most accomplished and distinguished engineering and medical school chairs, research directors, professors, innovators, and successful entrepreneurs comprise the College of Fellows. AIMBE Fellows are regularly recognized for their contributions in teaching, research, and innovation. AIMBE Fellows have been awarded the Nobel Prize, the Presidential Medal of Science and the Presidential Medal of Technology and Innovation and many also are members of the National Academy of Engineering, National Academy of Medicine, and the National Academy of Sciences. A formal induction ceremony will be held during AIMBE’s 2021 Annual Event on March 26. Dr. Alliston will be inducted along with 174 colleagues who make up the AIMBE Fellow Class of 2021. For more information about the AIMBE Annual Event, please visit www.aimbe.org.



Welcome, Class of 2026!

SAN FRANCISCO (March 22, 2021) -- The UCSF Department of Orthopaedic Surgery is pleased to announce the Residents of the Class of 2026!

Pictured from left:

Alicia Asturias
UC San Diego School of Medicine

Edgar Garcia-Lopez
The Warren Alpert Medical School of Brown University

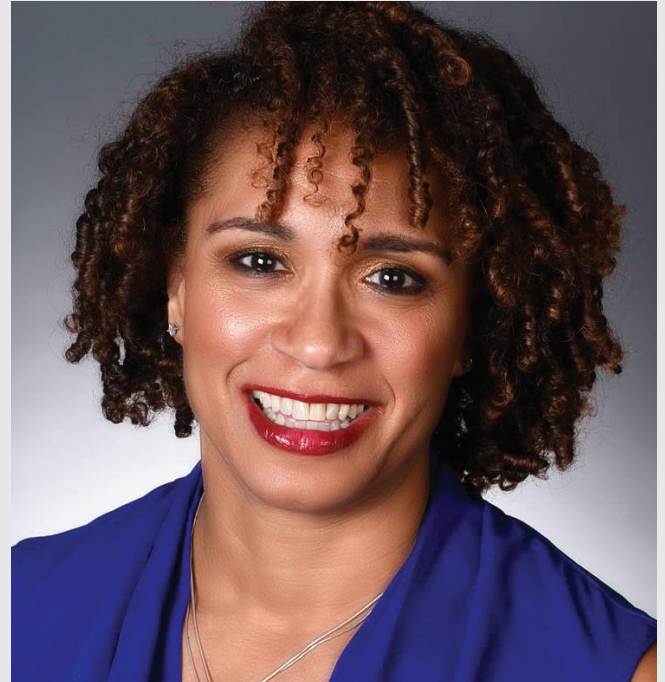
Ryan Halvorson
University of California, San Francisco, School of Medicine

Jeffrey Kwong
Stanford University School of Medicine

Kelechi Nwachuku
University of California, San Francisco, School of Medicine

Christopher Stewart
University of California, San Francisco, School of Medicine

Katherine Woolley
The Frank H. Netter MD School of Medicine at Quinnipiac University



Dr. Letitia Bradford receives 2021 UCSF Alumni Mentor Award

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 research program combines classical embryology, modern experimental and genetic tools, and advanced methods for quantifying and comparing phenotypes at a range of scales. This approach has significance for understanding not only the processes that contribute to and constrain evolutionary diversity, but also the individual phenotypic differences found within species and among individuals, including dysmorphologies associated with human disease states. 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.



UCSF to support the 76th US Women's Open at the Olympic Club in San Francisco

SAN FRANCISCO (June 4, 2021) -- The UCSF Department of Orthopaedic Surgery would like to announce its support of the 76th U.S. Women's Open, which is currently being held at the Olympic Club in San Francisco through Sunday June 6, 2021.

"Our team is excited to partner with the USGA and to help provide medical care for this exciting and prestigious tournament with the top women golfers in the world," said Dr. Drew Lansdown, an orthopaedic surgeon and sports medicine specialist, who serves as the UCSF team lead.



UCSF Department of Orthopaedic Surgery appoints Clinic Directors for Berkeley and Peninsula outlying clinics

SAN FRANCISCO (June 4, 2021) -- The UCSF Department of Orthopaedic Surgery is pleased to announce the appointments of two of its physicians to lead services at the existing UCSF/John Muir Berkeley Outpatient Center and the new Peninsula clinic located at the UCSF Health Redwood Shores Specialty Care Clinic.

Peter I-Kung WU, MD/PhD, a specialist in Physical Medicine and Rehabilitation (PM&R) and Pain Medicine, will serve as the Clinic Director at the UCSF/John Muir Berkeley Outpatient Center, located at 3100 San Pablo Ave. Berkeley, Calif.

Elly LaRoque, MD, an orthopaedic surgeon specializing in sports medicine, will serve as the Clinic Director at the new UCSF Health Redwood Shores Specialty Care Clinic, located 290 Redwood Shores, Parkyway, Redwood City., Calif.

Dr. Nicole Schroeder, MD, appointed Chief of the Division of Hand, Elbow and Upper Extremity for the UCSF Department of Orthopaedic Surgery

SAN FRANCISCO (July 13, 2021) – Effectively immediately, Dr. Nicole Schroeder, MD, a professor of orthopaedic surgery, will serve as Chief of the UCSF Department of Orthopaedic Surgery's Division of Hand, Elbow and Upper Extremity Surgery, a team of orthopaedic specialists who work with adult and pediatric patients to treat all bone and soft-tissue conditions of the hand, elbow and upper extremity.

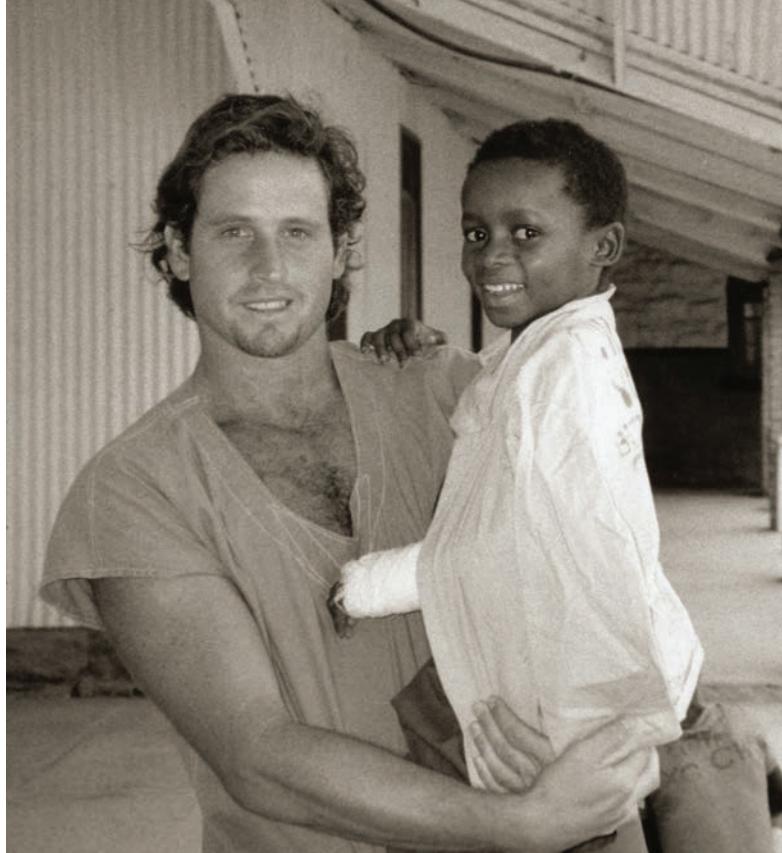
We congratulate her on taking this new leadership role.



Dave M. Atkin, MD, FAAOS, receives American Academy of Orthopaedic Surgeons' Humanitarian Award

SAN FRANCISCO, Oct. 4, 2021 – The UCSF Department of Orthopaedic Surgery is pleased to announce that Dr. Dave M. Atkin, MD, FAAOS, has been awarded the 2021 Humanitarian Award by the American Academy of Orthopaedic Surgeons. The Humanitarian Award recognizes members of the AAOS who have distinguished themselves through outstanding musculoskeletal-related humanitarian activities in the United States or abroad.

Dr. Atkin is a distinguished alumnus of the Department. He trained at UCSF as a resident in orthopaedics, and following his residency began his career in Transkei, a segregated homeland of apartheid South Africa.



Clinical Science
Jennifer Tangtiphaibontana, MD
Andrew Figoni, MD
Anthony Luke, MD
Alan Zhang, MD
Brian Feeley, MD
C. Benjamin Ma, MD

Dr. Jennifer Tangtiphaibontana was recently selected for the 2021 Charles S. Neer research award

SAN FRANCISCO (Nov. 10, 2021) -- Dr. Jennifer Tangtiphaibontana was recently selected for the 2021 Charles S. Neer research award along with fellow UCSF colleagues in Sports Medicine.

Abstract:

The Effects of Non-Steroidal Anti-Inflammatory Medications After Rotator Cuff Surgery: A Randomized Double-Blinded Placebo-Controlled Trial

IGOT Celebrates 15th anniversary

Founded in 2006 by the UCSF Department of Orthopedic Surgery faculty and residents, IGOT is celebrating 15 years of addressing global disparities in orthopaedic trauma care. IGOT's incredible team and the programs that are dramatically changing surgical outcomes. Validating IGOT's global impact, the Wyss Medical Foundation – a long-time supporter of IGOT – renewed its commitment to our organization in 2021 with a five-year grant.



IGOT announces renewed funding from the Wyss Medical Foundation

On the eve of our 15-year anniversary celebration - IGOT is excited to announce renewed funding from the Wyss Medical Foundation!

This funding promises to help launch a new era of growth and impact for IGOT. Wyss has pledged \$360,000 per year for five years to fund the further expansion of IGOT's educational programming, including the organization's Surgical Management and Reconstructive Training (SMART) courses, IGOT's Digital Learning Platform, Consortium of Orthopaedic Academic Traumatologist (COACT) outreach organization, and Visiting Scholar exchange programs.



American Association for Anatomy Meeting: "Inspiring Scientific Curiosity and Discovery"

February 25, 2021 -- Ralph Marcucio, PhD discusses the transdifferentiation of chondrocytes into osteoblasts in development and fracture healing bone.

Online: The Difficulty in Reconciling Dogma with Data

Sometimes the data that are generated by experiments are very far from what is anticipated. As part of a translational project using cartilage to heal large bone defects, we discovered that chondrocytes transform into osteoblasts. This outcome contradicts more than 100 years of dogma that apoptosis is the terminal fate of chondrocytes and has led to a discovery of new mechanisms of bone regeneration.

UCSF Department of Orthopaedic Surgery's statement on the passing of Dr. Elliott Schwartz, MD

With heavy heart, the UCSF Department of Orthopaedic Surgery is deeply saddened to learn of the passing of our esteemed colleague and friend, Dr. Elliott Schwartz. Dr. Schwartz made a big contribution to our community and throughout the country.

An outstanding physician and educator, Dr. Schwartz was a dedicated provider in our UCSF Skeletal Health Service. In addition to being a highly respected member of our Department, Dr. Schwartz also had a long-standing private practice in Nephrology and Bone Health in the East Bay. Many patients benefitted from his great care, and they continue to express deep appreciation for the thoroughness in the care that he provided.

As a passionate educator, Dr. Schwartz was extremely devoted to advancing bone health care. He held national positions in the International Society of Clinical Densitometry, and he hosted an annual Northern California Bone Health Conference. As a Department, we will be continuing his efforts in bone health education by launching UCSF Skeletal Health Seminars that will be named in his honor.

Dr. Schwartz was also one of the most respected and admired medical professionals in the sports world; he worked across multiple sports providing care to hundreds of athletes. He also served as a beloved and highly respected Team Physician for the Oakland A's and the Golden State Warriors for nearly four decades.

He was a mentor to many and impacted many with his humanity, compassion and kindness.



Gina Goodrich joins UCSF Department of Orthopaedic Surgery as Research Administration Director

The Department of Orthopaedic Surgery has made the SAN FRANCISCO (October 21, 2021) -- The UCSF Department of Orthopaedic Surgery is pleased to announce that Gina Goodrich will lead the Department as the Research Administration Director.

As the Director of Research Administration and Lab Operations, Gina works closely with the Vice Chair of Research and is responsible for strategizing, developing, planning, and implementing viable administrative structures and funding streams to support research activities. Developing long-range strategies and solving current complex issues, while providing the guidance and expertise to effect needed changes in a way that optimizes resource utilization and minimizes risk. The position acts independently to solve problems as they arise, to develop administrative policy as required and to facilitate decision-making for the Vice Chair of Research when necessary. The position works collaboratively with the Research Committee and are an important resource to both researchers, faculty and trainees in the interpretation of University policies and procedures. Additionally, this position provides staff leadership, direction and development playing a pivotal role in the coordination and interplay between University research interests and objectives.



Gina gained valuable, progressive experience working with The Permanente Medical Group at the Division of Research, Kaiser Foundation Hospitals, and the Kaiser Foundation Research Institute in Oakland (calif.). She has worked in the Department and Central Administration, as well as with the Institutional Review Board. Additionally, she has amassed a wealth of knowledge in servicing multi-faceted, pre- and post-awards for federal and industry projects in a research environment for past 20 years. Gina later moved to Georgetown University's Medical Center, at which she served as Senior Grants Manager and where she expanded her knowledge and applied her experience in the research field in a university setting. As demonstrated in her roles, she is adept at interpreting and applying her understanding of federal laws and regulations to institutional policies and procedures. We enthusiastically welcome Gina to the Department!



Philanthropy

Support the UCSF Department of Orthopaedic Surgery

Thank you to our incredibly generous donor community. We are deeply appreciative of your support.

Gifts from private donors keep the Department of Orthopaedic Surgery at the forefront of musculoskeletal care and research. Philanthropic support helps us attract and retain the best students and faculty members, make groundbreaking discoveries, and deliver compassionate care.

To learn more about how to make a gift for the Department of Orthopaedic Surgery, please contact Emily Wozniak, Director of Development at (415) 476-3515 or send an email to [emily.wozniak@ucsf.edu](mailto:wozniak@ucsf.edu).

Your contribution will positively impact musculoskeletal care, education and research.

makeagift.ucsf.edu



To learn more about research opportunities in the UCSF Department of Orthopaedic Surgery or to add your support, please visit:

orthosurgery.ucsf.edu





Pioneering musculoskeletal discovery and innovative care to transform lives.

UCSF Orthopaedic
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