Research Report

Highlights in Musculoskeletal Research 2023

UCSF Department of Orthopaedic Surgery

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Editorial Team

Brian Feeley, MD
Professor
Chief, Sports Medicine
Orthopaedic Surgery

Noah Bonnheim, PhD
Post-doctoral Fellow
Basic Science
Orthopaedic Surgery

Gina Goodrich
Director of Research Administration
Orthopaedic Surgery

Kathleen Jay
Marketing Manager
Orthopaedic Surgery

Pui Yee Law
Assistant Program Director, Research

Alick Shiu
Research Administrator
Orthopaedic Surgery

Erin Simon
Marketing Manager
Orthopaedic Trauma Institute

Special thanks to providing infographics:

Anirvan Chatterjee
Director of Data Strategy
UCSF Clinical & Translational Science Institute

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

orthosurgery.ucsf.edu

UCSF Department of Orthopaedic Surgery

Cover Photos
Main:

Researcher Cleo Liu, MS, from the lab of Christopher J. Hernandez, PhD, explores the impact of the gut microbiome on musculoskeletal tissues and orthopaedic surgery.

Left:

UCSF medical student Aidan Foley conducts studies in the METRiCS lab of Jeannie Bailey, PhD, at 95 Kirkham in San Francisco. Dr. Bailey and her team concentrate on lumbar spinal conditions and low back pain, delving into innovative approaches for identifying clinically relevant biomechanical phenotypes and examining potential interactive mechanisms between distinct musculoskeletal pain phenotypes.

Right:

UCSF orthopaedic surgery researchers use micro- and nanofluidic systems to understand the disease processes in musculoskeletal tissue.

Scientists in the UCSF Muscle Injury and Translational Orthopedic (MITO) Research Lab perform research on muscle tissue quality and its impact on common problems, such as rotator cuff tears, knee pain, limb immobilization, joint contractures, and low back pain. This stem cell research is funded by the NIH, VA, UCSF, and private donations.

Message from the Chair of the UCSF Department of Orthopaedic Surgery

Dear colleagues and friends,

With great excitement, I present my first annual research report, reflecting our unwavering commitment to advancing musculoskeletal health and transforming lives. At the heart of our department's mission lies the relentless pursuit of pioneering research aimed at addressing the multifaceted challenges in musculoskeletal care.

We have embraced a comprehensive approach encompassing basic, clinical, and translational research endeavors. Our steadfast goal is to ensure that innovations emerging from benchwork and clinical investigations conducted at UCSF benefit all patients and foster a future where optimal musculoskeletal health is attainable for everyone.

In the spirit of evidence-based inquiry, our researchers delve into diverse facets of musculoskeletal health, tackling issues ranging from osteoarthritis and hereditary disorders to the socio-economic determinants of health, including poverty, discrimination, malnutrition, and health care accessibility.

Notably, 2023 marked a pivotal year for our department, with the inauguration of two cutting-edge research facilities: Pride Hall at Zuckerberg San Francisco General and the 95 Kirkham/UCSF Orthopaedics dedicated motion analysis lab. These state-of-the-art facilities signify our unwavering commitment to advancing research infrastructure and fostering collaboration in our pursuit of scientific excellence.

Throughout the year, our vibrant research community continued to produce impactful scholarship, contributing numerous papers to the scientific community. Moreover, our department again secured substantial NIH funding, reflecting the recognition of our research's significance and potential for transformative impact. Our research collaboration has created impacts that have been felt locally, nationally, and across the globe.

Additionally, we proudly celebrate the outstanding achievements of two of our esteemed researchers. Dr. Tamara Alliston, PhD, and Dr. Ralph Marcuccio, PhD, received international awards in recognition of their exceptional contributions to musculoskeletal research.

As the new chair of the Department of Orthopaedic Surgery, I fully support all the impactful work of our faculty. I envision the next chapter of musculoskeletal research will focus on translational research that will bring our basic science discoveries to clinical use. I also want to build stronger infrastructure to support clinician scientists and the use of artificial intelligence to help guide patient care. I look forward to sharing with you all our successes in the future.

Lastly, I want to recognize the remarkable 16-year tenure of Dr. Thomas P. Vail, MD, my chair extraordinaire who has led our department to be a leader in musculoskeletal discoveries. Thank you!

Warm regards,

C. Benjamin Ma, MD

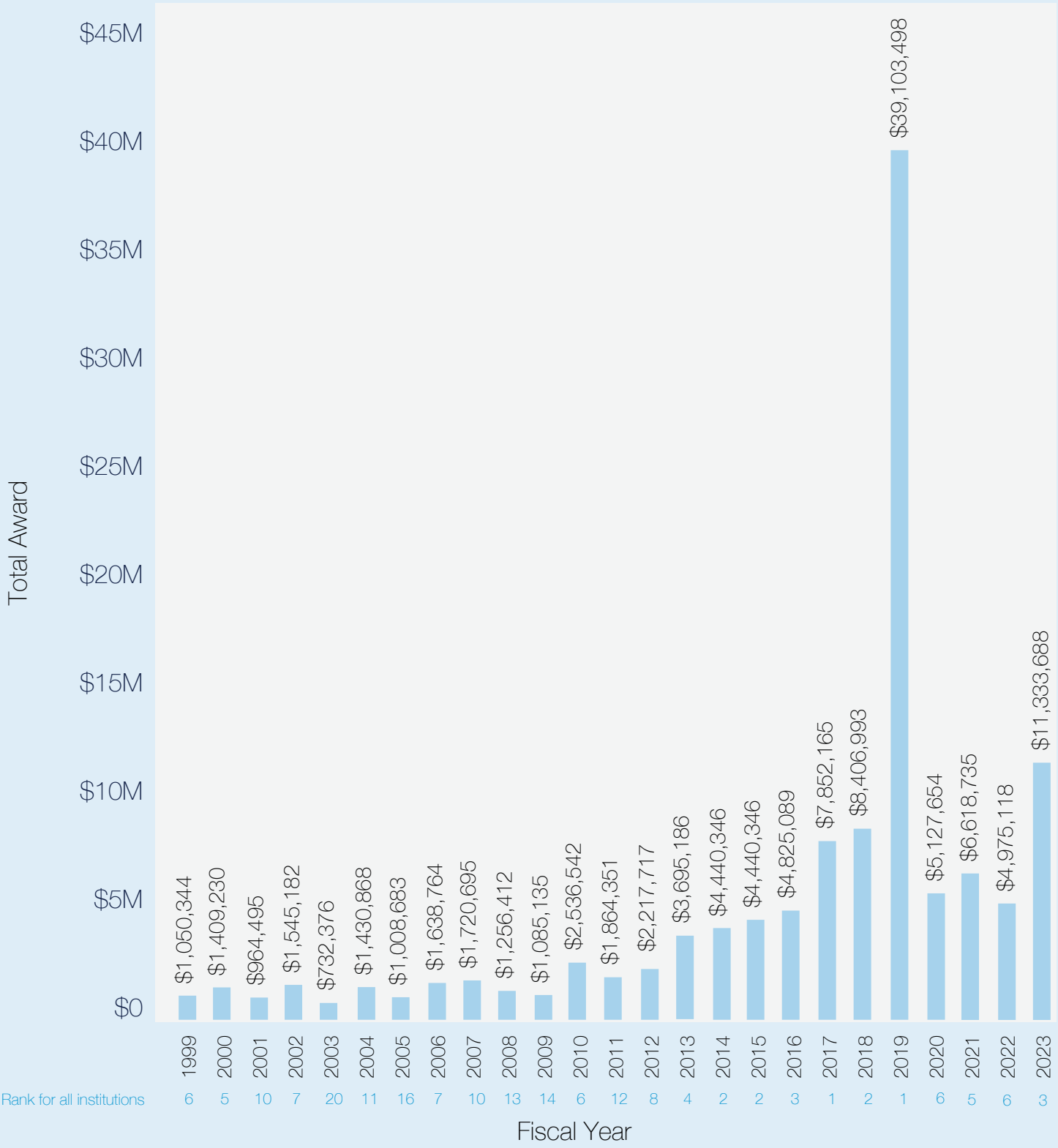
Our Vision

Pioneering musculoskeletal discovery and innovative care to transform lives.

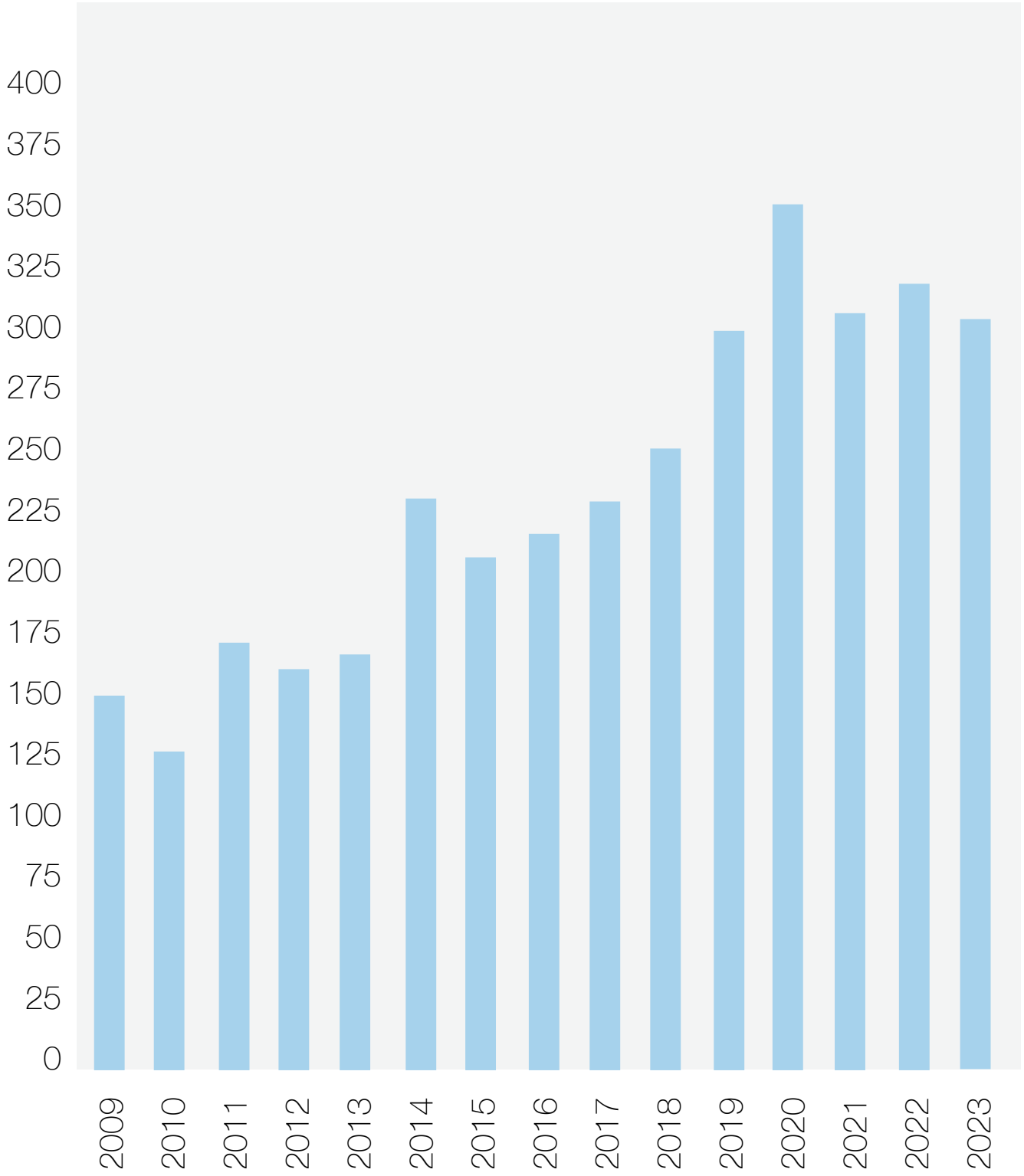
More than 275 musculoskeletal researchers gathered for the 2023 UCSF CCMBM, REACH & Department of Orthopaedic Surgery Scientific Retreat at Genentech Hall at UCSF Mission Bay campus in San Francisco. Researchers from the Department participate in more than 50 scientific meetings and conferences throughout the year. Pictured here are, at left, Cristhian Montenegro, PhD, and Nesa Milan, MD, post-doctoral scholars in the Muscle Injury and Translational Orthopedic (MITO) Lab, presenting a poster on orthopaedic regenerative medicine at the annual UCSF Research Retreat.

NIH Ranking

NIH Research Grants for UCSF Department of Orthopaedic Surgery

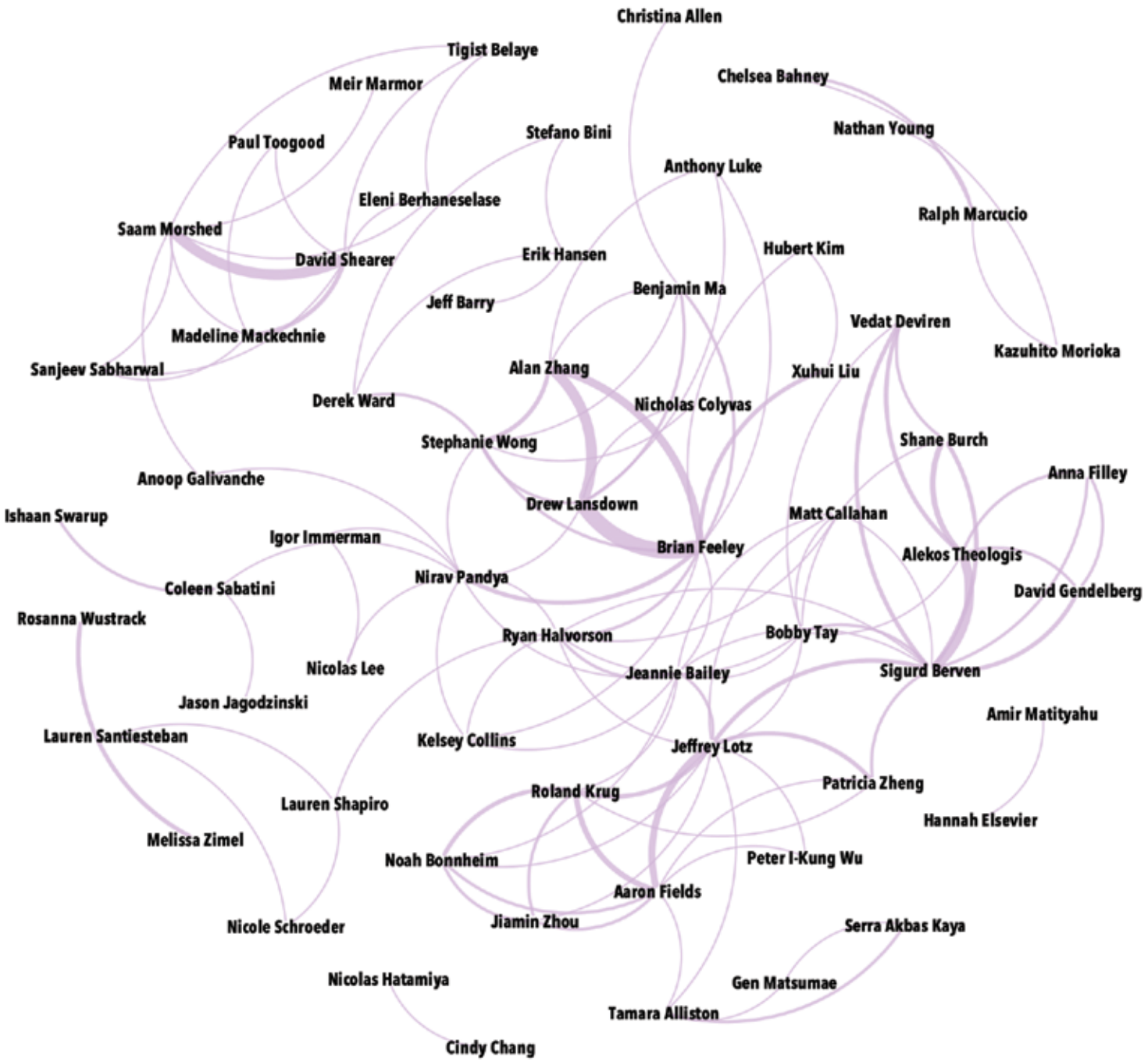


Research: UCSF Publications



Journals of our Published Research

Co-authorships within Department



2023 Grants and Fellowships

Tamara Alliston, PhD

NIH Natl Inst Arthr, Musculoskel & Skin T32

UCSF Musculoskeletal Training Program

4/1/2023-3/31/2028

$1,213,180

DOD US Army Med. Res. Acq. Activity

Joint Shape Change as a Target for the Understanding, Diagnosis, Prevention, and Treatment of Osteoarthritis

8/15/2023-8/14/2027

$2,401,711

NIH Natl Inst Arthr, Musculoskel & Skin R21

Osteocyte-dependent mechanisms of bone cartilage crosstalk in osteoarthritis

9/1/2023-8/31/2025

$408,669

Jeannie Bailey, PhD

NIH Natl Inst Arthr, Musculoskel & Skin R01

Mechanistic structure-function relationships for paraspinal muscle fat infiltration in chronic low back pain patients

6/1/2023-3/31/2028

$1,776,500

Jeffrey Barry, MD

Smith & Nephew plc

023-24 UCSF Chase-Bozic Adult Reconstruction Fellowship

8/1/2023-7/31/2024

$30,000

OMeGA Medical Grants Association

Arthroplasty OMeGA Fellowship Grant

8/1/2023-7/31/2024

$19,000

Noah Bonnheim, PhD

NIH Natl Inst Arthr, Musculoskel & Skin F32

Effects of in situ orientation on quantitative MR-based measures of cartilage endplate health

2/1/2023-1/31/2025

$151,182

Shane Burch, MD

Medtronic, Inc. - Fellowship

Spine Fellowship Award 2023-2024

8/1/2023-7/31/2024

$50,000

AO North America, Inc.

AO SNA Fellowship Program 2023

7/1/2023-6/30/2024

$30,000

Columbia University W81

Topical Application of Tranexamic Acid to Reduce Blood Loss During Spine Surgery (Sub-In Columbia U; PI Lehman; DoD Prime)

2/16/2023-2/15/2024

$234,950

Kelsey Collins, PhD

NIH Natl Inst Arthr, Musculoskel & Skin A142068

The Role of Fat in Osteoarthritis

8/1/2023-6/30/2026

$249,001

Arthritis National Research Foundation

The Role of Neuroimmune Metabolic Crosstalk in the Onset and Progression of Pain in Osteoarthritis

7/1/2023-6/30/2024

$125,000

Brian Feeley, MD

Conmed Corporation

Education Grant Program - Fellowship

10/25/2023-10/24/2028

$70,000

Aaron Fields, PhD

iSpine Ingenuity, Inc.

Assessing cytotoxicity and therapeutic effect of agents on human intervertebral disc nucleus pulposus cells in culture

1/5/2023-6/5/2023

$50,453.80

Edgar Garcia-Lopez, MD

American Foundation for Surgery of the Hand

A Biomechanical Analysis of Oblique Metacarpal Neck Fracture Fixation in a Cadaver Model

2/1/2023-1/31/2024

$5,000

2023 Grants and Fellowships

Eva Gonzalez Diaz, PhD

The Burroughs Wellcome Fund

Engineered 3D models to study the role of tumor-microbe crosstalk on metastasis and drug resistance

9/1/2023-8/31/2026

$60,000

Erik Hansen, MD

Howmedica Osteonics Corporation

A prospective, post-market, multi-center study of the clinical outcomes of the Insignia" Hip Stem

1/1/2023-12/31/2027

$158,797

Christopher Hernandez, PhD

National Science Foundation

BRITE Fellow: Rigid Engineered Living Materials

2/15/2023-2/28/2027

$959,292

NIH Natl Institute on Aging R01

The Microbiome and Bone Strength

5/1/2023-2/28/2026

$1,821,767

Hubert Kim, MD, PhD

Depuy Synthes, a Johnson & Johnson Co.

Depuy Synthes, a Johnson & Johnson Co. Fellowship

11/17/2023-11/19/2023

$1,250

Depuy Synthes, a Johnson & Johnson Co.

Depuy Synthes, a Johnson & Johnson Co. Fellowship

2/16/2023-2/18/2023

$1,250

Jeffrey Kwong, MD, MS

American Foundation for Surgery of the Hand

Impact of Insurance Type on Access to Care Following Distal Radius Fracture

2/1/2023-1/31/2024

$5,000

Jeffrey Lotz, PhD

CALIF Inst for Regenerative Medicine

2023 Center for Dental, Oral, & Craniofacial Tissue & Organ Regeneration (C-DOCTOR) Annual Spring Conference

6/1/2023-7/31/2023

$30,250

Ralph Marcucio, PhD

NIH Natl Inst Arthr, Musculoskel & Skin R01

Cell Transitions during Bone Fracture Healing

9/18/2023-8/31/2028

$2,801,297

Zuzana Vavrusova, PhD

NIH Natl Inst Dental & Craniofacial Res. F32

Integration of Brain and Face Morphogenesis in Normal and Disease Phenotypes

12/1/2023-11/30/2026

$229,697

Alan Zhang, MD

Smith & Nephew plc

Restricted Fellowship Grant

8/1/2023-7/31/2024

$25,000

Arthroscopy Association of North America – Fellowship

ARTHROSCOPY/SPORTS FELLOWSHIP 2023-2024

8/1/2023-7/31/2024

$6,795.14

Melissa Zimel, MD

American Academy of Orthopaedic Surgeons

A day-long leadership skills training course AAOS IDEA Grant Program

3/1/2023-9/9/2023

$10,000

2023 Center-Related Grants

CDMI

Christopher Hernandez, PhD

Understanding bacterial infiltration into bone and bone allograft

NSF CDMI (Center for Disruptive Musculoskeletal Innovations)-funded project

Jan. 1, 2023 – Dec. 31, 2024

$40,000

CCMBM

Brian Feeley, MD, and Steven Garcia, MD

"Cellular heterogeneity and sex-based differences in human ACL injuries"

NIH NIAMS P30AR075055 (CCMBM Pilot Feasibility Grant)

June 2, 2023 – June 30, 2024

$50,000

Noah Bonnheim, PhD

"Biochemical mechanisms affecting T1ρ relaxation times in the intervertebral disc"

NIH NIAMS P30AR075055 (CCMBM Tools and Technology Grant)

May 23, 2023 – June 30, 2024

$7,500

Karsyn Bailey, PhD

NIH NIAMS P30AR075055 (Junior Investigator Travel Award)

February 2023 – Orthopaedic Research Society Annual Meeting

$200

Jae-Young, Jung, PhD

NIH NIAMS P30AR075055 (Junior Investigator Travel Award)

March 2023 – The Minerals, Metals, and Materials Society (TMS) Annual Meeting

$200

Bethany Andoko

NIH NIAMS P30AR075055 (Junior Investigator Grant Development Award)

December 2023

$240

C-DOCTOR

Sarah Knox, PhD, and Chelsea Bahney, PhD

Regeneration of radiation-damaged salivary glands using neurogenic stimulation of stem cells

CIRM TRAN 1 [in process of being transferred from School of Dentistry, PI Sarah Knox, PhD]

July 1, 2023 – Sep. 30, 2024

$2,000,000

Research Programs and Activities

At the UCSF Muscle Injury and Translational Orthopaedic (MITO) research lab, Sankalp Sharma, BS, focuses on studying muscular dystrophy, kinematic tests with mice, and isolating various cell populations.

Basic, Translational, and Clinical Research

The UCSF Department of Orthopaedic Surgery has a diverse and broad basic science and translational research program in musculoskeletal biology. Areas of focus include molecular and cell biology, developmental and stem cell biology, tissue regeneration, biomechanics, imaging, and biomaterials. These research areas complement our clinical research program, which spans all orthopaedic subspecialties.

The major goal of our research is to bring new insights to the understanding of the musculoskeletal system in order 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.

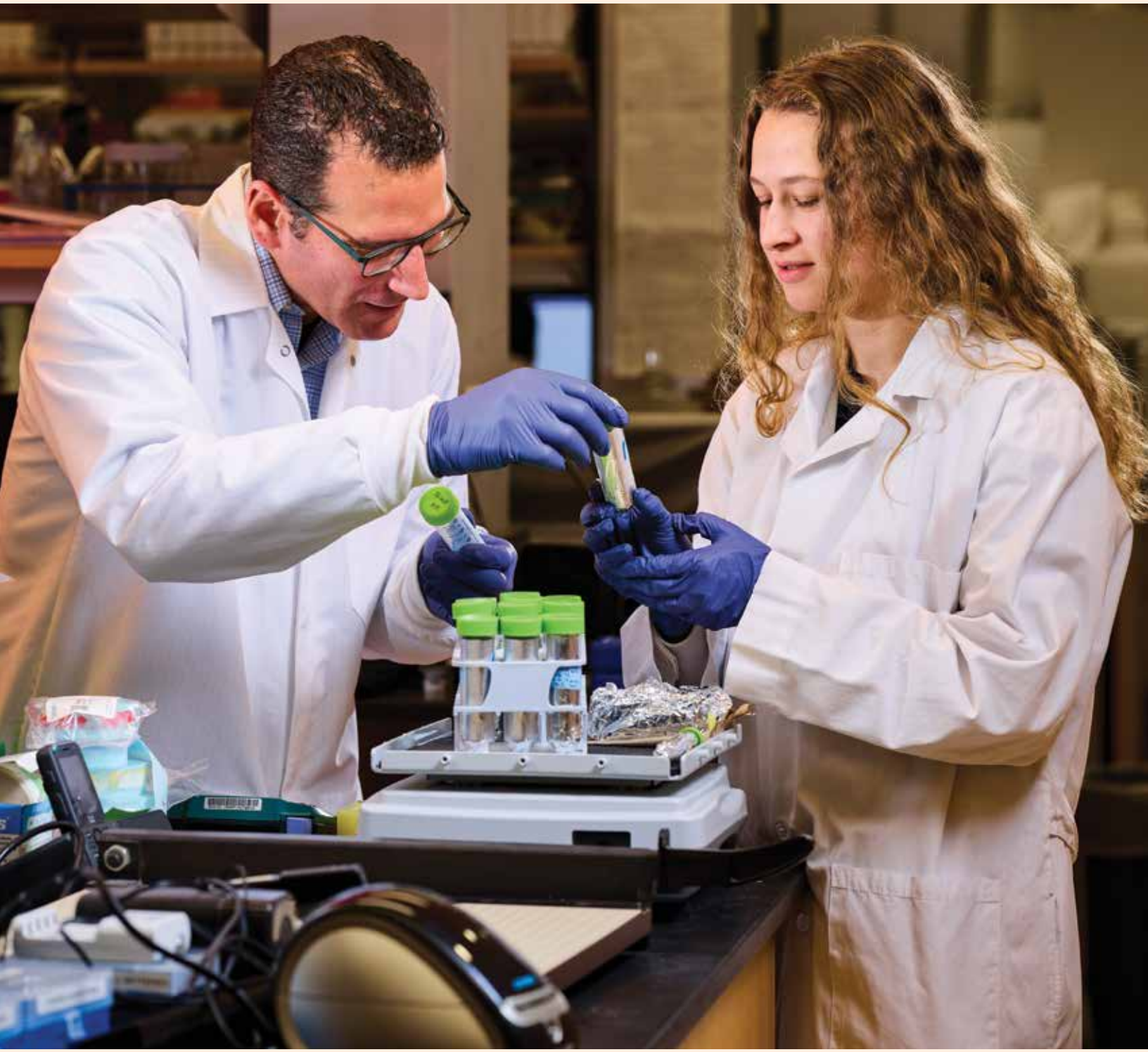
Over the past decade, we have established large collaborative networks both within UCSF as well as with national and international researchers. This has enhanced the impact and depth of our research.

Last year, our basic, translational, and clinical research was published in high impact journals including Bone, eLife, FASEB Journal, The Journal of Bone and Mineral Research (JBMR), Proceedings of the National Academy of Sciences (PNAS), as well as major orthopaedic journals including the Journal of Bone & Joint Surgery (JBJS), Journal of Orthopaedic Trauma (JOT), The Spine Journal, JOR Spine, European Spine Journal, Journal of Pediatric Orthopaedics (JPO), Clinical Orthopaedics and Related Research (CORR), and the American Journal of Sports Medicine (AJSM), among others.

Our faculty, fellows, and residents have presented at numerous national and international conferences such as those held by the American Academy of Orthpaedic Surgeons (AAOS); American Association for Anatomy (AAA), Orthopaedic Research Society (ORS); the American Orthopaedic Society in Sports Medicine (AOSSM); the International Society of the Study of the Lumbar Spine (ISSLS); 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).

While the individual projects are too numerous to list in detail, we highlight here several collaborative research projects related to spine surgery, chronic low back pain, osseointegration, 3D printing, shoulder arthroplasty and instability, imaging, global health through UCSF's Institute for Global Orthopaedics and Traumatology (IGOT), sports medicine, and pediatrics.

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. Aaron Fields, PhD, at left, and his staff research associate Julia Barylak conduct musculoskeletal tissue research, emphasizing nutrient transport for repair and regeneration. Their work combines engineering and biology to understand aging's impact and to develop diagnostic strategies, utilizing advanced experimental tools.

Hernandez Research Group

UCSF Parnassus Heights

The Hernandez Research Group is directed by **Christopher J. Hernandez, PhD.**

The Hernandez Research Group, part of the Department of Orthopaedic Surgery and UCSF Health Innovations Via Engineering, studies interactions between microbes, musculoskeletal disease, orthopaedic surgery, and materials science. A primary research thrust of the lab is to understand how the gut microbiome regulates the initiation and progression of musculoskeletal diseases, including osteoporosis and osteoarthritis. Our long-term goal is to identify microbiome-based therapeutics (probiotics, fecal microbiota transplant, or molecules generated by beneficial gut microbes) to address musculoskeletal disease. Our lab was the first to demonstrate that changes in the constituents of the gut microbiome can regulate the fragility of bone tissue and slow the development of osteoarthritis. Additionally, we have shown that the constituents of the gut microbiome in the weeks prior to implant surgery can influence susceptibility to periprosthetic joint infection, suggesting possible benefits of using probiotics in the weeks prior to elective surgery.

In the past year, our research group has shown that changes in the mechanical properties of bone tissue caused by the gut microbiome are reversible in the adult skeleton. This finding suggests the possibility that a microbiome-based therapeutic could be made to improve bone matrix materials properties. This is a beneficial effect distinct from current therapies that focus on increasing the amount of bone matrix (for example, bone size and density). We also performed our first clinical study examining the gut microbiome in patients before and after spinal fusion surgery. With support from the Chan-Zuckerberg Biohub San Francisco Investigator Program, Dr. Hernandez has established collaborative relationships with CZ Biohub scientists to bring the newest genomics and metabolomics techniques to orthopaedic research.

In another arm of our research, we use micro- and nanofluidic devices manufactured with tools used in the semiconductor industry to isolate and compress individual bacteria. With support from the Center for Disruptive Musculoskeletal Innovation, our group has studied the ability of the pathogen Staphylococcus aureus to squeeze into nanoscale channels within bone (similar in size to osteocyte canaliculi). Here, they are protected from neutrophils and other immune cells and may therefore contribute to the persistence of osteomyelitis. These findings have the potential to identify new strategies to address osteomyelitis and periprosthetic joint infection and to understand how bacteria colonize orthopaedic implants. Lastly, in continuing our collaborations with UCSF Health Innovations Via Engineering and the University of California, Berkeley, College of Engineering, we are applying our technologies, initially designed to study musculoskeletal disease, to empower an emerging field known as “Engineered Living Materials.” This is a new technological concept, in which living organisms are embedded within materials. Here, they act as sensors of damage and/or perform repair processes, just as cells within bone sense and repair mechanical loading and damage.

Grants

Chan Zuckerberg Biohub San Francisco, Investigator, Christopher J. Hernandez, $1,000,000

Trainee Awards and Grants 2023

UCSF Musculoskeletal Training Program T32 Postdoctoral Fellowship, Eva González Diaz, PhD

Burroughs Wellcome Fund Postdoctoral Diversity Enrichment Program, Eva González Diaz, PhD

Stanford.Berkeley.UCSF Next Generation Faculty Symposium, Eva González Diaz, PhD

UCSF Chancellor’s Postdoctoral Fellowship Award, Kelsey DeFrates, PhD

National Science Foundation Graduate Research Fellowship, Gissell Jimenez, BS

Papers

Heveran CM, Hernandez CJ. Make engineered living materials carry their weight. Matter. 2023 Nov 1;6(11):3705–18.

Presentations

Schwarz EM, Archer NK, Atkins GJ, Bentley KL de M, Botros M, Cassat JE ... Hernandez CJ, et al. The 2023 Orthopaedic Research Society’s International Consensus Meeting on musculoskeletal infection: Summary from the host immunity section. J Orthop Res. 2023.

Musculoskeletal Crosstalk

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

The Laboratory for Musculoskeletal Crosstalk is directed by **Kelsey Collins, PhD.**

Kelsey Collins, PhD, directs the Laboratory for Musculoskeletal Crosstalk, which opened in the UCSF Department of Orthopaedic Surgery and Musculoskeletal Center in April 2023. Dr. Collins completed her postdoctoral in the Department of Orthopaedic Surgery at Washington University in St. Louis School of Medicine. Her work focuses on osteoarthritis (OA), the leading cause of musculoskeletal pain, which represents the primary driver for patient care-seeking behavior. There are presently no disease-modifying OA drugs, and existing pain management strategies are inadequate. Obesity is one of the leading co-morbidities in OA patients, and as such, our work has focused on better understanding this complicated relationship. Her work has shown that cartilage damage and pain with OA may originate from factors outside cartilage or outside the knee joint, such as signals from adipose tissue (fat). These findings have contributed to a paradigm shift in our understanding of OA as a systemic disease. These studies were motivated by clinical and preclinical data illustrating that changes in body mass with obesity and loading incompletely explain OA burden.

Organisms are comprised of complex, interconnected signaling networks of organs, tissues, and cells. With chronic disease, aging, and multimorbidity, this interorgan communication can break down, resulting in pathology. The goal of the Laboratory for Musculoskeletal Crosstalk is to disentangle and understand interorgan crosstalk, which may be the key to developing a first-in-class drug for OA. To this end, Dr. Collins and her team leverage their interdisciplinary skillset to characterize crosstalk from systemic contributors to musculoskeletal (MSK) damage, such as fat, the gut microbiome, and circulating factors in the blood. These interactions are critical to understanding the basic mechanisms of the disease and developing much-needed novel therapeutic strategies. This approach is powerful at dissecting complex systemic mechanisms and interactions between age-related metabolic, biomechanical, and inflammatory factors in obesity and OA.

Using OA as a model system to understand these relationships, Dr. Collins and team can disentangle adipocyte interorgan crosstalk with effector tissues, like nerves and joint tissues in OA, obesity, diabetes, and aging. As pain is what drives OA patients to the clinic, the lab has developed a skillset in pain and behavioral testing, an outcome that is insufficiently addressed in OA. The team will harness these mechanisms to deliver novel cell-based therapeutics for arthritis, metabolic, and age-related diseases. We have developed a stem cell therapy-based platform to interchangeably and specifically delete signaling factors from fat to uncover the mechanism of fat-cartilage signaling using genome engineering tools. This approach can also be applied to leverage the cell's own regulatory mechanisms to guide therapeutic delivery in response to inflammatory signals. By endogenously delivering a variety of biologic drugs, this platform can be flexibly and readily expanded, establishing a novel approach and cell-based therapy using iPSCs that can be differentiated into designer fat or other tissues. Dr. Collins hopes to harness these mechanistic insights to create a first-in-class therapeutic strategy for OA with relevance to obesity, aging, and other chronic diseases.

Grants

Arthritis National Research Foundation, 2023-2025

Lipedema Foundation, 2023-2025

NIH NIAMS R00 Pathway to Independence Award

Papers

Ely, E. V., Kapinski, A. T., Paradi, S. G., Tang, R., Guilak, F., & Collins, K. H. (2023). Designer fat cells: adipogenic differentiation of CRISPR-Cas9 genome-engineered induced pluripotent stem cells.

Rai, M. F., Collins, K. H., Lang, A., Maerz, T., Geurts, J., Ruiz-Romero, C., ... & Kapoor, M. Three decades of advancements in osteoarthritis research: insights from transcriptomic, proteomic, and metabolomic studies. Osteoarthritis and Cartilage.

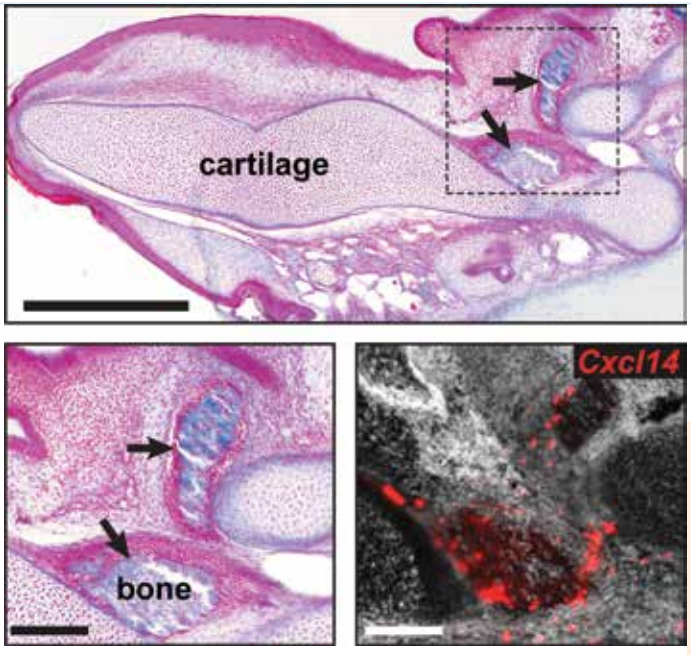
Buettmann, E. G., Chlebek, C., Lockard, C. A., Clayton, S. W., Lewis, K. J., & Collins, K. H. (2023). Post or Perish? Social Media Strategies for Disseminating Orthopedic Research. Journal of Orthopaedic Research.

Schneider Laboratory for Developmental and Evolutionary Skeletal Biology

UCSF Parnassus Heights

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

Richard A. Schneider, PhD, directs the Laboratory for Developmental and Evolutionary Skeletal Biology. Dr. Schneider and his lab investigate how the musculoskeletal system achieves its structural and functional integration during development. To do so, his lab created a unique surgical transplantation system that involves embryos from two distinct types of birds (quail and duck), which differ considerably in their evolutionary history, functional anatomy, and growth rates. Transplanting skeletal and other progenitor cells between these birds challenges the resulting chimeric "quck" and "duail" embryos to integrate two different species-specific developmental programs. By assaying for 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 acquire 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. For example, a recent publication and a current grant continue to identify genetic changes that can modulate expression levels of genes involved in bone deposition and resorption. This research has important implications for understanding normal bone development and homeostasis in the skeleton, as well as the etiologies of bone loss diseases, such as osteoporosis and osteonecrosis. Other ongoing projects focus on mechanisms that enable certain tendons to attain robust osteointegration, which has clinical implications for enhancing the capacity of torn muscle insertions to be re-attached to bone via molecular therapies. Discoveries from the Schneider Lab have also helped elucidate the role of development in evolution by revealing how genetic variation in programs for osteogenesis can drive species-specific changes in the skeleton.



The Schneider lab grows a lower jaw primordium from a chick embryo in culture and then stains the tissues to detect the presence of cartilage (white, with pink nuclei) and bone (black arrows pointing to extracellular matrix, stained blue). Normally, bone does not form at this stage, but due to the genetic over-expression of a novel molecule called Cxcl14, de novo bone (black arrows) is induced, as shown in the inset box (black dashed line) at higher magnification. An adjacent section shows that the fluorescent signal (red), which is indicative of where Cxcl14 is over-expressed, is coincident with the ectopic bone. Using this strategy, the Schneider lab is testing the role of various molecules in inducing bone formation, which has clinical implications for generating new bone in cases of injury, disease, and birth defects. Images courtesy of Dr. An Nguyen.

Grants

NIH Natl Inst Dental & Craniofacial Research: R01 DE016402

Mesenchymal Regulation of Osteogenesis

2/1/2022-3/31/2027

$3,170,360

Papers

MS Hur, S Lee, HS Jung, RA Schneider. 2023. Crossing fibers may underlie the dynamic pulling forces of muscles that attach to cartilage at the tip of the nose. Scientific Reports 13 (1), 18948

Laboratory for Skeletal Mechanobiology

UCSF Parnassus Heights

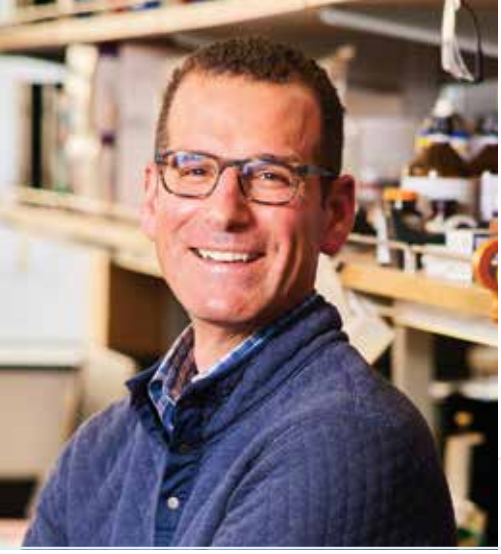
The Laboratory for Skeletal Mechanobiology is directed by **Tamara Alliston, PhD.**

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 TGFβ in synergistically coordinating physical and biochemical cues in bone and cartilage cells. Since TGFβ 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.

Currently, our research focuses on the systemic and skeletal roles of osteocytes, a head-to-toe network of mechanosensory cells embedded in our bones. These cells balance metabolic and mechanical homeostasis through mechanisms that we are uncovering for the first time. A recent publication by Dr. Charles Schurman and coauthors describes his graduate work in the Alliston lab, in which they found that the loss of osteocytic TGFβ signaling is a major factor in age-related bone fragility. Supported by new grants from the NIH and the DOD, the research team is building on this discovery to identify new therapeutic strategies to promote healthy aging and improve skeletal repair.

Musculoskeletal tissues possess abundant extracellular matrix (ECM), the material that makes bone hard or cartilage shock absorbent. The ECM complicates the use of cutting-edge molecular methods for profiling, spatial, and single cell analysis of the musculoskeletal system. The Alliston lab embraces the creative adaptation and development of new strategies to apply these approaches to musculoskeletal tissues. Within the last year, their collaborations led to important technical advances, including a novel pipeline for deep proteomic profiling, among others. Their efforts advance the field with essential new tools to investigate musculoskeletal tissues. By applying these approaches to experimental models and tissues from patients undergoing orthopaedic surgery, the Alliston lab is driving discovery of new mechanisms responsible for osteoarthritis and bone fragility in humans – a key step to developing the next generation of therapies to improve musculoskeletal health.

Musculoskeletal researcher Andrés Betancourt-Torres, performs research on metabolism and cell signaling of bone cells in the Alliston Laboratory of Skeletal Mechanobiology on the Parnassus campus.



Fields Laboratory for Orthopaedic Biomechanics and Biotransport

UCSF Parnassus Heights

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

Aaron J. Fields, PhD, directs the research in the Fields Laboratory for Orthopaedic Biomechanics and Biotransport, which broadly focuses on structure-function relationships in musculoskeletal tissues. It has a particular focus on discovering the mechanisms of nutrient transport in cartilage and bone and harnessing nutrient transport for tissue repair and regeneration. We combine engineering and biology approaches to (1) understand the effects of aging and disease on structure-transport relationships and (2) develop translatable diagnostic and therapeutic strategies.

A primary focus of the lab's current research is the role of nutrient supply in spinal disc degeneration and regeneration. Disc degeneration is a chronic matrix remodeling process that causes back pain in many patients. Therapies to regenerate the disc — including cell, gene, or growth factor injections — have shown promise in pre-clinical studies. But clinical trials in humans indicate these therapies are largely ineffective. Poor disc nutrient supply may be the culprit. This is because increasing the number of cells inside the disc or enhancing the metabolism of native disc cells requires a rich nutrient supply, which may be inadequate in many patients. To address this issue, the Fields lab recently developed a new MRI biomarker for identifying patients with adequate nutrient supply to support regenerative therapies (Bonnheim et al. 2023. Quantitative Imaging Medical Surgery). This new MRI biomarker provides a more comprehensive assessment compared to legacy techniques, and the lab is currently leading an ongoing, NIH-funded study to test if the biomarker is predictive of patient response to intradiscal platelet-rich plasma (PRP) treatment.

While improving patient selection is critical, it doesn't address the needs of patients for whom disc nutrient supply is inadequate. Thus, the Fields lab also engineered the first treatment for enhancing disc nutrient supply (Habib et al. 2023. Frontiers in Bioengineering and Biotechnology) and is now conducting pre-clinical testing.

Finally, the lab is continuing its track record of pioneering discoveries into structure-function relationships in spinal cartilage. For example, the group recently found that nutrient transport in the spinal cartilage endplate is impaired by molecular cross-links, which accumulate in the disc due to aging, disease, and diet (Jung et al. 2023. JOR Spine). This finding complements other recent work by the group which demonstrates that excessive cross-linking impairs the biomechanical behavior of the disc (Rosenberg et al. 2023. PNAS Nexus).

Highlights in 2023

The group was awarded the 2023 ISSLS Prize in Bioengineering Science (Bonnheim et al. 2023. European Spine Journal).

Noah Bonnheim, PhD was awarded a postdoctoral fellowship from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

Dr. Bonnheim was awarded a Tools and Technology Grant from the CCMBM for his proposal "Biochemical mechanisms affecting T1ρ relaxation times in the intervertebral disc."

Brack Laboratory for Skeletal Muscle Regeneration and Aging

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

The Brack Laboratory for Skeletal Muscle Regeneration and Aging is directed by **Andrew Brack, PhD**.

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.

Researcher Spencer Silvey, at left, and Alex Brown, PhD, perform experiments at the Brack Laboratory for Skeletal Muscle Regeneration and Aging on muscle aging and muscle recovery following cancer treatment.

Laboratory of Skeletal Regeneration

Zuckerberg San Francisco General (ZSFG)

The Laboratory of Skeletal Regeneration is directed by **Ralph Marcucio, PhD,** and **Ted Miclau, MD.**

The Laboratory of Skeletal Regeneration located at the Orthopaedic Trauma Institute focuses on development and regeneration of the skeleton. Skeletal birth defects often present as a range of changes that fall along a spectrum from mild to severe. We have uncovered fundamental mechanisms by which this occurs. Genetic mutations often lead to decreased function of the proteins that are encoded. This decreased function leads to a deviation from normative skeletal outcomes, as well as an increase in the variance in the outcomes. We also study skeletal trauma. During fracture healing, a large cartilage template forms that is replaced by bone. Our studies have revealed that this cartilage directly transforms into the bone as the chondrocytes "transdifferentiate" into the osteoblasts that make the new bone.

Our lab also studies skeletal trauma and regeneration. We have multiple ongoing studies that are aimed at understanding the cellular and molecular regulation of fracture healing and developing treatments for problematic fractures.

During fracture healing, a large cartilage template forms that is replaced by bone. Our studies have revealed that this cartilage directly transforms into the bone as the chondrocytes "transdifferentiate" into the osteoblasts that make the new bone. We have recently obtained a large NIH grant to study the molecular mechanisms by which this transformation occurs.

As people age, regenerative capacity declines. This also happens in animals. We use animal models of aging to understand mechanisms of delayed fracture healing upon aging. Elderly mice have increased inflammation due to aberrant macrophage activity. Reducing this inflammation rejuvenates the healing response in aged animals. We also use models of progeria, which is accelerated aging. These animals also have reduced healing potential, and we are exploring the relationship of the inflammatory response in these animals with elderly animals.

Trauma has systemic impacts on the body. In collaboration with colleagues in Germany, we are exploring how bone fracture impacts the cardiovascular system. We have discovered increased inflammation in the heart in response to bone injury. This could impact a patient's outcomes of injury, and we are assessing methods to reduce the impact of fracture on the heart.

Grants

NIH R01. Cell Transitions During Bone Fracture Healing. PI: Ralph Marcucio

NIH R01. The Role of Continuous Phenotypic Variation in Structural Birth Defects of the Face. PIs: Ralph Marcucio, Benedikt Hallgrimsson (U Calgary)

NIH R01. Transcriptional Regulatory Landscapes Underlying FEZ Formation. PIs: Ralph Marcucio, Licia Selleri (UCSF)

NIH, R01: Therapeutic Application of Painless Nerve Growth Factor to Accelerate Endochondral Fracture Repair. PI: Chelsea Bahney

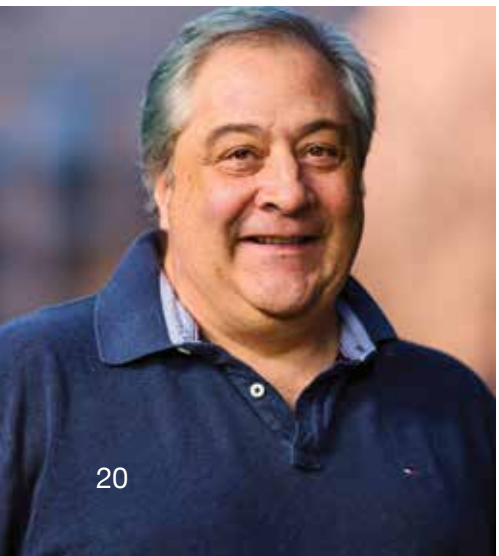
Papers

Encapsulation of β-NGF in injectable microrods for localized delivery accelerates endochondral fracture repair. Rivera KO, Cuylear DL, Duke VR, O'Hara KM, Zhong JX, Elghazali NA, Finbloom JA, Kharbikar BN, Kryger AN, Miclau T, Marcucio RS, Bahney CS, Desai TA. Frontiers in Bioengineering and Biotechnology. 2023 May 22;11:1190371. doi: 10.3389/fbioe.2023.1190371. eCollection 2023.

Altered early immune response after fracture and traumatic brain injury. Haffner-Luntzer M, Weber B, Morioka K, Lackner I, Fischer V, Bahney C, Ignatius A, Kalbitz M, Marcucio R, Miclau T. Frontiers in Immunology. 2023 Jan 25;14:1074207.

A Shifting Paradigm: Transformation of Cartilage to Bone During Bone Repair. Marcucio RS, Miclau T 3rd, Bahney CS. Journal of Dental Research. 2023 Jan;102(1):13-20.

Cardiac alterations following experimental hip fracture - inflammaging as independent risk factor. Lackner I, Weber B, Pressmar J, Odwarka A, Lam C, Haffner-Luntzer M, Marcucio R, Miclau T, Kalbitz M. Frontiers in Immunology. 2022 Sep 5;13:895888. doi: 10.3389/fimmu.2022.895888. eCollection 2022.



Ralph Marucio, PhD, at left, and Ted Miclau, MD run the Laboratory of Skeletal Regeneration at the Orthopaedic Trauma Institute in San Francisco.

Young Laboratory for Evolutionary Anatomy

Zuckerberg San Francisco General (ZSFG)

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

The Young Laboratory for Evolutionary Anatomy (LEA), located in the Orthopaedic Trauma Institute (OTI) at Zuckerberg San Francisco General Hospital's new Pride Hall, is directed by Nathan M. Young, PhD. It has three research foci: (1) characterizing phenomic variation in human evolution, health, and disease, including clinical and disease correlates of shape, predictive medicine, 3D medical imaging, geometric morphometrics, and shape analysis, (2) the evolution and development of the skeleton, including craniofacial and postcranial traits, skeletal development and growth, genotype-phenotype maps, and evolvability, and (3) human and ape evolution, including craniofacial and postcranial adaptations, primarily the face and shoulder.

The LEA research program seeks to address basic biomedical questions through the lens of evolution by incorporating the concepts of variation, functional compromise, and historical constraint as fundamental explanatory principles. LEA combines classical embryology in a range of model (mouse, chicken) and non-model (e.g., human, turtle, alligator) systems with modern genetic tools and advanced methods for quantifying and comparing phenotypes at a range of scales. This approach yields significant insights into not only the processes that contribute to evolutionary diversity among species, but also how individual differences ranging from normal to disease states are generated. Research investigations include both normal mechanisms of development as well as the etiology of structural birth defects, and is relevant to longstanding goals of providing personalized and predictive medicine.

A highlight of LEA's research program from 2023 includes a collaboration with Queen's University (Ontario, Canada) to develop tools to better visualize and quantify range of motion in the shoulder of humans and closely related living primates from in silico modelling. This has a proximate goal of better predicting function and behavior in fossil hominins, such as Australopithecus, our extinct relatives (Lee, Young, Rainbow, 2023. Proceedings of the Royal Society B). Further refinement of this approach aims to not only illuminate the evolutionary history of the human shoulder and its relation to changes in locomotion (see Williams et al., 2023; Young, 2023), but how function has changed over time. This may lead to compromises that affect performance and disability in living humans.

Additional collaborative research, particularly with the University of Calgary, is focused on characterizing development of the face and primary palate and the role of the brain in orchestrating normal and abnormal outcomes (e.g., see Richbourg et al., in press). Current focus of this research builds off of extensive developmental data generated from the lab's previous funding, R56DE029124, A Predictive Developmental Morphospace Model of Cleft Lip. This is the basis for an R01 grant submission in collaboration with Ralph Marcucio (OTI) entitled "Illuminating the Role of Brain-Face Interactions in Cranial Development" and served as preliminary data for postdoc Zuzana Vavrusova's, PhD, successfully funded F32 grant.

Papers

Lee ECS, Young NM, Rainbow MJ. 2023. A comparative approach for characterizing the relationship among morphology, range-of-motion, and locomotor behaviour in the primate shoulder. Proceedings of the Royal Society: Part B Biological Sciences 290(2009): 20231446.

Williams SA, Russo GA, Prang TC, Young NM, Gebo DL. 2023. African apes and the evolutionary history of orthogrady and bipedalism. Yearbook of Biological Anthropology, 181(S76): 58-80.

Hallgrímsson B, Aponte JD, Vidal-Garcia M, Richbourg H, Green R, Young NM, Cheverud JM, Calof AL, Lander AD, Marcucio RS. 2023. The Developmental Basis for Evolvability. In: Evolvability: A Unifying Concept in Evolutionary Biology (DH Thomas, TF Hansen, M Pavlicev, C Pélabon, editors), pp.171-198. Boston, MA: The MIT Press.

Richbourg HA, Vidal-Garcia M, Brakora KA, Devine J, Takenaka R, Young NM, Gong S-G, Neves A, Hallgrímsson B, Marcucio RS. in press. Dosage-Dependent Effects of FGFR2W290R Mutation on Craniofacial Shape and Cellular Dynamics of the Basicranial Synchondroses. Anatomical Record.

Additional Highlights

Seminar: Journeys through Morphospace: Explorations in Development and Evolution. New York University, Center for the Study of Human Origins (CSHO). Sep. 28, 2023.

Young NM. 2023. Hominoid shoulder ancestral states and evolutionary rates estimated from chronophylomorphospace reconstruction. American Association of Biological Anthropologists.

Muscle Injury and Translational Orthopaedic Research Laboratory (MITO)

UCSF Mission Bay Campus

The Muscle Injury and Translational Orthopaedic Research Laboratory is directed by **Xuhui Liu, MD and Brian Feeley, MD.**

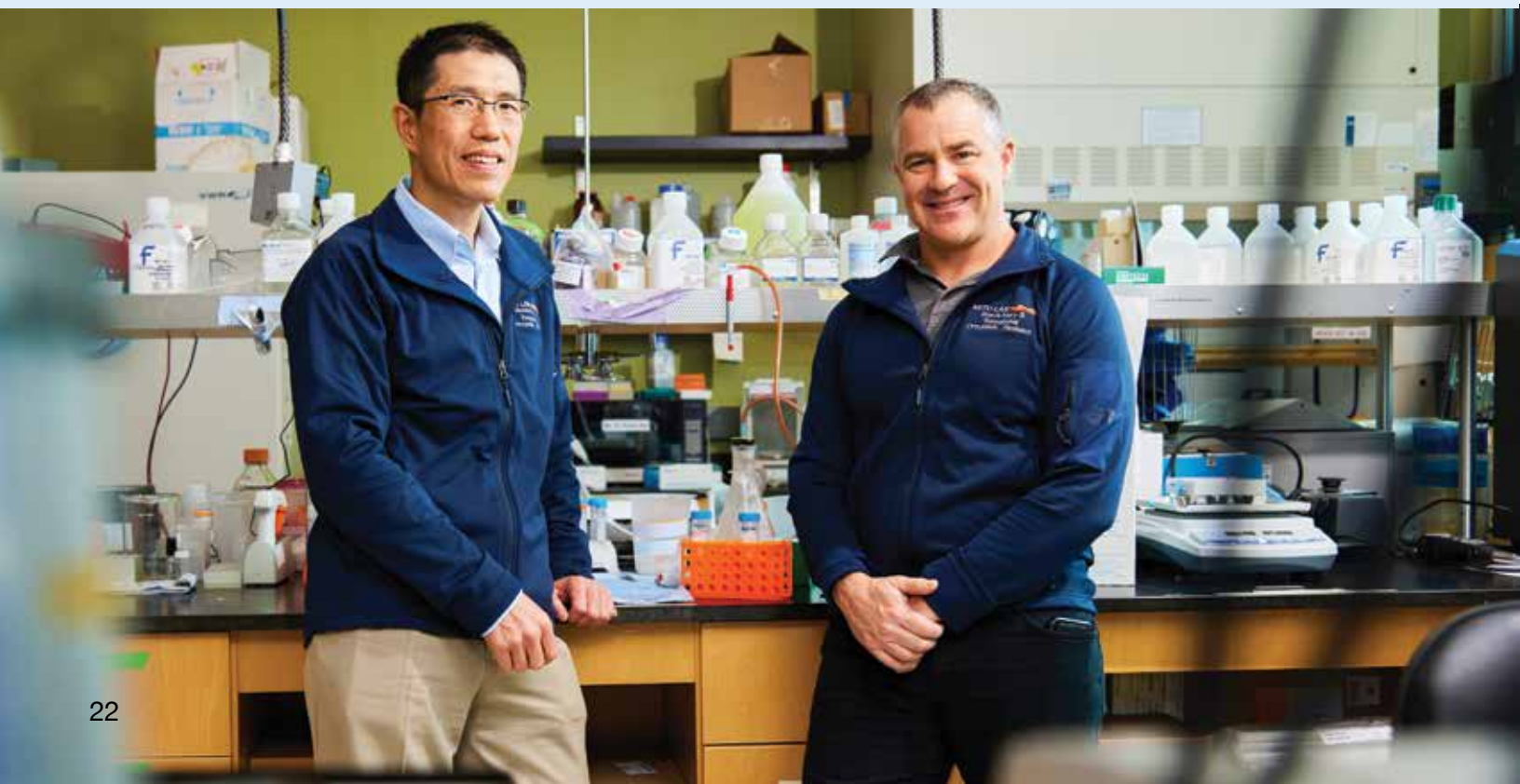
Muscle is the largest organ in the musculoskeletal system and is a dynamic organ that is critical in maintaining the health of athletes and weekend warriors. The focus of our research is to understand the cellular and molecular changes that occur within the muscle after different injuries, particularly rotator cuff tears. We have developed novel injury and repair models to study the acute and chronic effects of rotator cuff injury on the important signal transduction pathways that govern muscle cell size and stem cell fate within the muscle. We also focus on understanding how muscle injury patterns affect the stem cell populations within the muscle (satellite cells, FAP cells) in an effort to determine treatment strategies that would improve muscle function following orthopaedic injuries.

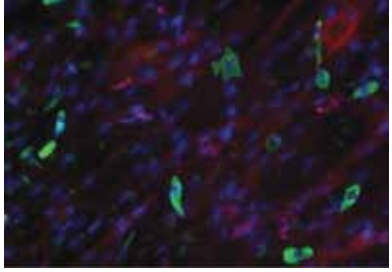
Our past research identified FAP cells as the key cellular source of fatty infiltration, which we subsequently confirmed in patients with rotator cuff tears. Then, we started to look at how FAP cells decide to remain classic, white fat or differentiate to beige fat and aid in muscle regeneration. To do so, we developed a mouse model that simulates human cuff tears and involves tiny surgeries that mimic human rotator cuff repair. Now, we are transplanting different cells and administering pharmacologic agents (medicines created for other purposes) into the mice and watching what happens. We are also evaluating exactly how beige fat promotes muscle regeneration, from the direct expression of different proteins, to the production of exosomes. Everything we've found so far suggests that we can influence FAP stem cells and increase regeneration in animal rotator cuff muscle.

We recently began clinical studies looking for FAPs (and other stem cells) and evaluating their activity in human rotator cuff tear patients. We want to know if there is a source of stem cells already within the rotator cuff muscle that can be used to help regenerate muscle after cuff repair. Early results suggest an abundant cell source already present in rotator cuffs that can be stimulated to help decrease muscle atrophy and stimulate muscle regeneration!

In 2023, Michael Davies, MD, and Hannah Chi led a research study on mitochondrial transfer in muscle stem cells, which won the AOSSM Cabaud Memorial Award. This study was the first to show muscle stem cells transferring mitochondria to surrounding myocytes. The work is the subject of a new VA Merit grant that started in November 2023. Additionally, Steven Garcia, MD, and Michael Davies led studies that were awarded several prizes at regional and national resident research competitions. David Darevsky, an MD/PhD student in the lab, published a paper in Scientific Reports showing how both mice and human patients with rotator cuff tears have similar function with a "string pull." We continue to receive support for our growing and diverse lab from the NIH, CIRM, and the VA, as well as private support.

Our goal over the next three to five years is to continue to expand our collaborations within the orthopaedic surgery department, as well as across UCSF and nationally. We are excited to work with neuroscientists, aging experts, and surgeon scientists at UCSF to improve our understanding of how cellular interactions affect outcomes across the injury and degeneration spectrum.





Stem cells found within the rotator cuff muscle can be stimulated into fibrotic tissue (red) or fat tissue (green) depending on the stimulus. (Courtesy of the UCSF Muscle Injury and Translational Orthopaedic (MITO) Laboratory)

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.

The focus of their team's research 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 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.

Laboratory for Digital Orthopaedic Biomechanics

UCSF Parnassus Heights

The Laboratory for Digital Orthopaedic Biomechanics is directed by **Jeannie F. Bailey, PhD.**

Jeannie F. Bailey, PhD, directs the Laboratory for Digital Orthopaedic Biomechanics. Her lab is part of the Musculoskeletal Research Consortium (METRiCS) bridging musculoskeletal research across Orthopaedic Surgery, Neurosurgery, and Physical Therapy. Dr. Bailey is also the director of the Physical Function and Biomechanics Research Core for an NIH Mechanistic Research Center for Phenotyping Chronic Low Back Pain in close collaboration with other UCSF Orthopaedic Surgery investigators. Her research develops 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 function and muscle health in various populations, including astronauts, low back pain patients, and orthopaedic surgery 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. While much of her basic science research is funded by the NIH and DOD, she also has numerous grants through the UCSF Innovations office to develop novel devices and digital health applications for orthopaedic patient care.

In the last year, she began her first R01 project teasing apart structure and function for paraspinal muscle health in chronic low back pain patients. She was also recognized as an Honorable Mention for the NIH HEAL Director's Trailblazer Award. In the next 3-5 years, she hopes to have established her research mobile platform for capturing remote biomechanical tests ("OrthoCAP") and have learned more about tracking multi-domain patient recovery using real-world data from smartwatches and mobile devices in effort to create patient-specific post-treatment recovery plans for improving long-term outcomes – for many MSK patient populations.

UCSF medical student Aidan Foley conducts studies in the METRiCS lab of Jeannie Bailey, PhD at 95 Kirkham in San Francisco. Dr. Bailey and her team concentrate on lumbar spinal conditions and low back pain, delving into innovative approaches for identifying clinically relevant biomechanical phenotypes and examining potential interactive mechanisms between distinct musculoskeletal pain phenotypes.

Musculoskeletal Regeneration Lab

Multi-Campus Laboratory

The Musculoskeletal Regeneration Lab is directed by **Chelsea Shields Bahney, PhD.**

The Musculoskeletal Regeneration Lab, led by Chelsea Shields Bahney, PhD, focuses on developing translationally relevant therapies or diagnostics to improve musculoskeletal health, primarily endochondral ossification. Their research combines engineering and biology to improve tissue regeneration in systems disrupted by injury or age.

The lab conducts high-impact research published in top journals, with over 50 peer-reviewed publications and Google Scholar reporting over 2,600 citations as of the start of 2024. Additionally, its translational research focus has generated 18 patents and patent applications and an NIH/CIRM-funded startup company. Given its cross-disciplinary approach, the Musculoskeletal Regeneration Lab employs team science to address unmet clinical needs, forming partnerships within the Department of Orthopaedics, other UCSF departments, and across research institutes, resulting in diverse publications in 2023.

Their research priorities include developing novel therapeutics to accelerate fracture repair, defining biomarkers of fracture healing for use in clinical trials, measuring and modulating pain during fracture repair, and understanding the role of immunosenescence in fracture healing.

Dr. Bahney's expertise in fracture repair and tissue engineering has led to multiple national and international leadership positions. She has served on various committees and boards, including the Advocacy Committee at the Orthopaedic Research Society, the International Section of Fracture Repair, and the boards of the Tissue Engineering and Regenerative Medicine International Society, the Orthopaedic Trauma Association, and the AO Foundation Craniomaxillofacial R&D Commission. Additionally, she serves as an associate editor for the Journal of Tissue Engineering and Regenerative Medicine.

Laboratory for Digital and Computational Health Science

Multi-Campus Laboratory

The Laboratory for Digital and Computation Health Sciene is directed by **Thomas Peterson, PhD.**

Thomas Peterson, PhD, leads projects at UCSF's Bakar Computational Health Sciences Institute and the REACH Analytics Core, aiming to blend technology and healthcare. His team collaborates with UCSF clinicians, utilizing clinical trials and Electronic Health Records for research. Their focus is on merging technology with clinical expertise to enhance patient care. Recently, they developed a groundbreaking Large Language Model (LLM) for extracting social determinants of health from clinical notes, with implications for orthopaedic care. They've also published predictive models for patient outcomes after spinal fusion surgery, surpassing traditional predictors. Peterson's team, part of the NIH HEAL BACPAC initiative at UCSF REACH, is researching chronic low back pain, emphasizing opioid addiction reduction. Future plans involve developing statistical and machine learning models for orthopaedic care. Collaborative research includes publications in Spine, Spine Deformity, and the International Journal of Spine Surgery.

Clinical Research

In 2023, the UCSF Department of Orthopaedic Surgery continued to advance clinical research initiatives across our subspecialties. Our research endeavors yielded numerous publications, meeting presentations, and awarded grants. The following section will highlight programs from each of our subspecialty sections.

Arthritis and Joint Replacement

One of the primary research focuses of the Arthritis and Joint Replacement Division has been in the field of periprosthetic joint infection (PJI). In the area of diagnosis, we are doing collaborative work with faculty from the Infectious Disease and Radiology departments to help identify novel ways to diagnose PJI using nuclear medicine imaging techniques. The hope is that these 3D scans will be a sensitive and specific future tool in our diagnostic armamentarium and can be used to help locate the areas of highest bioburden to guide surgical debridement. In the area of treatment, we are looking at improving outcomes of two-stage exchange arthroplasty by optimizing the choice of antibiotic spacer and have collaborated in a multicenter PRCT evaluating the one-stage exchange arthroplasty.

Another major research focus has been the adoption of technology to improve the personalization of our surgical procedures. We have done previous studies on the use of wearable sensors to collect data on mobility, kinetics, and kinematics and are currently utilizing robotics in the operating room. Stefano Bini, MD and several department colleagues concluded a two-year project that was funded by Google. They have submitted a groundbreaking article (expected publication is early 2024) that brings closer the possibility that we will use wearable motion sensors to recreate the complex gait analyses we perform in a gait lab beyond temporospatial variables. We were able to replicate both kinematic and kinetic data (the latter without a force plate). As part of the Google project, Dr. Bini also started to work with the Consumer Trade Association to create standards for IMU sensors to be used in medical motion tracking. This basic step, once implemented, will unlock the power of artificial intelligence (AI) and mobility by making AI independent of hardware. With the sensor standards in place, along with the proof-of-concept work done around sensors, Dr. Bini plans to lead a consortium of researchers and companies to create a global measure of human mobility to track and measure the impact of various interventions in health care (pharma, surgery, social interventions, for example). Such a metric could, in time, be used to measure the impact of the one-fifth of US gross domestic product spent on health care. This is a massive undertaking, and Dr Bini is seeking a $10 million to $20 million ARPA-H grant to drive this research to UCSF and build on the work already done with BACPAC.

Another important topic our division has been studying is the impact of socioeconomic factors on access and outcomes following joint replacement surgery. One recent group of projects looked at the impact that English as a first language had on perioperative outcomes and complications in our Asian and Hispanic populations. We have also studied whether the differences seen in TJA outcomes of non-white patients following primary joint replacement holds true in the revision setting.

Grants and Awards

Dr. Bini and several department colleagues concluded a two-year project that was funded by Google. They have submitted a groundbreaking article (expected publication is early 2024) that brings closer the possibility that we will use wearable motion sensors to recreate the complex gait analyses we perform in a gait lab beyond temporospatial variables. We were able to replicate both kinematic and kinetic data (the latter without a force plate).

Papers

Imaging joint infections using D-methyl- 11C-methionine PET/MRI: initial experience in humans. European Journal of Nuclear Medicine and Molecular Imaging. 2022 Sep; 49 (11): 2761-3771.

Comparison of Static and Articulating Spacers after Periprosthetic Joint Infection. Journal of the American Academy of Orthopaedic Surgeons Global Research and Reviews. 2023 Feb 01; 7(2)

The Microbiome of Osteoarthritic Hip and Knee Joints: A Prospective Multicenter Investigation. Journal of Bone and Joint Surgery. 2023 May 16. PMID: 37192280

Comparison Between Orthopaedic Trauma versus Arthroplasty Fellowship Training on Outcomes of Total Hip Arthroplasty for Femoral Neck Fractures. Journal of Arthroplasty. 2023 Jul 38 (7S): S72-77.

Why Personalized Surgery is the Future of Hip and Knee Arthroplasty: A Statement from the Personalized Arthroplasty Society. EFORT Open Rev 2023 Dec 1; 8(12): 874-882.

We are planning to utilize the PROMs collected via CODE technology to assess differences in outcomes of revision hip and knee surgery based on indication.

Lawrence Lam, PA, left, and Jardena Garner-Phu, PA, orthopaedic physician assistants, rebandage a wound for Melanee Wyatt in the Acute Care unit, at UCSF Mount Zion Medical Center. The Arthritis and Joint Replacement Division leads patient-centered clinical research, striving to enhance outcomes and quality of life.

Foot and Ankle

The Foot and Ankle division is actively engaged in numerous past and ongoing projects, with a particular focus on post-traumatic arthritis and Achilles ruptures. Notably, Achilles ruptures have become more prevalent in the aging population, paralleling the rise in an increasingly active senior demographic. Research exploring clinical, functional, and cellular outcomes will play a pivotal role in determining optimal treatment strategies for these patients.

Upcoming projects

The foot and ankle service has started a collaboration with the Muscle Injury and Translational Orthopaedic (MITO) Research Lab to evaluate geriatric Achilles ruptures and differences in gastrocnemius and soleus muscle tissue and tendon characteristics.

Hand, Elbow and Upper Extremity

The hand and upper extremity division has multiple past and on-going projects including those with a focus on healthcare disparities, biomechanical studies, and big data studies. Noteworthy publications include those focusing on the intersection of healthcare disparities and patient reported outcomes.

We have two grants from the American Foundation for Surgery of the Hand to study 1) the biomechanical properties of metacarpal fracture fixation and 2) disparities in access to care for distal radius fractures

Ongoing clinical trials

We have studies ongoing that evaluate the association of health literacy and outcomes of patients with distal radius fractures and those with carpal tunnel syndrome. We have another study evaluating the association of health literacy and shared decision making and decisional conflict. We have a series of big data studies evaluating the association of race, insurance status, area deprivation index on patients with a variety of upper extremity conditions (e.g. distal radius, proximal humerus).

Upcoming projects

We have a series of upcoming studies that evaluates the linguistic and cultural competency of commonly utilized patient reported outcome measures that we will be conducting domestically and abroad.

Papers

Lemos J, Xiao M, Castro Appiani LM, Katz P, Kamal RN, Shapiro LM. Are Patient-Reported Outcome Measures for Distal Radius Fractures Validated for Spanish Language and Culture? A Systematic Review. J Hand Surg Am. 2023;S0363-5023(23)00168-5.

Tankersley MP, Zhuang T, Julian K, Fernandez A, Kamal RN, Shapiro LM. Disparities in Treatment of Closed Distal Radius Fractures in Patients Aged 18-64 Years and ≥65 Years by Insurance Type. J Hand Surg Am. 2023;S0363-5023(23)00119-3.

Halvorson RT, Lalchandani GR, Cherches MF, Petit LM, Lattanza L, Lee NH, Kandemir U. Interobserver and Intraobserver Reliability of Classification Systems for Radiographic Complications After Radial Head Arthroplasty. J Hand Surg Am. 2023;48(5):513.e1-513.e8.

Equitable Integration of Patient Reported Outcomes into Clinical Practice – Opportunities, Challenges, and a Roadmap for Implementation. Journal of the American Academy of Orthopaedic Surgeons. 2023. In Press.

Truong NM, Stroud SG, Zhuang T Fernandez A, Kamal RN, Shapiro LM. Social Determinants of Health are Associated with Increased Postoperative Complications Following Distal Radius Fracture Surgical Fixation. J Hand Surg Am. 2023 In Press

Orthopaedic Oncology

Our group's main research focuses over the past year have been:

Long-term outcomes of endoprosthetic reconstruction using compressive osseointegration. We established a multicenter group to establish a shared database, including patients treated with compressive osseointegration, titled FORCE. The group includes UCSF, Stanford, UC Davis, OHSU, and Kaiser. We published one multicenter study looking at our outcomes with expandable distal femur Compress endoprosthesis for primary sarcomas in the pediatric population. We have submitted two other manuscripts this past year. One centers on the proximal tibia hemiarthroplasty, and the second on all proximal tibia Compress endoprostheses. Our group also presented our results on differences in short versus long spindles at the MSTS annual meeting.

Sarcoma immunotherapy. We continue to work with the BIOS tissue bank to collect sarcoma tissue. We have started early work with Camille Sullivan and our thoracic oncology group to compare the tumor immune microenvironment between primary and lung metastatic chondrosarcoma.

Disparity research. We worked with an MS1 student through the Heiman grant to evaluate the experience of hijab-wearing medical students when they rotate in the operating room. Our abstract was accepted at the Association of Surgical Education annual meeting.

Camille Sullivan's OREF grant will be used to explore the difference in TIME between primary extremity and metastatic chondrosarcoma.

Collaborative group FORCE., as mentioned above. We have quarterly meetings and continue to optimize data collection and cleaning.

This year we hope to begin data collection for the chondrosarcoma immunotherapy project.

As a smaller project within the larger chondrosarcoma project, we plan to evaluate the extremity and lung metastatic chondrosarcoma samples for tertiary lymphoid structures and B-cell signatures. The role of B-cells in the host immune response to sarcomas has only recently been described in soft tissue sarcomas, but it has not been investigated for chondrosarcoma.

Celebrating the remarkable career of Dr. Richard O'Donnell (Happy retirement!)

The UCSF Department of Orthopaedic Surgery announces the retirement of Dr. Richard J. O'Donnell, MD, a distinguished colleague who has been integral to the Oncology Division for two decades. Dr. O'Donnell's commitment to patient care, clinical research, and pioneering work in osseointegration, along with his leadership and mentoring, have made a lasting impact.

Dr. O'Donnell has held pivotal roles in our department for 20 years. As chief of Orthopaedic Oncology and founder of the Orthopaedic Surgical Osseointegration Society (OSOS), he has advocated for advanced endoprosthetic systems, driving research in osseointegration and implant durability.

Dr. O'Donnell directed UCSF's Musculoskeletal Research Consortium (METRiCS) and the International Center for Osseointegration Research, Education, and Surgery (iCORES). In this role, he was instrumental in bringing percutaneous bone-anchored prostheses to the United States. He contributed to the U.S. Department of Defense Osseointegration Program and aided amputees at Walter Reed National Military Medical Center. As Dr. O'Donnell retires, his legacy of innovation and dedication to improving musculoskeletal health will endure. Thank you, Dr. O'Donnell!

Papers

Tanaka, Kara S., et al. Survival and failure modes of the Compress® spindle and expandable distal femur endoprosthesis among pediatric patients: A multi-institutional study. Journal of Surgical Oncology 127.1 (2023): 148-158.

Jackson, Kristopher J., et al. Surgical site infection is not associated with 1-year progression-free survival after endoprosthetic reconstruction for lower-extremity osteosarcoma: a secondary analysis of PARITY Study data. Journal of Bone and Joint Surgery. 105.Suppl 1 (2023): 49-56.

Schott, Courtney R., et al. Osteosarcoma PDX-Derived Cell Line Models for Preclinical Drug Evaluation Demonstrate Metastasis Inhibition by Dinaciclib through a Genome-Targeted Approach. Clinical Cancer Research (2023): OF1-OF16.

Boone, Sean L., et al. Botryomycosis: a rare mimic of sarcoma as an initial presentation of acquired immunodeficiency syndrome. Skeletal Radiology (2023): 1-6.

Niu, Isabella, et al. A Case of Hypercalcemia from PTHrP-Producing Fibromyxoid Sarcoma Responsive to Glucocorticoid Therapy. Calcified Tissue International (2023): 1-8.

Papers

"Prosthesis preferences for those with upper limb loss: Discrete choice study of PULLTY for use in regulatory decisions" — Journal of Rehabilitation and Assistive Technologies Engineering, Jan. 20, 2023

"Racial Affinity Group Caucusing in Medical Education — A Key Supplement to Antiracism Curricula" — The New England Journal of Medicine, April 27, 2023

"Integrating Discussions on Racism and Health Equity into Clinical Reasoning Conference" — Academic Pediatrics, Aug. 9, 2023

Orthotics and Prosthetics

The UCSF Orthotics and Prosthetics research division seeks to develop stronger evidence for clinical decision-making in the treatment of orthotic and prosthetic patients around the globe. O&P focus on research that can be directly implemented into practice and incorporates assessment of how patients use their devices in daily life beyond the clinic.

The Orthotics and Prosthetics Center (OPC) currently has a total of approximately 15 research protocols approved by UCSF's Institutional Review Board (IRB), including pediatric and adult orthotic and prosthetic device users. Our prosthetic projects investigate amputee care locally and globally. They have continued to develop multiple projects that seek to improve outcomes for amputees, such as the Amputee Safe Smart Implant Sensor Technology study (ASSIST), which is designed to use sensors to better understand the kinematic movement patterns of patients living with amputation. Additionally, the Physical Rehabilitation Optimization and Patient Education for Life project (PROPEL) is using a multidisciplinary approach to create a customizable algorithm of exercises to help patients with unilateral transtibial and transfemoral amputation reach their physical goals. Lastly, in a joint project with San Jose State University, O&P are quantifying how biofeedback training impacts functional outcomes in above-knee prosthesis users.

Ongoing clinical trials

In addition to the projects listed above, the orthotic projects center around assessing the efficacy and impact of devices on the everyday lives of users. In a study using UCSF's pectus carinatum orthosis, they used pressure and temperature sensors to collect data on patients to determine the ideal treatment criteria. This study is now closed to accrual, and publication is in the works. O&P team have continued on with a study looking at how osteoarthritis knee orthoses impact patients' activity and pain outside of the clinical environment. Lastly, they are actively studying a cranial helmet treatment equation for babies diagnosed with plagiocephaly or brachycephaly. The standard treatment for babies with this diagnosis is a cranial remolding orthosis (CRO). This retrospective chart review is investigating the impact of treatment parameters, such as age and cranial deformity on CRO efficacy.

Heidi Truman, an ABC-certified Orthotist/Prosthetist specializing in pediatrics, offers her expertise in assisting a pediatric patient. Emphasizing family-focused care, the Division of Pediatric Orthopaedics develops clinical research projects that focus on clinical care, global health, public policy and technology.

Pediatric Orthopaedics

Pediatric Orthopaedic Clinical Research

Led by surgeons Dr.s 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.

The clinical research conducted by the pediatric orthopaedic faculty in the past year encompasses a broad spectrum of musculoskeletal conditions. Themes we focused on included adolescent idiopathic scoliosis, pediatric sports medicine, osteonecrosis of the femoral head, effective pain management strategies for young patients following surgical correction of spinal deformities, mental health and wellness in pediatric patients, and evaluating different patient-reported outcome scores in children with lower limb deformities.

The ongoing studies led by various team members cover a diverse range of topics, including prospective clinical studies for slipped capital femoral epiphysis (SCFE) and pediatric spine and lower limb deformities, and investigations into bullying amongst pediatric orthopaedic patients. Upcoming studies focus on evaluating long-term outcomes in understanding the experiences of families and social stigma in clubfoot and lower limb differences, and comparing short-leg versus long-leg casting for growth plate fractures around the ankle. These studies collectively contribute to the advancement of knowledge in pediatric orthopaedics and provide a foundation for evidence-based practices.

Papers

Siu JW, Chan C, Swarup I, Sabatini CS. Rate of Refracture After Removal of Hardware in Pediatric Femur Fractures. Journal Pediatric Orthopaedics. 2023 Sep 1;43(8):e674-e679. doi: 10.1097/BPO.0000000000002454. Epub 2023 Jun 19. PMID: 37340662.

Ramirez FD, Chang CJ, Watkins RA, Senter C, de Borja C. Primary Care Sports Medicine fellowship opportunities for Pediatrics-trained physicians in the United States. The Physician and Sportsmedicine. 2023 Feb;51(1):73-81. doi: 10.1080/00913847.2021.1996864. Epub 2021 Oct 28. PMID: 34674595.

Pennock AT, Bastrom TP, Boutelle KE, Carroll AN, Edmonds EW, Nepple JJ, Polinsky SG, Spence DD, Perkins C, Willimon SC, Bae DS, Busch MT, Ellis HB, Hergott K, Kocher MS, Li Y, Pandya NK, Sabatini CS, Wilson PL; FACTS Study Group; Heyworth BE. Bony Remodeling of Adolescent Displaced Clavicle Fractures: A FACTS Study. American Journal of Sports Medicine. 2023 Mar;51(4):871-876. doi:10.1177/03635465231152884. Epub 2023 Feb 20. Erratum in: Am J Sports Med. 2023 Apr 11;:3635465231168388. PMID: 36802767.

Soriano KKJ, Sabatini CS, Brar RK, Jagodzinski JE, Livingston KS. New Injury Patterns in Pediatric Supracondylar Fractures During COVID-19: Beds Are the New Monkey Bars. Journal Pediatric Orthopaedics. 2023 Apr 1;43(4):198-203. doi:10.1097/BPO.0000000000002350. Epub 2023 Jan 23. PMID: 36662751; PMCID:PMC9981246.

Pediatric Orthopaedics

In summary, our research team is actively engaged in addressing critical questions related to preoperative expectations, treatment outcomes, pain management, and psychosocial aspects of a diverse group of pediatric orthopaedic conditions. Their work spans from scoliosis and osteonecrosis of the femoral head to clavicle fractures and limb deformities. This research demonstrates a commitment to addressing a wide array of clinical and psychosocial aspects in pediatric orthopaedics, showcasing a comprehensive and patient-centered research agenda.

Grants and Awards

Scoliosis Research Society Grant, Young Investigator Award: Preoperative Patient Expectations in Patients with Adolescent Idiopathic Scoliosis. Dr. Ishaan Swarup

NOVA Grant: Osteonecrosis of the Femoral Head (ONFH) Outcomes After Core Decompression. Dr. Ishaan Swarup

NOVA Grant: Conditioning + Open-label Placebo for the Management of Pain in Children Who Undergo Surgical Treatment of Idiopathic Scoliosis. Dr. Mohammad Diab (lead), Dr. Ishaan Swarup, and Dr. Lionel Metz

Hank Chamber Award for Best Scientific Presentation: Mental Health and Wellness at the PRISM national meeting. Dr. Nirav Pandya

Ongoing clinical trials, research studies, including registries

SCFE Longitudinal International Prospective Registry (SLIP)
Investigators: Dr. Ishaan Swarup (lead investigator), Dr. Jason Jagodzinski
The registry includes initiation of a study examining patients' conditions prior to surgery and their long-term outcomes across participating multiple centers. It will provide valuable insight into the treatment and management of this condition.

Prospective, Multi-Center Adolescent Clavicle Shaft Fracture Registry (FACTS).
Investigators: Dr. Nirav Pandya, Dr. Coleen Sabatini
This study focuses on the long-term outcomes of surgical and non-surgical approaches to clavicle shaft fracture management and may help to establish guidelines and understand the best treatment options for adolescents with clavicle shaft fractures.

The Pediatric Spine Registry Study (PSSG)
Investigators: Dr. Ishaan Swarup (lead investigator), Dr. Mohammad Diab, Dr. Lionel Metz
This registry will serve as a hypothesis-generating database of prospectively collected outcomes. It will facilitate the development of targeted, hypothesis-testing randomized controlled trials and observational studies that can be housed within the larger registry.

Assessing the Prevalence of Bullying in Pediatric Orthopaedic Patients.
Investigators: Dr. Coleen Sabatini, Dr. Celina De Borja, Dr. Sanjeev Sabharwal, Dr. Ishaan Swarup
This study aims to determine the prevalence of bullying in a population of adolescents under the care of a pediatric orthopaedist. The focus is on children using orthopaedic devices or various assistive devices and children with chronic disabilities. We plan to determine if assistive devices (walkers/wheelchairs/crutches), braces, casts, or external fixators were associated with an increased risk of bullying as well as determine a link between bullying and musculoskeletal conditions.

Development of a new patient-reported outcome measure for children with lower limb deformities – Field Testing of LIMB-Q Kids.
Investigator: Dr. Sanjeev Sabharwal
This is a prospective study that will involve the completion of the LIMB-Q Kids outcome measure by children with lower limb deformities at various sites. The aim is to field test LIMB-Q Kids in an international heterogeneous population of pediatric patients.

The Pediatric ALL Evaluation and Trial (PALLET): A Randomized, Controlled Trial.
Investigator: Dr. Nirav Pandya
This study is a multi-center, unblinded, randomized controlled trial with longitudinal data collection. The purpose is to investigate whether adding anterolateral ligament reconstruction to anterior cruciate ligament (ACL) reconstruction in children will result in a lower rate of ACL re-tear than just ACL reconstruction alone.

International Legg-Calvé-Perthes Study Group (IPSG).
Site Investigator: Dr. Ishaan Swarup
This study will establish a database of prospectively identified patients with Legg-Calvé-Perthes disease and collect information regarding their presentation, treatment, and outcomes while receiving currently available treatments.

Children's Orthopaedic Trauma and Infection Consortium for Evidence-based Studies (CORTICES).
Site Investigators: Dr. Ishaan Swarup, Dr. Jaclyn Hill
CORTICES is a collaboration of pediatric orthopaedic surgeons dedicated to improving the quality, safety, and value in the management of emergent orthopaedic conditions (trauma and infection). This registry seeks to investigate the effects of pediatric orthopaedic trauma-related injuries and musculoskeletal infections, using the collaborative efforts of multi-center principal investigators, and to advance evidence-based pediatric orthopaedics.

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 multi-center pin site infection database. The study aims to determine the rate of pin site infections and compare the rates across participating surgical practices. It also seeks to document the factors affecting the rate of pin site infections across participating surgical practices and to compare methods of pin site care across participating surgical practices.

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Psychometric properties of the Gait Outcomes Assessment List for children with Limb Deformities (GOAL-LD).
Investigator: Dr. Sanjeev Sabharwal
The primary goal of limb-length equalization and deformity correction is the improvement of patients' gait and function, as well as pain and, hence, their quality of life. To the best of our knowledge, there is no (validated) specialized tool for assessing the physical and psychosocial function of children with lower limb abnormalities pre- and/or post-operatively, despite improved function being a major aim of surgery.

Special upcoming projects

A Multi-center Study Group for Pediatric Limb Deformity (CHILD STUDY).
Investigator: Dr. Sanjeev Sabharwal
This multi-center study will evaluate the long-term clinical, radiographic, and functional outcomes of pediatric patients with limb deformities. With prospective data collection, this study group aims to better define the appropriate indications and expected outcomes in children treated for pediatric limb deformity.

Understanding the Experience of Families and the Role of Social Stigma in Outcomes for children with clubfoot and lower limb differences.
Investigators: Dr. Coleen Sabatini, Dr. Sanjeev Sabharwal
The aim of this study is to understand the experience and stigmas associated with a pediatric clubfoot or other lower limb difference diagnoses through interviews with parents of pediatric patients. These interviews may help to better understand what questions parents have, their experience in terms of how they are treated when they have a child with a lower limb disability, and what resources they would benefit from having.

Short-leg versus long-leg casting for physeal ankle fractures.
Investigator: Dr. Ishaan Swarup
This is a prospective, observational, cohort study evaluating clinical, radiographic, and satisfaction outcomes in pediatric patients treated with either short-leg or long-leg casts for physeal ankle fractures. The study will investigate rates of displacement that are currently unknown to appropriately power future prospective studies on clinical outcomes comparing these two methods of non-operative cast treatment.

Physician Assistant Alex Giraldi (left) and Dr. Sanjeev Sabharwal (right) participate in the annual UCSF Limb Differences Family Picnic in Walnut Creek. Research on pediatric limb differences is a primary focus within the Division of Pediatric Orthopaedics.

Spine

UCSF's Spine Service continues to demonstrate excellence in research throughout 2023. Our spine surgeons at UCSF have authored over 500 peer-reviewed articles, and numerous textbooks and chapters demonstrating their expertise and commitment to advancing the field. In the past five years, UCSF Spine surgeons and scientists have received recognition for multiple major spine society awards in clinical and basic science research, including the Hibbs Awards, Harrington Award, the Henry Farfan award, the ISSLS prize, and the Whitecloud Award. These achievements underscore UCSF's Spine Service as a leading research center in the field of spine surgery.

Below are highlighted research initiatives from 2023

Prospective Evaluation of Elderly Deformity Surgeries (PEEDS) Study

Sponsor: AO Foundation

As the population ages, spinal deformity surgery for older patients is becoming more prevalent. However, the suitability of these patients for major spinal reconstruction procedures and the associated risks and benefits are still under investigation. An international multicenter study aimed to determine the value of surgery in spinal deformity patients aged 60 or older, using the Scoliosis Research Society-22r Questionnaire (SRS-22r) as the primary outcome measurement tool, as well as other secondary outcome measures including the Oswestry Disability Index (ODI), a numeric rating scale for pain (NRS), EQ-5D, and animal fluency test

Spinal Deformity Intraoperative Monitoring (SDIM) Study

Sponsor: AO Foundation

Multimodality monitoring is crucial in osteotomy procedures to prevent neurological injury and ensure successful outcomes. This international multicenter study aims to collect real-time data and identify contributing factors associated with intraoperative neuromonitoring changes during spinal surgeries. The data will help fill current knowledge gaps and educate spinal surgeons on how to recognize relevant changes and take appropriate actions to mitigate risks during complex spinal surgeries.

Below 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

Sponsor: Empirical Spine, Inc

The standard surgical option for degenerative spondylolisthesis is decompression with instrumented fusion, but implantation of a paraspinous tension band could provide additional benefits. This multi-center clinical study aims to compare the clinical outcomes of patients with lumbar degenerative spondylolisthesis and stenosis treated with decompression and the LimiFlex™ Paraspinous Tension Band to those treated with decompression and transforaminal lumbar interbody fusion (TLIF) with concomitant posterolateral fusion (PLF) and pedicle screw instrumentation, which is the current surgical standard. The tension band may offer a biomechanical advantage by preventing excessive postoperative flexion and increasing facet engagement.

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

Sponsor: NSF, CDMI

The use of point-of-care technology to assess bone density and paraspinous muscle characteristics in reconstructive spine surgery could improve outcomes by facilitating precise, data-driven, and individualized surgical decisions. The Radiofrequency Echographic Multi Spectrometry (REMS) technology allows for direct, non-ionizing measurement of bone mineral density and is portable, allowing for screening at the point of care. The study aims to compare the efficiency of REMS in assessing bone quality between radiology technicians and trained health professionals, identify the relationship between pre-operative REMS-based bone density and muscle quality with health status metrics, assess lumbar paraspinous musculature, and evaluate the time and cost of obtaining BMD using REMS compared to conventional DEXA techniques.

Validating a Novel UCSF Classification to Guide Degenerative Spondylolisthesis Treatment

Sponsor: Heiman Grant, UCSF School of Medicine Summer Explore Grant

The study aims to evaluate the UCSF Degenerative Spondylolisthesis Classification to establish a standard approach to treating DS. The classification criteria are location of spinal stenosis, global spinal alignment, leg and back pain, and segmental translation. The study has two purposes: to validate the classification and to demonstrate that consistent surgical techniques based on the classification's recommendations improve clinical outcomes. The study will use 10 cases evaluated by eight surgeons to evaluate interobserver and intraobserver variability, and a retrospective study of consecutive DS cases treated at the UCSF Medical Center between 2016 and 2020 to assess appropriate surgical strategies based on the classification and their impact on clinical outcomes.

Opiate in Spine Surgery:

Sponsor: Hellman Student Research Grant

Opiate utilization is an important predictor of perioperative outcomes in spine surgery. Social determinants of health are a predictor of preoperative opiate utilization. Preoperative opiate utilization is an important predictor of opiate consumption at 1 year after surgery. The development of policies for the appropriate prescription of opiates is an important priority for our spine service.

Predictive Models for Length of Stay and Discharge Disposition in Elective Spine Surgery: Development, Validation, and Comparison to the ACS NSQIP Risk Calculator

Sponsor: UCSF-CTSI Grant

This retrospective study aimed to predict hospital length of stay (LOS) and discharge disposition following adult elective spine surgery using machine learning and compare it with the ACS NSQIP prediction calculator. The study included 3678 adult patients undergoing elective spine surgery between 2014 and 2019, and predictive variables included demographics, surgical invasiveness, comorbidities, and more. Regression, classification trees, and LASSO were used to build predictive models, and the performance was evaluated using validation on 16% of patients and comparing it to the ACS NSQIP online risk calculator. The developed predictive models exhibited superior performance in predicting length of stay compared to the NSQIP and similarly for discharge location

Preoperative optimization in spine surgery

A systematic review to determine the level of evidence to support specific preoperative optimization protocols for spine surgery. Identification of risk factors for perioperative complications is useful to identify opportunities for preoperative optimization and for reducing complication rates. Preoperative optimization is an important priority in payment reform program and risk sharing healthcare economic models, including bundled payments and accountable care organizations. The purpose of this study is to provide a state of the art review of the literature on risk factors for complications in adult deformity surgery, and to guide an evidence-based approach to preoperative protocols.

Our non-operative spine team includes: Sibel Deviren, MD, Patricia Zheng, MD, Conor O'Neill, MD, Peter I-Kung Wu, MD, PhD, and Lyndly Tamura, MD.

Papers

CAPER: patient preferences to inform nonsurgical treatment of chronic low back pain: a discrete-choice experiment. Pain Medicine. 2023 08 01; 24(8):963-973. Wilson L, Zheng P, Ionova Y, Denham A, Yoo C, Ma Y, Greco CM, Hanmer J, Williams DA, Hassett AL, Scheffler AW, Valone F, Mehling W, Berven S, Lotz J, O'Neill C. PMID: 36975607.

Huie JR, Vashisht R, Galivanche A, Hadjadj C, Morshed S, Butte AJ, Ferguson AR, O'Neill C. Toward a causal model of chronic back pain: Challenges and opportunities. Frontiers in Computational Neuroscience. 2023 Jan 11;16:1017412. doi:10.3389/fncom.2022.1017412. PMID: 36714527; PMCID: PMC9874096.

Habib M, Hussien S, Jeon O, Lotz JC, Wu PI, Alsberg E, Fields AJ. Intradiscal Treatment of the Cartilage Endplate for Improving Solute Transport and Disc Nutrition. Frontiers in Bioengineering and Biotechnology. 2023 Feb 27;11:1111356. PMID: 36923455; PMCID: PMC10008947

The Back Pain Consortium (BACPAC) Research Program: Structure, Research Priorities, and Methods. Pain Med. 2023 08 04; 24(Suppl 1):S3-S12. Mauck MC, Lotz J, Psioda MA, Carey TS, Clauw DJ, Majumdar S, Marras WS, Vo N, Aylward A, Hoffmeyer A, Zheng P, Ivanova A, McCumber M, Carson C, Anstrom KJ, Bowden AE, Dalton D, Derr L, Dufour J, Fields AJ, Fritz J, Hassett AL, Harte SE, Hue TF, Krug R, Loggia ML, Mageswaran P, McLean SA, Mitchell UH, O'Neill C, Pedoia V, Quirk DA, Rhon DI, Rieke V, Shah L, Sowa G, Spiegel B, Wasan AD, Wey HM, LaVange L. PMID: 36622041; PMCID: PMC10403298.

Bonnheim NB, Lazar AA, Kumar A, Akkaya Z, Zhou J, Guo X, O'Neill C, Link TM, Lotz JC, Krug R, Fields AJ. ISSLS Prize in Bioengineering Science 2023: Age- and sex-related differences in lumbar intervertebral disc degeneration between patients with chronic low back pain and asymptomatic controls. European Spine Journal. 2023 May;32(5):1517-1524. doi: 10.1007/s00586-023-07542-6. Epub 2023 Feb 18. PMID:36805320; PMCID: PMC10205694.

Non-Operative Spine

The primary research focus of the non-operative spine service is to advance the understanding of the biopsychosocial mechanisms of low back pain in order to develop individualized treatment algorithms. Drs. Conor O'Neill, Patricia Zheng, Peter Wu and Sibel Demir-Deviren are investigators with the UCSF Core Center for Patient-centric, Mechanistic Phenotyping in Chronic Low Back Pain (REACH). Together, they have assembled two, ongoing longitudinal cohort studies, including an innovative digital cohort. Data from these cohorts will be used to answer important questions that can improve low back pain care. In addition to the two cohort studies, members of our group have collaborated on a number of ancillary projects with other REACH investigators. These projects span a number of diverse areas, including clinical biomechanics, disc biology, imaging, patient preferences, patient education, and social determinants of health.

REACH was funded with a five-year, $30 million award in 2019 from the Back Pain Consortium (BACPAC) of the NIH HEAL Initiative and received additional funds in 2023 to continue research through 2026.

The REACH cohort studies (comeBACK and BACKHOME) will continue to collect data in 2024.

Upcoming projects

Dr. Peter I-Kung Wu and Dr. Aaron Fields will continue their collaboration on identifying mechanistic biomarkers of intradiscal biologic therapy effectiveness. Dr. Patricia Zheng's plans include introducing a mental health application into the BACKHOME digital cohort and improving back pain educational materials for non-English speaking individuals. Dr. Conor O'Neill will be collaborating with Dr. Abel Torres-Espin, a data scientist, on better understanding the underlying causes and mechanisms of low back pain by applying AI methods to analyze data from the REACH cohorts.

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, Dr. Drew Lansdown, and Dr. Stephanie Wong. The team participates in numerous clinical research initiatives and collaborates with institutions from across the country.

In 2023, the group published 95 peer-reviewed studies and received over $1,300,000 in grant funding and sponsored study funding.

The Sports Medicine and Shoulder Service group is focused on three main research areas: orthobiologics, sports-related concussion, and health disparities in sports medicine. With respect to orthobiologics, we are looking at the effects of PRP in knee osteoarthritis using proteomics. We aim to learn more about the molecular pathway by which PRP may exert its effects. This will be a randomized control trial of PRP versus saline control. With respect to sports-related concussion, we are studying the types of evaluations and treatments that patients with these injuries are provided at the time of injury and up to one year post-injury. Regarding health disparities in sports medicine, we are evaluating the relationship between the Social Vulnerability Index and high school sports participation and access to athletic trainers.

Grants and Awards

Lynne and Marc Benioff Foundation (Luke PI) March 1, 2021 – Dec. 31, 2024

PRP – Knee osteoarthritis biomarkers

UCSF Orthopedic Equipment Grant – ABX Horiba Microseries Hematology Analyzer (2 units)

Ongoing clinical trials

In our sports concussion group, we have been performing a retrospective cohort analysis of a large database to evaluate utilization trends in concussion. This project has allowed us to describe the use of referrals, imaging, and prescription medication for patients who have suffered a concussion without loss of consciousness.

For orthobiologics, we are standardizing our injection documentation so that we can create a larger registry of all our injections.

We have also began investigating health disparities in primary care sports medicine. Our first project explores the relationship between the Social Vulnerability Index on high school sports participation and access to athletic trainers.

We continue to collaborate with our colleagues at University of California, Los Angeles, investigating the role of sleep and athletic performance.

Upcoming projects

Primary sports care is looking forward to optimizing our collection of patient-reported outcomes following minimally invasive sports medicine procedures, such as joint and soft tissue injections. This will allow them to advance the study of these interventions. They hope to enroll the majority, if not all, of the PRP-KOBE in 2024.

Papers

Pasculli R, Callahan E, Wu J, Edralin N, Berrigan W. Non-operative Management and Outcomes of Femoroacetabular Impingement Syndrome. Current Reviews in Musculoskeletal Medicine. 2023 Nov;16(11):501-513. doi: 10.1007/s12178-023-09863-x. Epub 2023 Aug 31. PMID: 37650998; PMCID: PMC10587039.

Schroer AB, Ventura PB, Sucharov J, Misra R, Chui MKK, Bieri G, Horowitz AM, Smith LK, Encabo K, Tenggara I, Couthouis J, Gross JD, Chan JM, Luke A, Villeda SA. Platelet factors attenuate inflammation and rescue cognition in ageing. Nature. 2023 Aug 16. doi: 10.1038/s41586-023-06436-3. Epub ahead of print. PMID: 37587343.

Su F, Tong MW, Lansdown DA, Luke A, Ma CB, Feeley BT, Majumdar S, Zhang AL. Leukocyte-Poor Platelet-Rich Plasma Injections Improve Cartilage T1ρ and T2 and Patient-Reported Outcomes in Mild-to-Moderate Knee Osteoarthritis. Arthroscopy, Sports Medicine, and Rehabilitation. 2023 Jun; 5(3):e817-e825. PMID: 37388893.

Van Blarigan EL, Chan JM, Sanchez A, Zhang L, Winters-Stone K, Liu V, Macaire G, Panchal N, Graff RE, Tenggara I, Luke A, Simko JP, Cooperberg MR, Carroll PR, Kenfield SA. Protocol for a 4-arm randomized controlled trial testing remotely delivered exercise-only, diet-only, and exercise + diet interventions among men with prostate cancer treated with radical prostatectomy (Prostate 8-II). Contemporary Clinical Trials. 2023 02; 125:107079. PMID: 36621597

Wei RJ, Orbeta L, Hatamiya NS, Chang CJ. Nutritional Strategies for Endurance Cyclists - Periodized Nutrition, Ketogenic Diets, and Other Considerations. Current Sports Medicine Reports. 2023 Jul 1;22(7):248-254. doi: 10.1249/JSR.0000000000001085. Erratum in: Current Sports Medicine Reports. 2023 Sep 01;22(9):340. PMID: 37417661.

Dr. Drew Lansdown attends to a patient at the UCSF Orthopaedic Institute in San Francisco. He is part of the sports medicine research group, which explores diverse clinical and translational studies to optimize outcomes in sports medicine and shoulder arthroplasty. In 2023, their focus was on translational research, including studies examining outcomes of hip arthroscopy, rotator cuff repair, ACL reconstruction, and shoulder replacement. Funding from NIH, VA, CIRM, AOSSSM, private donations, and industry supports their research endeavors.

Highlighted papers from the Sports Medicine group include:

Liu M, Ng M, Phu T, Bouchareychas L, Feeley BT, Kim HT, Raffai RL, Liu X. Polarized macrophages regulate fibro/adipogenic progenitor (FAP) adipogenesis through exosomes. Stem Cell Research and Therapy. 2023 Nov 7;14(1):321. doi: 10.1186/s13287-023-03555-6. PMID: 37936229; PMCID: PMC10631219.

Hettrich CM, Magnuson JA, Baumgarten KM, Brophy RH, Kattan M; MOON Shoulder Group; Bishop JY, Bollier MJ, Bravman JT, Cvetanovich GL, Dunn WR, Feeley BT, Frank RM, Kuhn JE, Lansdown DA, Benjamin Ma C, Marx RG, McCarty EC, Neviaser AS, Ortiz SF, Seidl AJ, Smith MV, Wright RW, Zhang AL, Cronin KJ, Wolf BR. Predictors of Bone Loss in Anterior Glenohumeral Instability. American Journal of Sports Medicine. 2023 Apr;51(5):1286-1294. doi: 10.1177/03635465231160286. Epub 2023 Mar 20. PMID: 36939180.

Garcia-Lopez E, Anigwe C, Wong SE, Zhang AL, Lansdown DA. Age is predictive of higher rate of conversion to total hip arthroplasty after core decompression for osteonecrosis of the hip. Journal of Orthopaedics. 2023 Jun 12;41:79-83. doi: 10.1016/j.jor.2023.06.002. PMID: 37362960; PMCID: PMC10285448.Woolley KA, Chi H, Allahabadi S, Fluet A, Roach C, Ward DT, Wong SE. Sex-Based Differences in the Utilization of Shoulder, Hip, and Knee Arthroplasty. Journal of the American Academy of Orthopaedic Surgeons Global Research and Reviews. 2023 Aug 7;7(8):e23.00022. doi: 10.5435/JAAOSGlobal-D-23-00022. PMID: 37549367; PMCID: PMC10586858.

Su F, Tong MW, Lansdown DA, Luke A, Ma CB, Feeley BT, Majumdar S, Zhang AL. Leukocyte-Poor Platelet-Rich Plasma Injections Improve Cartilage T1ρ and T2 and Patient-Reported Outcomes in Mild-to-Moderate Knee Osteoarthritis. Arthroscopy, Sports Medicine, and Rehabilitation. 2023 May 20;5(3):e817-e825. doi: 10.1016/j.asmr.2023.04.009. PMID: 37388893; PMCID: PMC10300591.

Sports Medicine Research Group

The sports medicine research group explores a diverse set of clinical and translational research to maximize a variety of outcomes across the sports medicine and shoulder arthroplasty spectrum of injury and recovery. During 2023, the group focused on highlighting translational research, with several studies examining the outcomes of hip arthroscopy, rotator cuff repair, ACL reconstruction, and shoulder replacement. They continue to receive funding from the NIH, VA, CIRM, and the AOSSSM, as well as private donations and industry funding.

Stephanie Wong, MD, was awarded the AOSSM Young Investigator Grant in 2023 for her work in collaboration with the MITO lab evaluating the role of sex on the transcriptomic signature of patients undergoing hip arthroscopy. Michael Davies, MD, Steven Garcia, MD, Xuhui Liu, MD, Brian Feeley, MD, and Hannah Chi, a senior medical student, were awarded the AOSSM Cabaud Memorial Award for their paper entitled Defining Endogenous Mitochondrial Transfer in Muscle Following Rotator Cuff Injury.

Ongoing clinical trials

There are several ongoing research clinical trials ongoing in sports medicine. Drs. Alan Zhang and Stephanie Wong run a large prospective database on hip arthroscopy outcomes. Chairman C. Benjamin Ma, MD, is currently evaluating the long-term outcomes of shoulder arthroplasty (>10 years) in a cohort of over 2,200 patients. Drew Lansdown, MD, is currently evaluating the outcomes of ACL reconstruction and treatment with montelukast to prevent cartilage degeneration.

Upcoming projects

In 2024, several new clinical studies will begin, including Dr. Wong's AOSSM Young Investigator Award to evaluate sex-based differences in the synovial transcriptomic profile and outcomes following hip arthroscopy. Additionally, the group continues to be active participants in several multicenter studies with the MOON Shoulder Group. These include evaluating the outcomes of shoulder stabilization as it relates to bony morphology. With the upcoming addition of Michael Davies (class of 2023), we anticipate expanding the research to include translational research on muscle degeneration/regeneration and tendon biology.

Dr. Stephanie Wong examines a patient at the UCSF Orthopaedic Institute in San Francisco. Leading clinical and translational research on athletic hip injuries, the UCSF Hip Preservation Center aims to evaluate molecular factors contributing to hip pain and osteoarthritis progression in athletes. With over 1,300 patients' clinical outcomes collected, the center focuses on hip arthroscopy surgery and other research initiatives, including hamstring tears and gluteus injuries.

UCSF Hip Preservation Center

As director of the UCSF Hip Preservation Center, Alan Zhang, MD, leads clinical and translation research on athletic injuries of the hip. Working together with Stephanie Wong, MD, who was awarded a highly competitive AOSSM Young Investigator Grant this year, the team aims to assess molecular factors that lead to hip pain and osteoarthritis progression in athletes.

The Hip Preservation Center has prospectively collected clinical outcomes measurements on over 1,300 patients who have undergone hip arthroscopy surgery at UCSF and have additional clinical research initiatives in studying hamstring tears and gluteus injuries. Our specialists in open hip surgery Mohammad Diab, MD, and Ishaan Swarup, MD, are also advancing the treatment and research for children and adults with hip dysplasia.

Orthopaedic Trauma Institute Clinical Research Center

Led by Saam Morshed, MD, MPH, PhD, the Orthopaedic Trauma Institute Clinical Research Center (OTI CRC) is dedicated to designing and implementing clinical and translational studies to answer the most important questions in the care of patients with musculoskeletal injuries. In collaboration with industry, government (Department of Defense and National Institutes of Health), and professional societies (Orthopaedic Trauma Association, AO Foundation), the OTI CRC develops and coordinates clinical trials to evaluate the latest technologies and innovative treatment approaches in orthopaedic trauma. We are interested in the treatment and management of lower extremity fractures, surgical site infections, lower-limb amputations and data science that will advance the practice of trauma care.

Project Highlights

ADAPT

Do smart phone application-based guided mindfulness exercises improve patient-reported outcomes after musculoskeletal trauma?

Principal Investigator: Dr. Saam Morshed

PAAIN

The Pain Alleviation Project uses wearable devices to measure the response of orthopaedic patients to pain medications pre-operatively.

Principal Investigator: Dr. Meir Marmor

Weight Bearing

Effect of early weight bearing on rehabilitation outcomes in patients with traumatic ankle and tibial plateau fractures

Site Investigator: Dr. Saam Morshed

DIFFIR

Geriatric distal femur: Fixation versus replacement – A randomized controlled trial of acute open-reduction internal fixation (ORIF) versus distal femur replacement (DFR). Observational study.

Site Investigator: Dr. Saam Morshed

SEXTANT

Evaluation of a new strategy for protocolized antibiotic care for severe open fractures

Site Investigator: Dr. Saam Morshed

ULTRAPRESS

Development of a novel method for non-invasive diagnosis of compartment syndrome

Principal Investigator: Dr. Meir Marmor

GO-Tibia

A masked, randomized controlled trial to evaluate local gentamicin versus saline in open tibia fractures. Tanzania

Principal Co-Investigator: Dr. David Shearer

INVEST

Increasing Diversity: A study for the improvement of racial and ethnic minority participation in low back pain research

Principal Co-Investigator: Dr. Karina Del Rosario

PROTECT

Empowering chronic low back pain patients to reduce disparities.

Principal Co-Investigator: Dr. Karina Del Rosario

OTI Summer Research Program

The goal of this internship is for the interns to gain skills in medical research while being exposed to the field of orthopaedic trauma surgery. Interns will have the option of working either with the Orthopaedic Trauma Institute services at Zuckerberg San Francisco General Hospital or at the Regional Medical Center in San Jose. Interns will contribute to new or ongoing research projects that revolve around advancing the field of orthopaedic trauma. Fields of research include, but are not limited to, prospective and retrospective clinical research, systematic reviews and meta-analyses, biomechanical research, and data science.

Orthopaedic Trauma Institute Clinical Research Center

In partnership with the CCMBM, providing access to post-doctoral fellows, graduate students, orthopaedic residents, and medical and undergraduate students allows them to conduct high-quality secondary analyses of secondary data sets from collaborative research national and international research consortia (e.g., METRC, PREP-IT).

Research Awards and Grants

A majority of our projects are funded by ongoing Department of Defense (DOD) awards and sub-awards.

Principal Investigator: Saam Morshed, MD, PhD, MPH

2021 – 2024

UCSF

• Funding: $25,000

• Project: Do smartphone application-based guided mindfulness exercises improve patient-reported outcomes after musculoskeletal trauma? (ADAPT)

DOD Sub-award

• Funding: $10,000

• Project: Evaluation of a new strategy for protocolized antibiotic care for severe open fractures (SEXTANT)

Unity Health Toronto/Sub-award

• Funding: $10,000

• Project: DIFFIR: Geriatric Distal Femur: Fixation versus Replacement - A Randomized Controlled Trial of Acute Open Reduction Internal Fixation (ORIF) versus Distal Femur Replacement (DFR). (Observational study)

Principal Investigator: Meir Marmor, MD

2021 – 2024

DOD

• Funding: $1,497,881

• Project: Development of a novel method for non-invasive diagnosis of compartment syndrome. (ULTRAPRESS)

Principal Investigator: David Shearer, MD

2021 – 2025

National Institute of Health (NIH)

• Funding: $748,285

• Project: GO Tibia: A masked, randomized controlled trial to evaluate local gentamicin versus saline in open tibia fractures.

Principal Investigator: Karina Del Rosario, MD

2021 – 2024

NIH Sub-award

• Funding: $500,000

• Project: INVEST Increasing diversity: A study for the improvement of racial and ethnic minority participation in low back pain research.

NIH Sub-award

• Funding: $300,000

• Project: PROTECT: Empowering chronic low back pain patients to reduce disparities.

Accomplishments in 2023

In October 2023, at the Orthopaedic Trauma Association annual conference, the UCSF Orthopaedic Trauma Clinical Research Center was recognized for extraordinary implementation and data quality by the Major Extremity Trauma Research Consortium (METRC).

Musculoskeletal researchers gather at the 2023 UCSF Research Retreat to discuss recent developments from the past year.

Orthopaedic Trauma Institute Clinical Research Center

Papers

Marmor MT, Mahadevan V, Solans BP, Floren A, Jarlsberg L, Cohen I, Savic R. Inpatient pain alleviation after orthopaedic trauma surgery-are we doing a good job? European Journal of Orthopaedic Surgery and Traumatology. 2023 Aug 31. doi: 10.1007/s00590-023-03670-3. Epub ahead of print. PMID: 37650973.

Marmor MT, Coufal S, Parel PM, Rezaei A, Morshed S. Complex Orthopaedic Trauma Is Shifting Away From Level I to Non-Level I Trauma Centers: An Analysis of the National Trauma Data Bank. Journal of the American Academy of Orthopaedic Surgeons Global Research Reviews. 2023 Feb 7;7(2):e22.00288. doi: 10.5435/JAAOSGlobal-D-22-00288. PMID: 36749712; PMCID: PMC9907928.

Marmor MT, Coufal S, Parel PM, Rezaei A, Morshed S. Complex Orthopaedic Trauma Is Shifting Away From Level I to Non-Level I Trauma Centers: An Analysis of the National Trauma Data Bank. Journal of the American Academy of Orthopaedic Surgeons Global Research Reviews. 2023 02 01; 7(2). PMID: 36749712

Brown K, Flores MJ, Haonga B, Chokotho LC, O'Marr JM, Rodarte P, Shearer D, Morshed S. Best Practices for Developing International Academic Partnerships in Orthopaedics. Journal of Bone and Joint Surgery. 2023 Oct 18. PMID: 37851955

Rodarte P, O'Marr J, Haonga B, Patrick D, Niknam K, Urva M, Cortez A, Metsemakers WJ, Shearer D, Morshed S. Diagnostic Performance of a telephone questionnaire for fracture-related infections (FRIs) in open tibia fracture patients in Tanzania. Injury. 2023 Nov 07; 55(2):111179. PMID: 37972489

Patterson JT, Morshed S. Letter to the editor on: Treatment Failure in Femoral Neck Fractures in Adults Younger than 50 Years: Analysis of 492 Patients Treated at 26 North American Trauma Centers. Journal of Orthopaedic Trauma. 2023 03 01; 37(3):e139-e140. PMID: 36513599.

Haonga BT, O'Marr JM, Ngunyale P, Ngahyoma J, Kessey J, Sasillo I, Rodarte P, Belaye T, Berhaneselase E, Eliezer E, Porco TC, Morshed S, Shearer DW. GO-Tibia: a masked, randomized control trial evaluating gentamicin versus saline in open tibia fractures. Trials. 2023 Jun 15; 24(1):406. PMID: 37322521.

The OTI Digital Science Lab (OTI-DSL) makes use of digital technology, such as wearable sensors, image analysis, computer simulation, artificial intelligence (AI), and data science, to research and develop new technologies in orthopaedic trauma.

Our primary focus areas are:

• Use of ultrasound-based technologies to diagnose acute compartment syndrome and limb perfusion compromise

• Use of AI and wearable devices to optimized post-operative pain alleviation

• Use of wearable devices and image capture to measure outcomes in trauma patients

• Data science and AI applications to improve fracture management in vulnerable populations

Using a collaborative cross-disciplinary approach, the lab offers expertise in engineering, clinical research, and data science in the following domains:

• Data: Predictive modeling and retrospective analysis of large clinical datasets and prospective collected longitudinal biometrics

• Imaging: MSK ultrasound, AI, computer vision

• Sensors: Implantable sensors and wearable technologies to monitor injury recovery

• Simulation and modeling: Experimental biomechanics, finite element analysis (FEA), machine learning

The lab has received funding from the Department of Defense (DOD), National Science Foundation (NSF), AO Foundation, Orthopaedic Trauma Association (OTA), Center for Disruptive Musculoskeletal Innovation (CDMI), and UCSF Human Performance Center (HPC) which include projects such as "Development of a handheld ultrasound-based system to assist in clinical diagnosis of acute compartment syndrome" and "Validation of use of previously collected Apple health data to determine current performance level"

Ongoing projects:

UltraPress: Use of ultrasound to detect early stages of acute compartment syndrome (ACS)

PDUS ACS/Swelling: Use of power doppler to detect early-stage ACS and assess tissue swelling

PAAIN: Use of wearables and AI to optimize post-operative pain management

BYODV-Performance: Validation of performance metrics routinely collected on smartphones by performance testing

Plans in the upcoming year:

ASSERT: Assessment of skill using intra-operative task-specific video image analysis

RadRep: Use of NLP and LLMs to classify fractures

Pain Recorder: Clinical testing of a device to continuously record subjective pain experience

BYODV-Survey: Validation of performance metrics routinely collected on smartphones by patient-reposted outcome surveys

Papers

Marmor MT, Mahadevan V, Solans BP, Floren A, Jarlsberg L, Cohen I, Savic R. Inpatient pain alleviation after orthopaedic trauma surgery-are we doing a good job? European Journal of Orthopaedic Surgery and Traumatology. 2023 Aug 31

Matz J, Debopadhaya S, Herfat S, Marmor MT. Physiologic Motion in the Intact and Unstable Syndesmosis During Plantigrade Weightbearing in Controlled Ankle Motion Boots. Journal of Foot and Ankle Surgery. 2023 Sep-Oct;62(5):785-787.

Marmor M, Guenthner G, Getman T, Ghert M. The Importance of Pragmatic Study Design to the Scholarly Influence of Surgical Hip Fracture Randomized Controlled Trials. Journal of the American Academy of Orthopaedic Surgeons, Global Research and Review. 2023 Mar 7;7(3):e21.00161.

Braun BJ, Histing T, Menger MM, Platte J, Grimm B, Hanflik AM, Richter PH, Sivananthan S, Yarboro SR, Gueorguiev B, Pokhvashchev D, Marmor MT. "Bring Your Own Device" – A New Approach to Wearable Outcome Assessment in Trauma. Medicina (Kaunas). 2023 Feb 19;59(2):403.

Marmor MT, Coufal S, Parel PM, Rezaei A, Morshed S. Complex Orthopaedic Trauma Is Shifting Away From Level I to Non-Level I Trauma Centers: An Analysis of the National Trauma Data Bank. Journal of the American Academy of Orthopaedic Surgeons, Global Research and Review. 2023 Feb 7;7(2):e22.00288.

Dr. Karina Del Rosario, on the left, is the current ZSFG site investigator for the INVEST and PROTECT sub-studies, part of the NIH-funded REACH Participant Diversity Program Grant, with a focus on bolstering diversity in chronic low back pain research. Dr. Lisa Pascual, at right, continues her role as an investigator for the ZSFG-based TRACK-SCI research group, which has expanded to multiple centers.

Orthopaedic Trauma Institute Clinical Research Center

Dr. Karina Del Rosario is currently the ZSFG site investigator for the INVEST and PROTECT sub-studies that are part of the NIH-funded REACH Participant Diversity Program Grant to increase diversity in chronic low back pain research. The goals of the studies are to increase enrollment and retention of underrepresented racial and ethnic minorities in low back pain research, attain additional insight into their back pain treatment and health care experience, and improve culturally and linguistically appropriate patient-facing materials for non-English speakers. Dr. Masato Nagao is also serving as investigator for these studies and assisting with patient recruitment.

Dr. Lisa Pascual continues as an investigator for the ZSFG-based TRACK-SCI research group that now extends to multiple centers. Multiple disciplines participate in this collaboration, which includes neuroscientists, data scientists, and subspecialists in the fields of PM&R, neurosurgery, orthopaedic surgery, anesthesiology, neurologic intensive care, emergency medicine and neuroradiology. The group seeks to identify factors that impact or may predict functional outcomes of patients sustaining spinal cord injury.

Ongoing awards and grants

REACH Participant Diversity: Aug. 1, 2021 – May 3, 2024

TRACK-SCI, Department of Defense: July 2020 – Jan. 2023

Ongoing projects

INVEST and PROTECT will continue to recruit patients and collect data in 2024.

TRACK SCI continues recruiting patients and performing follow-up data collection from multi-center sites.

Papers

Lui A, Park C, Chryssikos T, Radabaugh H, Patel A, Aabedi AA, Ferguson AR, Torres Espin A, Mummaneni PV, Dhall SS, Duong-Fernandez X, Saigal R, Chou A, Pan J, Singh V, Hemmerle DD, Kyritsis N, Talbott JF, Pascual LU, Huie JR, Whetstone WD, Bresnahan JC, Beattie MS, Weinstein PR, Manley GT, DiGiorgio AM. Safety and comparative efficacy of initiating low-molecular-weight heparin within 24 hours of injury or surgery for venous thromboembolism prophylaxis in patients with spinal cord injury: a prospective TRACK-SCI registry study. Neurosurgical Focus. 2023 Oct;55(4): E17. doi: 10.3171/2023.7. FOCUS23362. PMID: 37778033.

Special Research Initiatives

The Center for Disruptive Musculoskeletal Innovations (CDMI)

The Center for Disruptive Musculoskeletal Innovations (CDMI) is a National Science Foundation (NSF)-funded Industry-University Cooperative Research Center (IUCRC). The CDMI is a Phase II IUCRC currently consisting of three university sites: University of California, San Francisco (UCSF), University of Toledo, and Ohio State University. The CDMI addresses pressing societal needs associated with the growing burden of musculoskeletal disorders (MSDs), with the goal of generating data on incidence, pathomechanisms, treatment outcomes, and costs associated with MSDs. Based on these data, it develops new technologies for MSD prevention, diagnosis, and treatment.

Each CDMI site has faculty with unique technical and clinical strengths. UCSF faculty are particularly interested in developing a more comprehensive, quantitative understanding of MSD biology, diagnostics, clinical cohorts, and clinical data analytics, while leveraging the increasing need for digital health resources. This complements interests of faculty at other sites that include tools for studying MSD risk assessment and investigating MSD causal pathways, biomechanical computational models, advanced materials, and sensors.

The CDMI sustains interactions between academic researchers, trainees, and member companies who comprise the CDMI's Industrial Advisory Board (IAB.) It serves as a hub to match industry-inspired fundamental research questions to new, high-impact discoveries, which serve as a nucleus for transformative industry and university collaborations.

CDMI center directors Drs. Jeffrey Lotz, PhD, and William Marras (OSU), PhD, CPE, have shared relationships with both the National Institutes of Health-funded Back Pain Consortium Research Program (BACPAC) and CDMI. Because of this, and because CDMI has an interest in low back pain research, the center has been working to establish an artificial intelligence-driven platform for data integration. In 2023, CDMI hosted a workshop between BACPAC and NSF to highlight the significance of BACPAC data and technology resources. This provided an opportunity for industry researchers and clinical groups alike to learn more about how to leverage the comprehensive efforts underway for lower back pain treatment and prevention.

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

Expanding his innovative research into developing diagnostic tools, clarifying mechanisms, and testing biologic therapies for chronic low back pain (cLBP), Jeffrey Lotz, PhD, serves as the director and principal investigator of the Core Center for Patient-centric, Mechanistic Phenotyping in Chronic Low Back Pain (REACH). REACH is an NIH U19 Back Pain Consortium (BACPAC) Mechanistic Research Center (MRC) focused on positively impacting the opioid epidemic through the discovery of cLBP mechanisms and phenotypes. This will ultimately lead to precision medicine for low back pain and reduced dependence on additive therapies.

In 2023, REACH received a $4 million, sixth-year supplement from NIAMS, and continues to conduct two ongoing, longitudinal clinical cohort studies: comeBack and BACKHOME. In both studies, data elements from psychological, biological, and social domains are measured in cLBP subjects. REACH is also participating in the Biomarkers for Evaluating Spine Treatments trial (BEST), a multi-center BACPAC study being led by the University of North Carolina at Chapel Hill, as well as a control cohort for BACPAC with the University of Pittsburgh that will include all the deep-phenotyping measures.

The theoretical modeling challenge is ongoing and includes the following projects:

- Developing robust prediction models for outcomes following surgical interventions for cLBP
- Pooled analysis and phenotype development for cLBP patients across theoretical model working group datasets
- Phenotyping patients with endplate bone marrow lesions: psychosocial factors and image-based biomarkers
- Challenging and improving mechanistic cLBP models
- Validating machine-learning algorithms for better treatment of cLBP
- Semi-automated knowledge graph construction for mechanistic cLBP models

Led by REACH co-directors Lotz and Conor O'Neill, PhD, REACH investigators also received supplement funding from the Helping to End Addiction Long-term initiative (HEAL) for the

REACH Participant Diversity Program (INVEST). The program aims to ensure participant diversity in the longitudinal cohort studies.

The REACH Physical Function and Biomechanics Core was awarded 500 Apple Watches to use in the BACKHOME cohort. Under REACH investigators Jeannie Bailey, PhD, Patricia Zheng, MD, and Trisha Hue, PhD, MPH, the watches will be used to collect data on vital signs, such as heart rate variability, sleep, mobility, and activity data. Dr. Bailey was also awarded funds from BACPAC to investigate utilization and assessment of biomechanics technologies within the BACPAC consortium.

The following REACH ancillary projects are ongoing:

- Role of the gut microbiome in the progression of vertebral endplate bone marrow lesions (Modic changes) in cLBP
- Adding neuroimaging for a new mindfulness intervention assessment (ANIMA Study)
- To date, REACH authors have published over 30 articles and presented more than 15 abstracts/posters.

Core Center for Musculoskeletal Biology and Medicine (CCMBM)

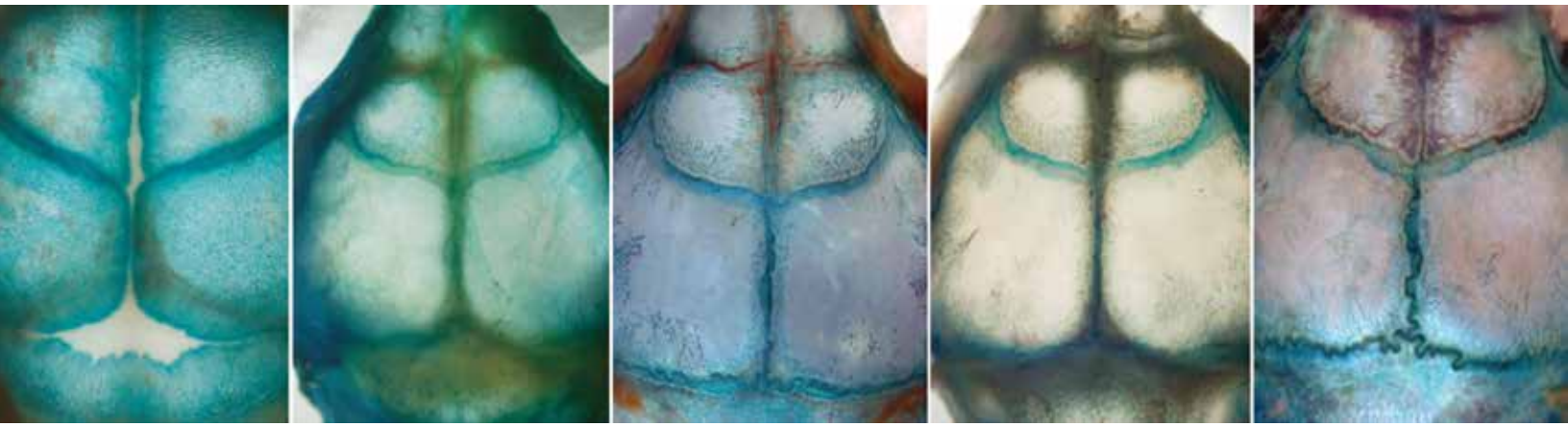
A cornerstone of support for UCSF musculoskeletal (MSK) research is a prestigious grant from the National Institutes of Health-National Institute of Arthritis and Musculoskeletal and Skin Diseases P30 Center that funds CCMBM. Under the direction of Dr. Tamara Alliston, this program supports the success of UCSF MSK investigators across the basic, clinical, computational, and population research spectrum. In the past five-year cycle, these investigators have earned a doubling of research support from $65 million to $156 million and have published over 550 MSK-related research articles. Collaborative publications among UCSF MSK investigators have increased by 2.4 fold (Figure 1). The NIH P30 renewal application submitted in May 2023 received an outstanding score. If funded, the grant would be renewed for another five years (>$4 million).

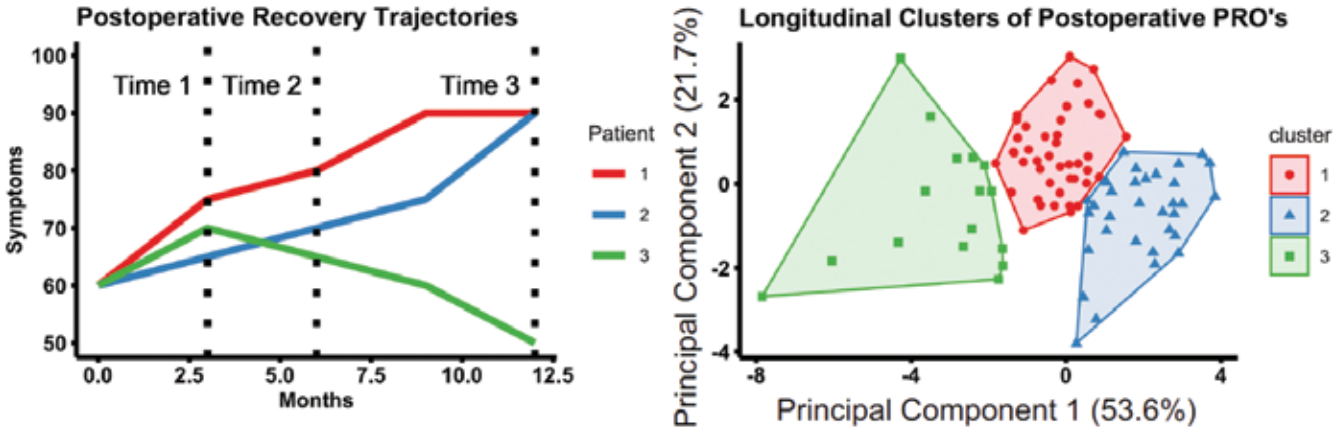
The first cohort of UC Skeletal Research Enhancing Training Collaboration and Health (STRETCH) scholars began during Summer 2023. STRETCH engages and supports diverse undergraduate learners in mentored collaborative UC-systemwide MSK research. Our first cohort, comprised of three teams, has been a stunning success, with collaborative projects across seven UC campuses.

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

Realizing that few of the National Institutes of Health's investments in basic, discovery research ever directly results in tangible patient impacts, the National Institute of Dental and Craniofacial Research (NIDCR) established two national Tissue Regeneration Resource Centers. These are tasked with the specific goal of accelerating clinical translation of innovative regenerative technologies to replace dental, oral, and craniofacial (DOC) tissues or organs lost to congenital disorders, traumatic injuries, diseases, and medical procedures.

C-DOCTOR (c-doctor.org) is one of NIDCR's resource centers and is led by UCSF co-principal Dr. Jeffrey Lotz, PhD, and University of Southern California co-principal Dr. Yang Chai, DDS, PhD. C-DOCTOR is a public-private partnership, with the primary mission of providing full clinical, scientific, technical, regulatory, financial/industrial, and management resources to promote cost-effective translation and timely development of DOC tissue engineering/regenerative medicine (TE/RM) technologies.





The METRiCS lab at UCSF delves into trajectory analyses of Patient-Reported Outcome Measures (PROMs) to enhance patient care and outcomes. Here, they are able to cluster patients based on different post-operative recovery trajectories.The figure above displays two images: left shows the distinct recovery trajectory pattens of three patient cluster groups identified on the right. (Source: UCSF Metrics Lab)

Patient-Reported Outcome Measures (PROMs)

The UCSF Department of Orthopaedic Surgery has prioritized the collection of patient-reported outcome measures (PROMs) in recent years, collaborating with CODE Technology to gather data from all surgical cases.

CODE Technology, a specialized company in PROM collection, has facilitated data collection seamlessly, enhancing our long-term PROM capture rate for surgical patients while maintaining clinical flow. This partnership has enabled the department to amass a robust data asset, applicable to both research and quality-of-care improvement endeavors. Since 2019, CODE has collected PROMs on 38,682 surveys from the Department of Orthopaedic Surgery, achieving a 65% overall capture rate across all modules and intervals.

Dr. Bobby Tay, MD, is leading the effort for the department with philanthropic support from the Guzik Foundation to integrate PROM data into point-of-care settings with Dr. Riley Bove, MD, who is leading the BRIDGE Lab. This collaboration aims to incorporate research data into our electronic medical record system in real time, enabling dynamic decision-making and enhancing care planning for each surgical candidate.

Diversity, Equity, and Inclusivity

Updates from our Faculty

I am doing a multi-institutional study (UCSF, Tufts University, Memorial Sloan Kettering Cancer Center, New York University, Providence hospitals, and a few others) on access to definitive cancer surgery for a subset of cancer surgery by race and socioeconomic status. We are looking at the difference from cancer identification to definitive surgery using the OMOP common data model. – **Tom Barber, MD, Arthritis and Joint Replacement**

We've done work on evaluating differences in periop outcomes following total joint arthroplasty between English-speaking and non-English speaking patients in our Asian and Latin X patient populations.

We've also looked at racial disparities in access and outcomes for our revision hip and knee arthroplasty patients. – **Erik Hansen, MD, Arthritis and Joint Replacement**

We are evaluating the factors that might lead to differences in outcomes across races after total knee arthroplasty. –**Alfred Kuo, MD, PhD, Arthritis and Joint Replacement**

I am a mentor and co-principal on the ASBMR THRIVE mentorship program to enhance the success of scientists in underrepresented groups. I am also a leader within the Society of Hispanic Professional Engineers, organizing professional development programs for faculty and graduate students. Last May, I went to the White House to discuss ways to promote engineering within Hispanic populations within the US. – **Chris Hernandez, PhD, Basic Research**

We are conducting work evaluating the associations of socioeconomic, acculturation, language, and other variables on access and outcomes to those receiving hand and upper-extremity surgery. Specific examples include the association of insurance type, patient preferred language, and health literacy on time to surgery, complications, and patient-reported outcomes.

We are conducting two national database studies on association of race/ethnicity on types of surgical treatments for distal radius and proximal humerus fractures (Ramesh Ghanta, Ryan Halvorson, Lauren Shapiro, and me). We're also doing a similar study on UC-wide data across all UC campuses.
– **Lauren Shapiro, MD MS, Hand, Elbow and Upper Extremity**

I perform disparities research looking at access to care and impact of disparities on pediatric sports medicine conditions and youth sports participation. I have published eight disparity-related papers and have several ongoing projects looking at the impact of language on access to care. – **Nirav Pandya, MD, Pediatric Orthopaedics**

We have completed and are working on several studies looking at improving the readability and availability of patient educational materials in Spanish. We are also working to expand CODE to be more inclusive and applicable to non-English speaking patients. – **Ishaan Swarup, MD, Pediatric Orthopaedics**

Drs. Berrigan, Luke, and I are working with our primary care sports medicine fellow, Dr. Frances Tao, to evaluate the relationship of social vulnerability index scores (SVI) on access to high school athletic trainers in California based on census tracts and zip codes. – **Nicolas Hatamiya, MD, Sports Medicine**

The division of sports medicine has several ongoing research projects supporting DEI initiatives. This past year, we focused on transcriptomic differences in tissue, including ACL tissue and hip synovium. Drs. Wong, Feeley, O'Connell, and Garcia have shown transcriptomic-level sex-based differences in ACL injury, which may explain why women tear their ACL two to eight times more than men. Drs. Wong, in collaboration with the MITO Lab and Steven Garcia, MD, were recently awarded the AOSSM Young Investigator Award for their project on sex differences in hip synovium of femoroacetabular impingement syndrome leading to differences in clinical outcomes. Frances Tao, the primary care sports medicine fellow, is leading a study evaluating access to athletic training staff in high schools using several socioeconomic tools. The group, in collaboration with Kris Jones, MD, at University of California, Los Angeles, identified gender differences in medical and athletic training staffs in women's' professional sports leagues. – **Stephanie Wong, MD, Sports Medicine**

Drs. Conor O'Neill, Karina Del Rosario, Masato Nagao, and I are working on PROTECT, a project to develop culturally and linguistically appropriate back pain self-help materials for non-English patients. We're focusing on the Spanish and Cantonese populations. Focus groups are being held at ZSFG, and we hope to eventually build a multimedia slew of contents to include print, web, and video. – **Patricia Zheng, MD, Spine**

I am involved in a NIH/NIDDK-funded research project looking at the social determinants of health in regard to diabetic foot ulcers and limb preservation. It is a multi-university group where we formed the Diabetic Foot Consortium and are collaborating together in many levels of diabetic foot research. – **Charles Park, MD, Podiatry**

Mathias Sorensen, exercise physiologist, at left, and Dr. Anthony Luke, director of the UCSF Human Performance Center (HPC), at right, collaborate with Tom Powell in San Francisco. The HPC conducts vital tests, such as VO2 max, to fuel their groundbreaking research endeavors.

UCSF Human Performance Center

The Human Performance Center (HPC) is the key center for exercise-related science serving the UCSF community. State-of-the-art equipment and expert staff enable the center to remain at the forefront of research involving human motion and exercise. Research includes investigating knee osteoarthritis, prostate cancer, Parkinson's disease, and other conditions that plague human function as people age.

Anthony Luke MD, MPH, is the director of HPC, Brooke Schultz, MS, is the manager and biomechanist, Mathias Sorensen, MS, is the exercise physiologist, and Richard Souza, PT, PhD, is the director of research.

2023 Highlights

In March 2023, HPC installed a new Qualisys Motion Capture camera system. This includes a 10-camera Arqus A5 traditional marker-based system and a 10-camera Miqus color video system for Theia3D markerless motion analysis. These systems can be run independently as well as simultaneously. Furthermore, the markerless system is portable and can be used inside and outside of the laboratory.

Jeannie Bailey, PhD, is collaborating with HPC on an R01 grant to use the new Theia3D markerless motion capture system for full-body biomechanical analysis. The project is focused on teasing apart the structure and functional relationship of the multifidus muscle in chronic low back pain patients.

PhD student Hector Carbajal Mendez completed a $5,000 HPC seed grant of concurrent assessment and inter-session repeatability of the new markerless motion capture system with that of the traditional marker-based motion capture system.

Authors including Drs. Adam Schroer, PhD, Saul Villeda, PhD, (endowed chair of Biomedical Sciences in the Department of Anatomy), and Anthony Luke, MD, MPH, (Benioff Distinguished Professor in Sports Medicine) published their work in "Nature" in August 2023 identifying elevated platelet factor 4 (PF4) in younger mice compared to older ones. The implications of their findings suggest that restoring important immune factors can have a positive effect on the brain, which is similar to some findings observed in exercising mice. This is promising work for identifying anti-aging solutions.

The completion of Victor Cheuy, PhD,'s HPC seed grant from 2022 directly led to successful multi-site R01 funding in 2023. UCSF, together with Washington University in St. Louis, High Point University, and Wake Forest University, will now longitudinally investigate bone, pressure, and functional factors to determine their effects on clinically relevant foot outcomes in a cohort with diabetes and chronic kidney disease. The long-term goal of this work is to reduce the risk of amputation.

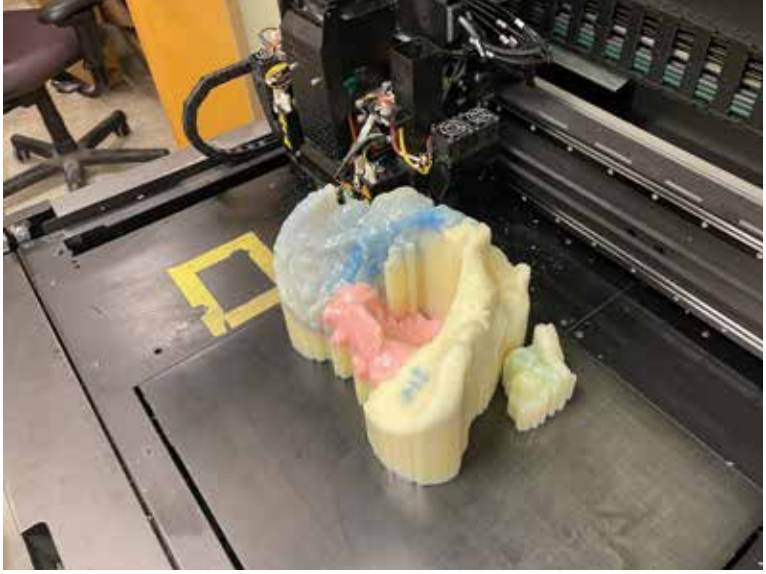
HPC recorded its most successful year yet in 2023 for community performance assessments such as VO2 max, blood lactate profiling, and resting metabolic rate measures. The desire for data-driven integration into health and wellness lifestyles of Bay Area residents is evident. HPC's RunSafe program continued its high demand in 2023, with sold out clinics all year long.

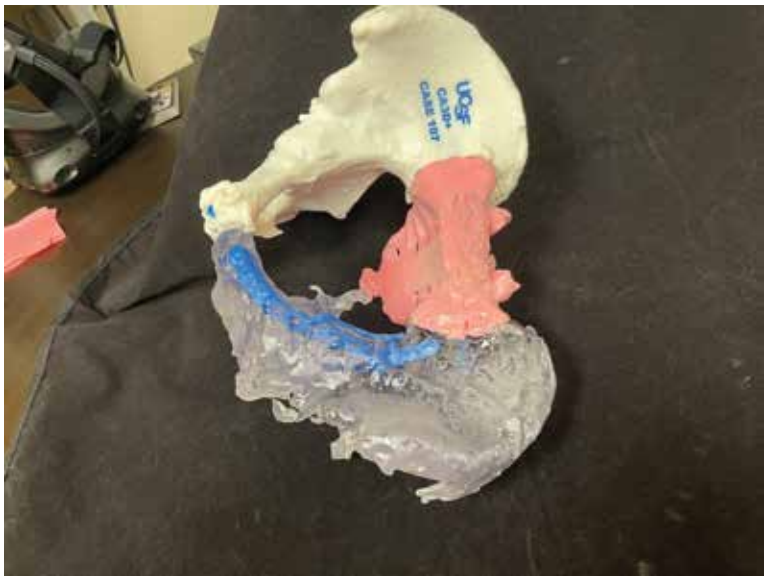
Ongoing Research in the Human Performance Center

HPC continues to support Richard Souza, PT, PhD, with his research on osteoarthritis progression in the lower extremities. His continued collaboration with the Department of Radiology and Biomedical Imaging on joint osteoarthritis currently has two active R01 research projects and one CCMBM Pilot/Feasibility grant. These include (1) evaluating the interconnectivity of the knee and hip joints (2) investigating the interaction of bone and cartilage in the patellofemoral joint, and (3) evaluating changes in gait biomechanics from decline treadmill walking on patients with patellofemoral joint osteoarthritis. Both R01 studies conduct longitudinal tracking of participants, evaluate tissue health through X-ray and MRI, and use 3D motion capture and functional testing motion analysis. Additionally, study participants wear the AX6 activity tracker for seven days of continuous physical activity tracking in their home environment.

Drs. Anthony Luke, MD, MPH, William Berrigan, MD, RMSK, and Nicolas Hatamiya, DO, just launched the Knee Osteoarthritis Biomarker Exploration Platelet Rich Plasma study (KOBE-PRP) Phase 3 study, a randomized controlled trial to evaluate whether similar protein changes occur in blood and synovial fluid following platelet-rich plasma injection versus saline control in knee osteoarthritis patients. They aim to explore the biological pathways by which PRP acts, including mirroring the human study in mice. This research is supported by the Lynne and Marc Benioff Foundation and other philanthropic donors.

In the SPARX3 study (PI: Dr. Nijee Luthra, MD, PhD, Neurology), the HPC team implemented a treadmill-based exercise training program that utilizes heart rate zones for patients with early-stage Parkinson's disease. It involves a VO2 peak fitness assessment that is administered at multiple timepoints in addition to disease biomarkers and other functional movement tests. Dr. Luthra received a K23 award in 2022 to continue her investigation of exercise for patients with Parkinson's. The EXCEL-PD study kicked off in 2023 and includes a resistance training program in addition to treadmill-based aerobic exercise.





The EDGE Lab

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

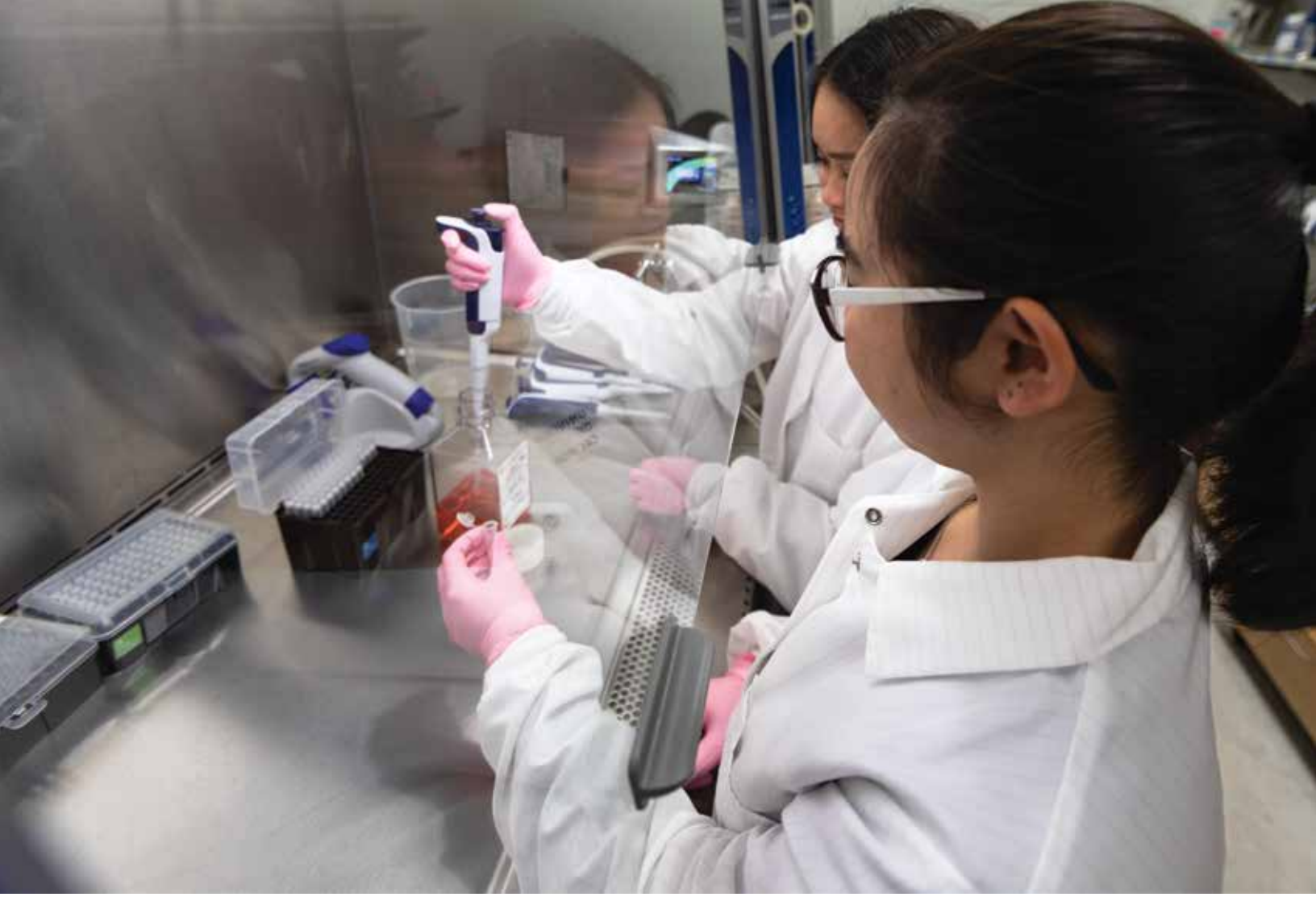
The EDGE Lab was founded in 2018 by Aenor Sawyer, MD,MS, Alexis Dang, MD and Alan Dang, MD with a focus on Engineering, Designing, and Growth Enabling digital (EDGE) and manufacturing technologies.

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 an exciting programs in advanced visualization and manufacturing technologies at UCSF that started this year.

At the San Franciso 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. this is now considered the flagship medical 3D printing program within the Veterans Administration nationally.

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



Kristen Chan, a visiting scholar in the Laboratory for Musculoskeletal Crosstalk of the UCSF Musculoskeletal Center, investigates fat-cartilage signals in osteoarthritis, leading to innovative regenerative therapies. Utilizing advanced techniques like induced pluripotent stem cells and CRISPR-Cas9, researchers aim to develop novel treatments for improved patient outcomes.

The UCSF Musculoskeletal (MSK) Center

The UCSF Musculoskeletal Center led by Tamara Alliston, PhD, nucleates the collaboration of musculoskeletal (MSK) investigators with one another and with outstanding investigators across UCSF. The center creates an environment for transformative discovery and clinical impact that extends far beyond MSK health and disease.

In April 2023, a National Institutes of Health T32 grant was awarded to establish a new MSK Training Program (>$1 million) to support the scientific education of basic, translational, and surgeon scientists in MSK research over the next five years. The program prepares a diverse community of PhD scientists and MD or MD/PhD residents and fellows for a lifetime of scholarly pursuits that lead to in-depth understanding and improved care of patients with MSK diseases. This program, spearheaded by Aaron Fields, PhD, has awarded grants to the first three MSK training program scholars this year. The MSK Center clears a path for and fuels human discovery biology and builds on the success of the UCSF CoLabs Initiative. Since MSK tissues are intractable to many state-of-the-art methods used in other fields, we are pioneering new protocols and funding the first CoLabs MSK co-projects to identify disease mechanisms for precision MSK diagnostics and therapies.

The center builds an integrated research community by helping to recruit talented new faculty affiliated with bioengineering and therapeutic sciences in UCSF's schools of pharmacy and medicine, cell and tissue biology, dentistry, orthopaedic surgery, and endocrinology, as well as the Bakar Aging Research Institute, UCSF's Diabetes Center, the Benioff Center for Microbiome Medicine, and the Eli and Edythe Broad Center for Regeneration Medicine and Stem Cell Research, among others.

Open MSK Integrated Knowledge Exchange (Open MIKE) was launched in 2023 to support the collaboration of MSK researchers with experts outside the MSK field. Our first Open MIKE with the Benioff Center for Microbiome Medicine identified opportunities to collaborate and grow a vibrant community of investigators working at the intersection of MSK and microbiome research.

UC Space Health

“Out of This World” MSK Research and Health Tech Innovation

Dr. Aenor Sawyer, an associate professor of Orthopaedic Surgery, heads the UC Space Health program. Most recently, the program hosted “Out of This World,” an ongoing science seminar series on space biology and health. Among the attendees were NASA astronaut Michael Barratt, UC Davis faculty member Stephen Robinson, and the late Millie Hughes-Fulford, a former NASA shuttle mission specialist and UCSF scientist. The annual conference focuses on exploring advancements in space biology and health.

NASA astronaut Kate Rubins working with WetLab-2 Ribonucleic Acid (RNA) SmartCycler tubes for Session 3. Wetlab RNA SmartCycler is a research platform for conducting real-time quantitative gene expression analysis aboard the International Space Station (ISS). The system enables spaceflight genomic studies involving a wide variety of biospecimen types in the unique microgravity environment of space.

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2023 Resident Research Highlights

OREF Resident Research Grant

Camille Sullivan, MD

Orthopaedic Research and Education Foundation

Elucidating immunologic drivers of chondrosarcoma progression and metastasis

10/1/23 – 9/30/ 24

$5,000

Manning Outstanding Paper Award

Syed Ali, MD

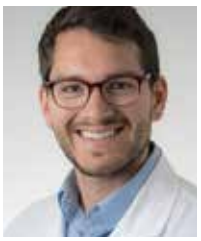
"The Cost-Effectiveness of Intramedullary Nailing Versus External Fixation for the Treatment of Open Tibia Fractures in Tanzania"

$500

Micheal Davies, MD

"Defining Endogenous Mitochondrial Transfer in Muscle Following Rotator Cuff Injury "

$500



Steven Garcia, MD

"Heterogeneous Human Fibroadipogenic Cell Subpopulations are Altered in Chronic Injury "

$500

JOJ Resident Research Grants

Kelly Bach, MD

"Short versus Long Leg Casting for Physeal Ankle Fractures"

$5,000

Lisa Bonsignore-Opp, MD

"Validation of an Injury Severity Score in Pediatric Spinal Trauma"

$5,000

Ramesh Ghanta, MD

"Patient/Surgeon Assessment of Resiliency and Risk Factors for Discordance"

$5,000

Natalie Kucirek, MD

"Impact of antibiotic choice, timing, and duration after open fractures"

$5,000

Angel Xiao, MD

"The Use of Motorized Cold Therapy Unit in the Postoperative Period Influences Pain and Narcotic Use following Arthroscopic Rotator Cuff Repair"

$5,000

New Faculty

Tom Barber, MD

Arthritis and Joint Replacement

San Francisco (Orthopaedic Institute)

Berkeley Outpatent Center

Professor

Undergraduate: Harvard University

Medical School: University of Rochester School of Medicine

Internship: University of Rochester Residency: Boston University

Clinical Expertise

• Total hip, knee replacement, including difficult primary replacement and revision surgery

• Surface replacement arthroplasty, minimally invasive total knee surgery

Research interests

• Using registries to improve the knowledge base and surgical outcomes in total hip and knee

• Effectiveness of different types of cement in the primary total knee surgery

Michael Chau, MD, PhD

Pediatric Orthopaedics

UCSF Benioff Children's Hospital Oakland, Walnut Creek

Assistant Professor

Undergraduate, Graduate (MS): Northwestern University

Graduate School (PhD): Karolinska Institute in Stockholm, Sweden

Medical School: Penn State College of Medicine Residency: University of Minnesota

Fellowships: University of Texas Southwestern (Scottish Rite for Children, pediatric orthopaedic surgery), Cedars-Sinai (Kerlan Jobe Institute; pediatric sports medicine)

Clinical Expertise

Specializes in the surgical and non-surgical management of sports-related injuries and conditions affecting the shoulder, elbow, hip, and knee in young athletes

Research interests

Understanding the biology of growth plate and articular cartilage development, musculoskeletal tissue engineering, and improving clinical outcomes of joint preservation strategies

Russell Dedini, MD

Foot and Ankle

Marin

Associate Professor

Undergraduate: UC Davis

Medical School: UC Davis School of Medicine

Residency: UCSF Department of Orthopaedic Surgery

Fellowship: University of Pennsylvania, Foot and Ankle

Clinical Expertise

Specializes in addressing intricate orthopedic issues of the foot and ankle, dealing with trauma, deformities, and arthritis

Managing complications associated with diabetes mellitus in the foot

Research interests

Safe surgical techniques for ankle fusions, osteochondral lesions of the talus, and cost-effectiveness analyses of knee arthroplasty procedures

Claudio Diaz, MD

Arthritis and Joint Replacement

San Francisco(Orthopaedic Institute)

Redwood Shores

Professor

Medical School: Pontificia Universidad Catalica de Chile ‘

Residency: Orthopaedic Surgery Residency. Clinica Alemana de Santiago, Universidad

del Desarrollo, Chile Fellowships:

Research Fellowship: The Rothman Institute at Thomas Jefferson University

Adult Reconstruction Fellowship. The Rothman Institute at Thomas Jefferson University

Clinical Expertise

Arthritis and Joint Replacement

Research interests

Arthritis and Joint Replacement

New Faculty

Jaclyn Hill, MD

Pediatric Orthopaedic Surgery

UCSF Benioff Children's Hospital San Francisco

Associate Professor

Undergraduate: Princeton University

Medical School: Baylor School of Medicine

Residency: Harvard University Orthopaedic Residency Program

Fellowship: Pediatric Orthopedic Surgery Fellowship at Boston Children's Hospital

Clinical Expertise

Specializes in pediatric orthopedics, clubfoot, lower extremity differences and reconstruction.

Her major areas of interest and expertise are in clubfoot and limb deformity/reconstruction.

Research interests

Pediatric Deformity Correction

Kevin Hwang, MD

Spine

Marin

Assistant Professor

Undergraduate: Duke University

Medical School: Baylor School of Medicine

Residency: UCSF Department of Orthopaedic Surgery

Fellowship: Harvard Combined Spine Surgery Fellowship in Boston

Clinical Expertise

Complex and minimally invasive spine surgery

Using minimally invasive techniques to allow

patients to recover more rapidly and with less pain.

Research interests

Improving clinical outcomes in spine surgery

Increasing access to care for vulnerable populations

Incorporating of new technologies into the practice of surgery

Donald Kephart, MD

Pediatric Orthopaedic Surgery

UCSF Benioff Children's Hospital Oakland, Walnut Creek

Cerebral Palsy & Neuromuscular Disease Clinic in Oakland

Assistant Professor

Undergraduate: Dartmouth College

Medical School: Emory School of Medicine

Residency: University of California, Davis Medical Center Fellowship: Hospital for Sick Children in Toronto.

Clinical Expertise

Care for infants, children, and adolescents facing a range of lower extremity dysplasia, deformity, trauma, infections, and neuromuscular diseases

Special interest in caring for children with neuromuscular conditions, such as cerebral palsy

Research interests

Utilization of technology to analyze children's gait patterns

Amelia Mostovoy, DPM

Podiatry

Orthopaedic Trauma Institute at Zuckerberg

San Francisco General

Assistant Professor

Undergraduate: Trinity College

Medical School: Samuel Merritt University, California School

of Podiatric Medicine

Residency: St. Mary's Hospital, San Francisco

Clinical Expertise

Podiatric Medicine

Research interests

Podiatric Medicine

Kiauntee Murray, MD

Orthopedic Oncology

San Francisco
(Mission Bay Hospital)

San Francisco VA

Assistant Professor

Undergraduate: Brown University

Medical School: Rutgers University School of Medicine

Residency: Rutgers University Orthopaedic Surgery Residency Program

Fellowships: Harvard Combined Orthopaedic Oncology Fellowship Program; Boston Children's Hospital Orthopaedic Clinical Research Fellowship Program

Clinical Expertise

Treating oncologic conditions in children and adults

Specialized care for patients with benign and malignant bone and soft tissue tumors as well as metastatic disease

Research interests

Musculoskeletal oncology

Faustine Ramirez, MD

Pediatric Orthopaedics,

Primary Care Sports Medicine

UCSF Benioff Children's Hospital San Francisco (Mission Bay)

Greenbrae (Marin County)

Assistant Professor

Undergraduate: University of

Washington Medical School: UCSF School of Medicine

Residency: UCSF Pediatrics Residency Program

Fellowship: Stanford University (Primary Care Sports Medicine)

Clinical Expertise

Pediatric primary care sports medicine

Special interests in musculoskeletal ultrasound (an imaging technique), bone health, growth plate injuries, and care for adolescent female athletes

Research interests

Understanding how sports specialization affects mental health and burnout, bone health and injury risk in young athletes

Kayla Williams, MD

Pediatric Physical Medicine and Rehabilitation

UCSF Benioff Children's Hospitals (Oakland

and San Francisco)

Assistant Professor

Undergraduate: Hampton University

Medical School: Howard University School of Medicine

Residency: University of Texas Southwestern

Clinical Expertise

Caring for infants, children, and adolescents with rehabilitation needs stemming from congenital or acquired impairments or disabilities.

Patients with brain or spinal cord injuries, amputations or limb deficiencies, rheumatic disorders, neurological conditions, cancer, and musculoskeletal conditions.

Research interests

Actively engaged in research to enhance the quality of life for children and families facing medical and functional challenges

Mark Chu Xu, MD

Spine, Trauma and Problem Fractures

Regional Medical Center of San Jose

Orthopaedic Trauma Institute at Zuckerberg San Francisco General

Assistant Professor

Medical School: Winnipeg, Canada

Residency: Winnipeg, Canada

Fellowship: University of British Columbia - Vancouver General Hospital (Trauma fellowship); University of Toronto - Toronto Western Hospital (Combined orthopaedic and neurosurgical spine surgery fellowship)

Clinical Expertise

Dual subspecialty training in orthopedic trauma and spine surgery

Managing traumatic injuries of the extremities and pelvis

Treating degenerative and traumatic spinal pathology

Research interests

Clinical outcomes and biomechanical studies comparing surgical fixation techniques

News and Media

Dr. Theodore Miclau, at center, was endowed the Orthopaedic Trauma Institute international chair on May 3, 2023, at UCSF Mission Bay in San Francisco. Dr. Miclau was joined by (from left) Jenna Lim, Judy Guggenhime, Kim Meredith, Dr. Sue Carlisle, Connie Shanahan, and Dr. Susan P. Ehrlich (Photo: Courtesy of UCSF Foundation)

Theodore Miclau, MD has been appointed as the Orthopaedic Trauma Institute International Chair

SAN FRANCISCO (May 3, 2023) – The UCSF Dept. of Orthopaedic Surgery is pleased to announce that Theodore Miclau III, MD, has been appointed as the Orthopaedic Trauma Institute International Chair.

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

“Dr. Miclau exemplifies the Department’s commitment to medical education in developing countries,” said Thomas P. Vail, MD, chair of the UCSF Department of Orthopaedic Surgery. “The endowed chair allows for extra funds to support and strengthen Dr. Miclau’s mission in developing the Department’s international program.” The investiture was originally to take place April 2020 but was postponed due to COVID.

Department welcomes Thomas C. Barber, MD, Professor, Arthritis and Joint Replacement

SAN FRANCISCO (JUNE 2, 2023) –The UCSF Department of Orthopaedic Surgery is pleased to announce that Thomas C. Barber, MD, has joined our faculty in the Arthritis and Joint Replacement division.

Dr. Barber is an orthopaedic surgeon specializing in total joint replacement. He has a special interest in total hip and total knee replacement, including difficult and challenging primary replacement and revision surgery. He also has expertise in surface replacement arthroplasty and minimally invasive total knee surgery.

Dr. Barber served as chair of the American Academy of Orthopaedic Surgeons’ (AAOS) Council on Advocacy from 2013-2017. He has long been active in the academy. He was chair of the Board of Councilors in 2010, an AAOS board member from 2007 to 2010, and a member of both the Health Care Delivery Committee and the Prevention of Medical Errors Committee. He has also served as a board member of the American Joint Replacement Registry (AJRR).

Dr. Barber received a bachelor’s degree in economics from Harvard and a medical degree from the University of Rochester School of Medicine. He completed an internship in general surgery at the University of Rochester and his residency in orthopaedic surgery at Boston University.

Dr. Barber, who had previously served on the UCSF faculty, recently returned to the Bay Area after serving as deputy physician in chief of Perioperative Services at Memorial Sloan Kettering Cancer Center in New York City for the past three years during the Pandemic. He also had a long career at Kaiser Permanente, where he helped launch the Kaiser Permanente Total Joint Registry and pioneered a patient-to-physician messaging system.

His research interests include using registries to improve the knowledge base and surgical outcomes in total hip and knee surgery. His most recently accepted paper details the effectiveness of different types of cement in primary total knee surgery.

Rosanna Wustrack, MD, to serve as Acting Chair

SAN FRANCISCO (June 23, 2023) –The UCSF Department of Orthopaedic Surgery is pleased to announce that Rosanna Wustrack, MD, will serve as acting chair of the UCSF Department of Orthopaedic Surgery, effective July 1, 2023.

Dr. Wustrack is an associate professor and orthopaedic surgeon who specializes in diagnosing and treating patients with musculoskeletal tumors and fragility fractures (breaks that happen during normal activities because bones have become weak). Currently, Dr. Wustrack serves as section chief of the Division of Orthopaedic Oncology. She is a leader in the department's Quality Improvement and Morbidity and Mortality committees.

Additionally, Dr. Wustrack is a member of the UCSF Sarcoma Center, a multidisciplinary team of sarcoma specialists who provide patients with the most precise diagnostic tools, novel surgical and reconstructive techniques, and promising new therapies.

Widely published, Dr. Wustrack's research interests include functional outcomes in cancer patients, osseointegration (bone growth that serves to secure a surgical implant), and sarcoma immunotherapy.

Dr. Wustrack is also highly active on the department's Diversity, Equity, and Inclusion (DEI) Committee. She leads monthly programming, actively participates in the Perry Initiative, and serves as a mentor to medical students, interns and residents, and fellows. She is also a team leader of UCSF Sarcoma Strong 5K, an annual UCSF event that benefits sarcoma research.

Dr. Wustrack received an undergraduate degree from Yale University before earning a medical degree from Washington University School of Medicine in St. Louis. She completed an internship and residency training in orthopaedic surgery at UCSF. Subsequently, she completed fellowship training in musculoskeletal oncology at Memorial Sloan Kettering Cancer Center in New York. Dr. Wustrack joined the department faculty in 2013.

Alan Zhang, MD, to serve as Medical Director of the UCSF Orthopaedic Institute

SAN FRANCISCO (June 26, 2023) – The UCSF Department of Orthopaedic Surgery is pleased to announce that Alan Zhang, MD, will serve as medical director of the UCSF Orthopaedic Institute (OI) effective July 1, 2023.

Dr. Zhang is a professor and an orthopaedic surgeon who specializes in sports medicine and minimally invasive arthroscopic surgery of the hip, knee, and shoulder.

As a leader at the Orthopaedic Institute, Dr. Zhang has worked as the chair for the New Product Request Committee for the last three years, during which he became familiar with operational budgets and the value of cost-conscious practices. In this role, he worked to negotiate with vendors for competitive market pricing. In doing so, he has helped to save the OI more than $100,000 per year in carrying costs for operating room supplies and implants.

Over the past three years, Dr. Zhang has also co-chaired the department's Research Committee. In this role, he became familiar with budgeting for the department's research initiatives and research infrastructure. He led the committee's processes in grant allocation and management and served as editor of the annual Research Report.

In clinical care, Dr. Zhang is director of the UCSF Hip Preservation Center, a combined adult and pediatric orthopaedic program to provide a unique continuum of care model for all patients.

In medical education, Dr. Zhang is director of the prestigious Sports Medicine and Shoulder Surgery Fellowship. During his five years as fellowship director, he has worked collaboratively with the UCSF Graduate Medical Education office to expand our program from two to three fellows. Dr. Zhang also serves as team physician for the University of San Francisco NCAA Division I teams and Archbishop Riordan High School in San Francisco.

As a researcher, Dr. Zhang is a fellow of the American Academy of Orthopaedic Surgeons and the Arthroscopy Association of North America. He was elected to the American Orthopaedic Society for Sports Medicine Council of Delegates and is an editorial board member for the American Journal of Sports Medicine and the Arthroscopy Journal. He is an invited international speaker and has published over 150 research articles, winning numerous awards on his studies. He is also an instructor for advanced hip arthroscopy courses and is a member of the International Society for Hip Arthroscopy.

Dr. Zhang received his undergraduate degree from Rice University before earning a medical degree from the UCSD School of Medicine. Dr. Zhang completed residency training in Orthopaedic Surgery at the University of California, Los Angeles, Medical Center, followed by a fellowship in sports medicine and shoulder surgery at UCSF. Dr. Zhang joined the department faculty in 2013.

Institute for Global Orthopaedics and Traumatology (IGOT) Tanzania SMART Course

SAN FRANCISCO (July 12, 2023) – After a three-year pause due to the pandemic, the Institute for Global Orthopaedics and Traumatology (IGOT) partnered with SIGN and the Muhimbili Orthopaedic Institute (MOI) to hold the eighth annual Tanzania SMART Course in June 2023.

The course attracted over 160 attendees from 14 countries across Sub-Saharan Africa, and the faculty comprised 16 orthopaedic and plastic surgeons from Africa and North America, including 10 SIGN surgeons.

The four-day course covered a variety of topics, including fractures of the pelvis, hip, and knee as well as open fracture treatment and soft-tissue flaps.

Background

The "Flap Course" has been held annually in the US for more than 10 years as a collaboration between SIGN and IGOT at UCSF. In 2013, leadership from MOI expressed interest in hosting a course that would be more accessible to the many surgeons in Africa who were unable to travel for the SIGN conference and "Flap Course". After the first successful course, it was the combination of teaching fracture treatment and soft-tissue flaps in Tanzania that led to the name "Surgical Management and Reconstructive Training" (SMART). Subsequently, both IGOT and SIGN have partnered with MOI to deliver this course on an annual basis. The course involves a variety of topics and teaching formats, including didactics, case discussions, and hands-on workshops.

In the early years, the course was predominantly taught by faculty from North America, but it has evolved to become a multi-disciplinary team of North American and African surgeon-leaders. This year's course included faculty representing seven countries: Pak Baidoo (Ghana), Kebba Marenah (The Gambia), Daniel Sciuto (Kenya), Mapuor Mading (South Sudan), Joseph Mwanga (Tanzania), Billy Haonga (Tanzania), Felix Mrita (Tanzania), John Ekure (Uganda), Akimu Mageza (Zimbabwe), and Brian Paketh (Zimbabwe).

Resident Natalie Kucirek, announced as Krevans awardee for 2023

SAN FRANCISCO (JUNE 18, 2023) –In June, the UCSF School of Medicine, Zuckerberg San Francisco General (ZSFG), celebrated exceptional achievements by interns through the annual Krevans Awards.

Natalie Kucirek, a second-year resident with the UCSF Department of Orthopaedic Surgery, was announced as a Krevans Award recipient for 2023!

The Krevans Award recognizes "excellence in patient care, as exemplified by clinical competence, professional conduct, concern for patients, and interaction with all levels of staff, including peers." Recipients are selected by the chiefs of the various medical departments at the Priscilla Chan and Mark Zuckerberg San Francisco General Hospital and Trauma Center.

The award was established in 1979 by the Gladstone Institutes, a privately funded, UCSF-affiliated research institute formerly on the ZSFG campus. The award is named for former UCSF Chancellor Julius R. Krevans.

Natalie Kucirek was born and raised in the Bay Area. She completed her undergraduate degree at the University of California, Berkeley, and received the Outstanding Scholar Award from the Department of Molecular and Cell Biology at graduation. She then completed her medical degree at UCSF, where she discovered her interest in orthopaedic surgery. A lifelong musician and athlete, Natalie enjoys helping patients regain function and return to the activities that matter to them. In medical school, she received a Heiman Fellowship to study the basic science of fracture healing. She also worked on an initiative to reduce social isolation among hospitalized patients during COVID, which received the Dean's Commendation for Exceptional Volunteerism. She is passionate about promoting and mentoring women in surgery and has been a member of the UCSF Muriel Steele Society and the Ruth Jackson Orthopaedic Society. In residency, she continues to conduct research in sports surgery and orthopaedic trauma. Outside of the hospital, Natalie is an avid runner, skier, and flutist and enjoys spending time with her family and spouse.

UCSF Sports Medicine, MITO Lab receive prestigious 2023 Cabaud Memorial Award in orthopaedic research

SAN FRANCISCO (July 21, 2023) – The UCSF Department of Orthopaedic Surgery is pleased to announce that the Muscle Injury and Translational Orthopaedic (MITO) Laboratory, run by Dr. Brian Feeley, MD, and Dr. Xuhui Liu, MD, received the 2023 Cabaud Memorial Award by the American Orthopaedic Society for Sports Medicine (AOSSM).

Given annually in honor of Henry Edward ("Ed") Cabaud, III, MD, by the AOSSM Research Committee, the research award honors the best full-length submitted manuscript that pertains to hard- or soft-tissue biology, in-vitro research, laboratory or "bench-type" research, or in-vivo animal research.

Dr. Anthony Ding, admitted to the Haile T. Debas Academy of Medical Educators

SAN FRANCISCO (Aug. 7, 2023) – Dr. Anthony Ding, an orthopaedic trauma surgeon, has been admitted to the Haile T. Debas Academy of Medical Educators as a new member.

He will be inducted into the esteemed medical educator academy Wednesday, Sep. 13, at the Pritzker Auditorium at Mission Bay.

Dr. Ding joined the faculty at UCSF in 2018 and works primarily out of the UCSF/San Francisco General Hospital Orthopaedic Trauma Institute (OTI). His clinical interests include hand, upper extremity, and microvascular. He is committed to high-quality patient care and resident education.

UCSF Orthotic and Prosthetic Centers proudly announces Aarti Deshpande's nomination to the board of USISPO

SAN FRANCISCO (Sept. 11, 2023) –The UCSF Department of Orthopaedic Surgery is delighted to announce that Aarti Deshpande, MS, clinical manager of the UCSF Orthotic and Prosthetic Center at Zuckerberg San Francisco General (ZSFG), has been nominated as a new board member of the United States Member Society of the International Society of Prosthetics and Orthotics (US-ISPO), a significant milestone in her journey of promoting health care for individuals with physical disabilities.

As a board member, Deshpande's goal is to create and expand a global network of health care and clinicians who are passionate about raising awareness, contributing to international outreach, fostering education, conducting research, and supporting sustainable health care practices worldwide.

"I have a passion for global outreach work," Deshpande said.

"For me, global outreach includes a hybrid approach, a mix of providing clinical care to patients where health care is not available, offering resources to existing facilities and providers in resource-scarce regions, and facilitating the transfer and exchange of clinical and technical knowledge. This approach seeks to improve health care worldwide and empower local facilities to become self-sufficient, with the ultimate goal of ensuring accessible and high-quality sustainable health care in all corners of the world."

"As someone who has focused tremendous effort on improving education and clinical care in underserved populations across the globe, Aarti is well-positioned to help lead the ISPO board to new areas of discovery and programmatic development," said Matthew Garibaldi, CPO, director of the UCSF Orthotic and Prosthetics Centers.

Deshpande ‹s dedication to international outreach is not a recent endeavor. Her previous contributions include:

Participating as a prosthetic mentor and team member of US-ISPO's first student service trip to Belize in association with Prosthetic Hope International Belize (PHIB) in August 2018. During this mission, Deshpande and her team completed the fitting of 11 legs, one arm, 18 repairs, and 25 pre-prosthetic consults, with the participation of five orthotic and prosthetic students and five physical therapy students.

Participating as a prosthetic mentor through US-ISPO with Hughes International Clinics in Colombia in May 2019, where Deshpande and her team fitted 25 patients in just one week.

She served as a prosthetic mentor and team member with Hughes International Clinic in collaboration with Crimal Clinic in Queretaro, Mexico.

"Aarti's tireless efforts and unwavering commitment to improving the lives of individuals with physical disabilities have made her an invaluable asset to our organization and the field of orthotics and prosthetics. We look forward to witnessing her continued contributions and leadership on the board of US-ISPO," Garibaldi added.

Daniel Thuillier, MD, named chief of foot and ankle surgery

SAN FRANCISCO (Sept. 15, 2023) – The UCSF Department of Orthopaedic Surgery is pleased to announce that Daniel Thuillier, MD, has been named chief of Foot and Ankle Surgery. After 10 years as a faculty member in the department and his impressive track record in patient care, research, and resident education, Dr. Thuillier is well-poised to lead the team.

About Daniel Thuillier, MD

Dr. Thuillier earned his bachelor's degree from Georgetown University and medical degree from the UCSF School of Medicine. He then completed his residency in the UCSF Department of Orthopaedic Surgery, followed by a fellowship in foot and ankle surgery at Harborview Medical Center in Seattle. Following his fellowship, he joined the faculty at the UCSF Department of Orthopaedic Surgery. In addition to his clinical practice, Dr. Thuillier also serves as team physician for the Oakland Roots SC.

The department would like to take this opportunity to express our deep appreciation to Dr. Kirstina Olson, who has held the position of chief of Foot and Ankle Surgery for the past 12 years. Dr. Olson's dedication, leadership, and contributions to our department have been invaluable, and we thank her for her outstanding service. Thank you, Dr. Olson!

Melissa Zimel, MD, appointed director of the UCSF Sarcoma Program

SAN FRANCISCO (Oct. 6, 2023) – The UCSF Department of Orthopaedic Surgery is thrilled to announce that Melissa Zimel, MD, has been appointed director of the UCSF Sarcoma Program. She will lead a team of multidisciplinary sarcoma specialists dedicated to providing patients with cutting-edge treatment of bone and soft-tissue sarcomas.

A distinguished orthopaedic oncologist, Dr. Zimel has been an integral part of our sarcoma program since joining the faculty in 2017. She will be taking over the directorship from Dr. Richard O'Donnell, who has led the program for the past 20 years. We extend our heartfelt gratitude to Dr. O'Donnell for his many years of dedicated service.

"Dr. Zimel is not only an outstanding surgeon, but she is also a true leader in the field of orthopaedic oncology. Her compassion and dedication to her patients are unparalleled, and I have no doubt that she will lead the UCSF Sarcoma Program to even greater heights," said Dr. Rosanna Wustrack, acting chair of the UCSF Department of Orthopaedic Surgery. Dr. Melissa Zimel, MD, is a board-certified orthopaedic surgeon who specializes in the diagnosis and treatment of children and adults with bone and soft-tissue tumors and tumor-like conditions. She has vast experience in limb salvage surgery for adult and pediatric patients, custom pelvic implants, and the treatment of metastatic bone disease.

Dr. Zimel grew up in Portland, OR. She graduated with a bachelor's degree from the University of Southern California. She received her medical degree from Northwestern University Feinberg School of Medicine and completed her residency in orthopaedic surgery at the William Beaumont Hospital in Royal Oak, Michigan. She then completed two additional years of fellowship training in orthopaedic oncology at Memorial Sloan Kettering Cancer Center in New York City.

Dr. Zimel joined the faculty in the UCSF Department of Orthopaedic Surgery in 2017. She has been director of the multidisciplinary tumor board since 2020. Dr. Zimel also has a passion for diversity, equity, and inclusion (DEI). She is the chair of the UCSF Department of Orthopaedic Surgery's DEI Committee and oversees the monthly DEI education program as well as efforts around retention and recruitment. She is an IDEAL Academy member and member of the UCSF SOM Diversity Leaders. Dr. Zimel is also one of the organizers of UC Women of Ortho, a yearly leadership summit for female orthopaedic faculty and residents across all UC sites.

Dr. Sara Edwards, director of the UCSF Women's Sports Medicine Center, stands at the forefront of orthopaedic care for female athletes. Thanks to a $2.5 million gift from #startsmall, the center aims to break barriers and provide inclusive care along the West Coast. Dr. Edwards leads not only clinical care but also research studies within the center, advancing our understanding of orthopaedic health for female athletes through cutting-edge clinical research initiatives.

$2.5M Gift Empowers UCSF Women's Sports Medicine Center

SAN FRANCISCO (Oct. 12, 2023) – The UCSF Department of Orthopaedic Surgery is delighted to announce a $2,505,250 gift from Jack Dorsey's philanthropic initiative #startsmall to enhance the mission of the UCSF Women's Sports Medicine Center to deliver comprehensive and inclusive orthopaedic care to female athletes of all abilities and levels along the West Coast. It's the largest gift the center has received.

"#startsmall's commitment to empowering our center marks a transformative impact to our program," said Dr. Sara Edwards, director of the UCSF Women's Sports Medicine Center. "This will enable the center to not only provide specialized care to female athletes but also to address historical barriers to orthopaedic health for this underserved group."

While female participation in sports has increased significantly over the past 50 years, resulting in tremendous health benefits, significant barriers still exist that prevent women and girls from fully optimizing health and wellness. These barriers include limited orthopaedic and sports medicine literature focusing on female athletes and a lack of access to high-quality care and opportunities for female athletes in lower-income communities.

#startsmall's investment in the center enables UCSF to address these disparities by building a specialty clinic for female athletes, supporting research that addresses gender differences in orthopaedics and sports medicine, and providing community education programs that help local female athletes stay active and healthy.

"As we look ahead, beyond the pandemic, to prioritize women's health and education, we are deeply grateful for #startsmall's visionary support," Dr. Edwards added. "Together, we can build a healthier environment, where every girl has the opportunity to thrive."

The center currently offers surgical and nonsurgical orthopaedic care, injury prevention guidance, and safe return-to-play solutions. Patients receive personalized analysis of their sports performance, access to experts in sports nutrition, sports psychology, athletic training, and physical therapy, in addition to the specialized services provided by the UCSF Human Performance Center and the UCSF Sports Medicine Center for Young Athletes.

"#startsmall's generous gift emphasizes its commitment to promoting the health and well-being of women and girl athletes in the Bay Area and beyond," said Dr. Brian Feeley, chief of the UCSF Sports Medicine and Shoulder Service. "It will enable our center to extend its reach and impact to even more athletes and individuals seeking world-class orthopaedic care."

#startsmall is Jack Dorsey's philanthropic initiative to fund global crisis relief, girls' health and education, and open internet development. Dorsey transferred $1 billion (28% of his wealth) to #startsmall in 2020.

Dr. Sigurd Berven, orthopaedic spine surgeon at the UCSF Spine Center, receives the prestigious 2023 David Selby Award from the North American Spine Society (NASS) for his outstanding contributions to spinal disorder management.

NASS Recognizes Sigurd Berven MD, with the David Selby Award for Distinguished Contributions to Spinal Disorder Management

SAN FRANCISCO (Oct. 19, 2023) – The UCSF Department of Orthopaedic Surgery is delighted to announce that the North American Spine Society (NASS) has unveiled the recipient of the prestigious 2023 David Selby Award. This esteemed recognition was conferred today upon Dr. Sigurd Berven, an orthopaedic spine surgeon at the UCSF Spine Center, in honor of his unwavering commitment to advancing the art and science of spinal disorder management through dedicated service to NASS in various roles. Dr. Berven was presented the award this morning in Los Angeles at the NASS Annual Meeting.

Sigurd H. Berven, a dedicated NASS member since 2002, has served on numerous NASS committees and was a NASS 2022 program co-chair. Berven has a strong interest in the care of children and adults with spinal disorders. These include pediatric and adult deformities, degenerative conditions of the spine, spinal tumors, and spinal trauma. In the realm of research, Berven is particularly focused on assessing outcomes for patients who undergo orthopaedic surgery.

Dr. Sigurd Berven's receipt of the David Selby Award underscores his exceptional dedication and commitment to the field of spinal disorder management. This recognition highlights his ongoing efforts to enhance the quality of spine care and improve patients' lives.

Welcome Class of 2028!

SAN FRANCISCO (March 17, 2023) — The UCSF Department of Orthopaedic Surgery is pleased to announce the Class of 2028. Welcome to the Department!

From left: Wyatt David, MD (Yale School of Medicine); Chloe Dlott, MD (Yale School of Medicine); Michael Flores, MD (Yale School of Medicine); Omair Khan, MD (University of Colorado School of Medicine); Sara Kiani, MD, MPH (Icahn School of Medicine at Mount Sinai); Justin Solarczyk, MD (UCSF School of Medicine); Lacey Smith, MD (Harvard Medical School); and Liam Wong, MD (Oregon Health & Science University School of Medicine).

Philanthropy

Support the UCSF Department of Orthopaedic Surgery

To learn more about how to make a gift for the Department of Orthopaedic Surgery, please contact Ian Shore, MNA, CFRE, Associate Director of Development, UCSF University Development & Alumni Relations, at (415) 502-3482 or send an email to ian.shore@ucsf.edu

makeagift.ucsf.edu

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

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UCSF Department of Orthopaedic Surgery