BIOGRAPHICAL SKETCH

NAME: Kogan, Feliks

eRA COMMONS USER NAME (credential, e.g., agency login): FKOGAN

POSITION TITLE: Instructor, Department of Radiology, Stanford University

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Rochester, Rochester, NY	B.S.	05/2007	Optics, Applied Mathematics
University of Pennsylvania, Philadelphia, PA	Ph.D.	05/2013	Bioengineering, Imaging Sciences
Stanford University, Stanford, CA	Postdoctoral Fellowship	10/2015	Radiology

A. Personal Statement

My research focuses on the development and clinical translation of novel quantitative and molecularly specific imaging technologies geared toward early diagnosis and studying mechanisms of musculoskeletal disease. In particular, I am interested in the development of novel quantitative imaging techniques that can evaluate in vivo, in humans and in real time, changes in bone physiology and soft tissue microstructure, that I will ultimately apply to studying the pathophysiology and role of mechanics in musculoskeletal disease.

B. Positions and Honors

Positions and Employment

Jan 2005 – May 2006 Research Assistant, Laboratory for Laser Energetics, Rochester, NY
May 2006 – Aug 2006 Research Assistant, Wellman Center, Massachusetts General Hosptial, Boston, MA
Sept 2006 – Jun 2007 Research Assistant, Department of Radiology, University of Rochester, Rochester, NY
Aug 2007 – May 2013 Bioengineering Researcher, Radiology, University of Pennsylvania, Philadelphia, PA
May 2013 – Aug 2013 Postdoctoral Researcher, Radiology, University of Pennsylvania, Philadelphia, PA
Sept 2013 – Oct 2015 Postdoctoral Fellow, Department of Radiology, Stanford University, Stanford, CA
Oct 2015 – Dec 2016 Research Associate, Department of Radiology, Stanford University, Stanford, CA
Jan 2017 – April 2019 Instructor, Department of Radiology, Stanford University, Stanford, CA
May 2019 - Present Assistant Professor, Department of Radiology, Stanford University, Stanford, CA

Other Experience and Professional Memberships

2009 – Present Member - International Society for Magnetic Resonance in Medicine (ISMRM)
2014 – 2015 Stanford Radiologic Sciences Annual Retreat Planning Committee Member
2015 – 2016 ISMRM Publications Committee Member (Non-Voting)
2015 – 2016 ISMRM Trainee Working Advisory Group Member
2016 – 2017 ISMRM Musculoskeletal Study Group Executive Committee (Trainee Representative)
2017 – Present Member – Orthopedic Research Society (ORS)
2018 – Present Council of Early Investigators in Imaging ($CECI_2$) – Academy for Radiology & Biomedical Imaging Research
2019 – Present Member – Osteoarthritis Research Society International (OARSI)

Academic Honors

2007	Distinction in Applied Mathematics, University of Rochester
2007	High Distinction in Optics, University of Rochester
2007	University of Rochester Optics Faculty Award
2007	HHMI-NIBIB Interfaces Fellowship in Imaging Sciences
2007	National Science Foundation Graduate Fellowship Honorable Mention
2010	NIH National Institute of Biomedical Imaging and Bioengineering (NIBIB) Training Grant
2010	Juan Grana Graduate Teaching Assistantship
2012, 2015	ISMRM Summa Cum Laude Merit Award
2013, 2018	ISMRM Magna Cum Laude Merit Award
2014	Editors Pick Article – Magnetic Resonance in Medicine
2015	ISMRM Junior Fellow
2015	Merit Award for Highest Scoring Trainee Abstract – International Workshop on OA Imaging
2016, 2017	Distinguished Reviewer – Journal of Magnetic Resonance Imaging
2016	Editors Recognition Award – Current Radiology Reports (Top 10 Most Downloaded Articles)
2017	ISMRM Young Investigator Cum Laude Award (W. S. Moore Award Finalist)
2017	MRM Top-5 (#4) Most Cited Articles of 2014 (ISMRM)
2017	Young Investigator Award – ISMRM Workshop on OA Imaging
2018	Council of Early Investigators in Imaging Travel Award
2019	Distinguished Reviewer – Magnetic Resonance in Medicine
2019	W. S. Moore Award Winner (ISMRM Young Investigator Award) – (Mentor/Co-Author – Akshay Chaudhari)
2019	SCBT-MR Innovations Award (Mentor/Co-Author – Elka Rubin)
2019	Firestone Medal Winner (Top Ten Percent of all Stanford Honors Theses) – (Advisor - Joanna Langner)
2019	Stanford Bio-X Interdisciplinary Initiatives Seed Grants Program Symposium Poster Award (Mentor – Lauren Watkins)

C. Contribution to Science

Simultaneous PET-MR Imaging of Osteoarthritis

New PET/MRI systems can simultaneously assess multiple early morphologic, metabolic, and biochemical markers of knee OA across multiple tissues in the joint. While MRI has been a powerful tool to non-invasively study complex disease processes in soft tissues, its lack of signal in bone has made functional imaging of subchondral bone structures in the knee infeasible. $_{18}$F-NaF PET provides a measure of bone metabolism while $_{18}$F-FDG PET is sensitive to active areas of inflammation. I have demonstrated the feasibility and potential of simultaneous PET/MR hybrid knee imaging. Results show that metabolic activity in subchondral bone lesions (BML, osteophytes, sclerosis) identified on MRI was significantly higher than that of normal appearing bone. Further, my work has shown that $_{18}$F-NaF PET can detect metabolic changes in subchondral bone remodelling which may occur prior to the appearance of structural changes on MRI. Another benefit of hybrid PET-MR imaging of OA is that it uniquely allows the simultaneous evaluation of spatial relationships across tissues. We have demonstrated a correlation between increased $_{18}$F-NaF PET uptake in subchondral bone and increased T_2 relaxation times in adjacent cartilage in patients with unilateral ACL tears, who are known risk of developing early OA. Lastly, I have also work on many of the technical aspects of PET-MR knee imaging including PET photon attenuation by MR hardware and kinetic models of dynamic PET uptake.

1. Haddock B, Fan A, Jorgenson N, Suetta C, Gold G, **Kogan F** (2019). Kinetic [$_{18}$F]-fluoride of the knee in normal volunteers. *Clinical Nuclear Medicine.* 44(5):377-385. PMCID: PMC6449188
2. **Kogan F**, Fan A, Monu U, Iagaru A, Hargreaves B, Gold G (2018). Quantitative Imaging of Bone-Cartilage Interactions in ACL-Injured Patients with PET-MRI. *Osteoarthritis and Cartilage*. 26(6): 790-796. PMCID: PMC6037170

3. **Kogan F,** Fan A, McWalter E, Oei E, Quon A, Gold G. (2017). PET/MR Imaging of Metabolic Activity in Osteoarthritis: A Feasibility Study. *Journal of Magnetic Resonance Imaging,* 45(6):1736-1745. PMCID: PMC5761655
4. **Kogan F**, Broski S, Yoon D, Gold G (2018). Applications of PET-MRI in Musculoskeletal Disease. *Journal of Magnetic Resonance Imaging*. 48(1): 27-47. PMCID: PMC6032526

Fast, Volumetric and Quantitative MRI of Articular Cartilage

Osteoarthritis is the leading cause of disability in developed countries. While knee MRI is commonly performed, there is tremendous demand for imaging markers of OA that can be used to evaluate new drugs and therapies. In its early stages, OA is characterized by an increase in enzymatic degradation in cartilage, resulting in glycosaminoglycan (GAG) depletion. I have led the development, understanding and application of several volumetric quantitative MRI techniques to map GAG content in articular cartilage. I have focused efforts on novel pulse sequence design to use image GAG content in cartilage using exchange between hydroxyl (-OH) protons on GAG and bulk water protons (GagCEST). Additionally, as OA is commonly a bilateral disease, I have implemented hardware modifications and parallel imaging techniques to allow for scanning of both knees simultaneously with similar scan time and SNR compared to single knee acquisitions, while maintaining quantitative accuracy. Lastly, I have worked to develop and translate rapid, comprehensive, and quantitative techniques for clinical MSK imaging to not only reduce scan times but also to improve contrast mechanisms and diagnostic accuracy.

1. **Kogan F**, Levine E, Chaudhari A, Monu U, Epperson K, Oei E, Gold G, Hargreaves B (2018). Simultaneous Bilateral-Knee MR Imaging. *Magnetic Resonance in Medicine*. 80(2): 529-537. PMCID: PMC5910219
2. **Kogan F**, Hargreaves B, Gold G. (2017). Volumetric Multi-Slice GagCEST Imaging of Articular Cartilage: Optimization & Comparison with T1rho. *Magnetic Resonance in Medicine,* 77(3):1134-1141. PMCID: PMC5002392
3. Chaudhari A, Stevens K, Sveinsson B, Wood J, Beaulieu CF, Oei EHG, Rosenberg J, **Kogan F**, Alley M, Gold GE, Hargreaves BA (2019). Combined 5-Minute Double-Echo in Steady-State with Separated Echoes and 2-Minute Proton-Density-Weighted 2D FSE Sequence for Comprehensive Whole-Joint Knee MRI Assessment. *Journal of Magnetic Resonance Imaging*. 49(7):e183-e194. PMID: 30582251
4. Chaudhari A, Fang Z, **Kogan F**, Wood J, Stevens K, Gibbons E, Lee JH, Gold GE, Hargreaves BA (2018). Super-Resolution Musculoskeletal MRI Using Deep Learning. *Magnetic Resonance in Medicine*. 80(5):2139-2154. PMCID: PMC6107420

Loading Effects on Tissue Microstructure and Metabolism

Biomechanics and physiology are known to play a large role in the development of MSK disorders and pathology. However, functional processes remain difficult to study with non-invasive measures and the link between mechanics, physiology and mechanisms of tissue-level disease remain poorly understood. I have sought to develop novel imaging tools, in combination with measures of mechanical loading, to study the effects of biomechanics on tissue function and microstructure. We have shown that acute loading alters the bone physiology affecting ^{18}F-NaF pharmacokinetic rate constants that can be assessed via dynamic PET imaging. Additionally, we have demonstrated that advanced quantitative MRI methods can detect reduced cartilage microstructure degradation in patients undergoing gait retraining compared to an unaltered gait control group. Lastly, we have developed methodology for fast MRI assessment of joint alignment that can be integrated into clinical exams with minimal additional scan time.

1. Haddock B, Fan A, Uhlrich S, Jorgenson N, Suetta C, Gold G, **Kogan F** (2019). Assessment of acute bone loading in humans using [18F]-NaF PET/MRI. *European Journal of Nuclear Medicine and Molecular Imaging.* 46(12):24522-463. PMCID: PMC6813760
2. Watkins L, Haddock B, Uhlrich S, Mazzoli V, Gold GE**, Kogan F**. Sodium Fluoride PET-MRI Detects Regions of Abnormal Bone Response to Acute Exercise. *2019 International Workshop on Osteoarthritis Imaging,* Prince Edward Island, Canada 2019
3. Mazzoli V, Uhlrich S, Rubin E, **Kogan F**, Hargreaves B, Delp S, Beaupre G, Gold G. Gait Retraining as a Conservative Treatment for Medial Knee OA: preliminary findings. *Osteoarthritis and Cartilage.* 2019; 27: s349

4. **Kogan F**, Uhlrich SD, Berkson M, Chaudhari A, Black M, Mazzoli V, Gold GE, Hargreaves BA. Rapid Whole-Leg MRI For Assessment of Leg Alignment. *2019 International Workshop on Osteoarthritis Imaging,* Prince Edward Island 2019

High Resolution Imaging of Muscle Energetics

MR techniques have been used extensively for noninvasive functional investigations of exercising muscle metabolism and are becoming increasingly more important for studying muscular diseases. ^{31}P MRS was the first and is currently the most utilized method to study oxidative metabolism of skeletal muscle but suffers from poor spatial resolution as well as low sensitivity. I developed a new MRI method to image endogenous creatine distribution in skeletal muscle with high spatial resolution. This technique offers the ability to provide key information about primary disorders muscle metabolism and secondary complications associated with heart failure, renal failure, and peripheral vascular disease. This method has also been adapted to study myocardial tissue viability post myocardial infarction.

1. **Kogan F**, Stafford R, Englund E, Gold G, Hariharan H, Detre J, Reddy R. (2017). Perfusion has no effect on the in vivo CEST effect from Cr (CrCEST) in skeletal muscle. *NMR In Biomedicine,* 30(1). PMCID: PMC5518925
2. Haris M, Singh A, Cai K, **Kogan F**, McGarvey J, DeBrosse C, Zsido G, Witschey W, Koomalsingh K, Pilla J, Chirinos J, Ferrari V, Gorman J, Hariharan H, Gorman R, Reddy R. (2014). A Novel Technique for *In Vivo* Mapping of Myocardial Creatine Kinase Metabolism**.** *Nature Medicine*, 20(2):209-214. PMCID: PMC4127628
3. **Kogan F,** Haris M, Singh A, Cai K, DeBrosse C, Nanga RP, Hariharan H, Reddy R. (2014). A Method for high-resolution imaging of creatine in vivo using chemical exchange saturation transfer. *Magnetic Resonance in Medicine*, 71(1):164-72. PMCID: PMC3725192
4. **Kogan F**, Haris M, Singh A, DeBrosse C, Cai K, Nanga RP, Hariharan H, Reddy R. (2014). In vivo CEST Imaging of Creatine (CrCEST) at 3T. *Journal of Magnetic Resonance Imaging*, 40(3):596-602. PMCID: PMC4059780

Endogenous Chemical Exchange MRI

Molecular imaging has the potential for the diagnosis of disease at the earliest causative stages, development of disease biomarkers, characterization of the preclinical stages of metabolic or molecular disturbance, and real-time monitoring of disease progression as well as therapeutic response. While many methods have been proposed for molecular imaging *in vivo,* factors such as suboptimal spatial resolution and the use of invasive contrast agents have limited their application in clinical settings. My early work focused on the development and application of chemical exchange saturation transfer (CEST) techniques that exploit the amine proton exchange phenomenon to quantify endogenous metabolites in biological tissues, in vivo. I developed and patented new MRI techniques that utilize CEST to quantitatively image glutamate in the brain and spinal cord to study glutamate function in the central nervous system as a potential biomarker for diagnosis and treatment of neurologic disorders. Additionally, I created MRI pulse sequence (CESTrho) to optimize contrast for metabolites with faster exchanging spins and to decouple confounding effects of changing pH from measurements of metabolite concentration in studies of stroke and other pH modifying disorders.

1. **Kogan F**, Singh A, DeBrosse C, Haris M, Cai K, Nanga RP, Hariharan H, Reddy R. (2013). Imaging of glutamate in the spinal cord using GluCEST. *Neuroimage*, 77:262-67**.** PMCID: PMC3804007
2. **Kogan F,** Hariharan H, Reddy R. (2013). Chemical Exchange Saturation Transfer (CEST) Imaging: Description of Technique and Potential Clinical Applications. *Current Radiology Reports*, 1(2):102-114**.** PMCID: PMC3665411
3. Cai K, Haris M, Singh A, **Kogan F**, Greenberg JH, Hariharan H, Detre J, Reddy R. (2012). Magnetic Resonance Imaging of Glutamate. *Nature Medicine*, 18(2):302-6. PMCID: PMC3274604
4. **Kogan F**, Singh A, Cai K, Haris M, Hariharan H, Reddy R. (2012). Investigation of Chemical Exchange at Intermediate Exchange Rates using a Combination of Chemical Exchange Saturation Transfer (CEST) and Spin-Locking methods (CESTrho). *Magnetic Resonance in Medicine,* 68(1):107-19. PMID: PMC3564676

Complete List of Published Work in MyBibliography:

http://www.ncbi.nlm.nih.gov/sites/myncbi/feliks.kogan.1/bibliography/48530132/public/?sort=date&direction=descending

D. Research Support

Ongoing Research Support

R00 EB022634-03 (PI: Feliks Kogan, Ph.D) 8/1/19 – 4/30/22
NIH/NIBIB
Quantitative Assessment of Early Metabolic and Biochemical Changes in Osteoarthritis
This project aims to Develop new, quantitative, and simultaneous PET-MR Imaging methods to evaluate metabolic and cellular changes in cartilage and bone as well as spatial relationships between the two tissues in early osteoarthritis
Role: Principal Investigator

R01 EB002524-11 (PI: Garry Gold, M.D.) 4/01/15-1/31/21
NIH/NIBIB
Osteoarthritis: Quantitative Evaluation of Whole Joint Disease with MRI
The goal of this proposal is to develop and validate a comprehensive examination of osteoarthritis, which is a leading cause of chronic disability on the United States.
Role: Co-Investigator

R01 AR074492-01A1 (PI: Garry Gold, M.D.) 07/01/2019 – 06/30/2024
NIH/NIAMS
Development of Sodium Fluoride PET-MRI for Quantitative Assessment of Knee Osteoarthritis
This project seeks to develop PET-MRI methods to sensitively track OA changes in response to biomechanical loading
Role: Co-investigator

R61 HL146775-01A1 (PI: Seda Tierney, M.D.) 3/2012 - 2/2021
NIH/NHLBI
Title: RE-ENERGIZE FONTAN - RandomizEd Exercise INtERvention desiGned to MaximIZE Fitness in Pediatric FONTAN patients
Goals: A milestone-driven, randomized controlled trial in pediatric Fontan patients to test the hypothesis that a live-video-supervised exercise (aerobic + resistance) intervention will improve cardiac and physical capacity, muscle mass, strength and function, and endothelial function.
Role: Co-Investigator

Sponsored Project (PI: Richard Reimer, M.D.) 9/2019– 8/20192
Cystinosis Research Foundation
The effect of resistant exercise on muscle dysfunction in cystinosis
To addresses progressive muscular dysfunction in cystinosis by studying the effect of high intensity exercise with respect to overall muscle function and especially muscle mitochondrial function in the disease.
Role: Co-Investigator

Sponsored Project (PI: Garry Gold, M.D.) 9/1/17-8/31/20
General Electric Healthcare
Knee and Patellofemoral Overload and Articular Cartilage Injuries: Advanced Imaging Protocol Study
Acquire high-quality advanced longitudinal MRI data in basketball players and correlate the microstructural changes seen in cartilage, meniscus, subchondral bone, tendon, and other tissues with activity tracking.
Role: Co-Investigator

Completed Research Support:

T32 CA074781-04 (PI: Felix Wehrli, Ph.D.) 03/2010-02/2012
Title: Training in Quantitative Magnetic Resonance Imaging
Goals: Training in quantitative MRI methodology focusing on MR image acquisition, reconstruction and postprocessing tools for diagnosis and treatment monitoring
Role: Predoctoral Trainee

Howard Hughes Medical Institute Interfaces Fellowship 08/2007-07/2009

Title: Predoctoral Training in Clinical Imaging and Information Sciences
Goals: Immersive medical school coursework concomitant with advanced training in imaging to develop hypothesis-driven, clinically focused biomedical imaging research
Role: Graduate Fellow