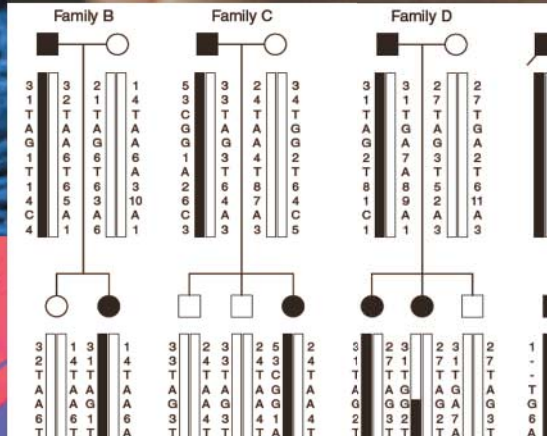
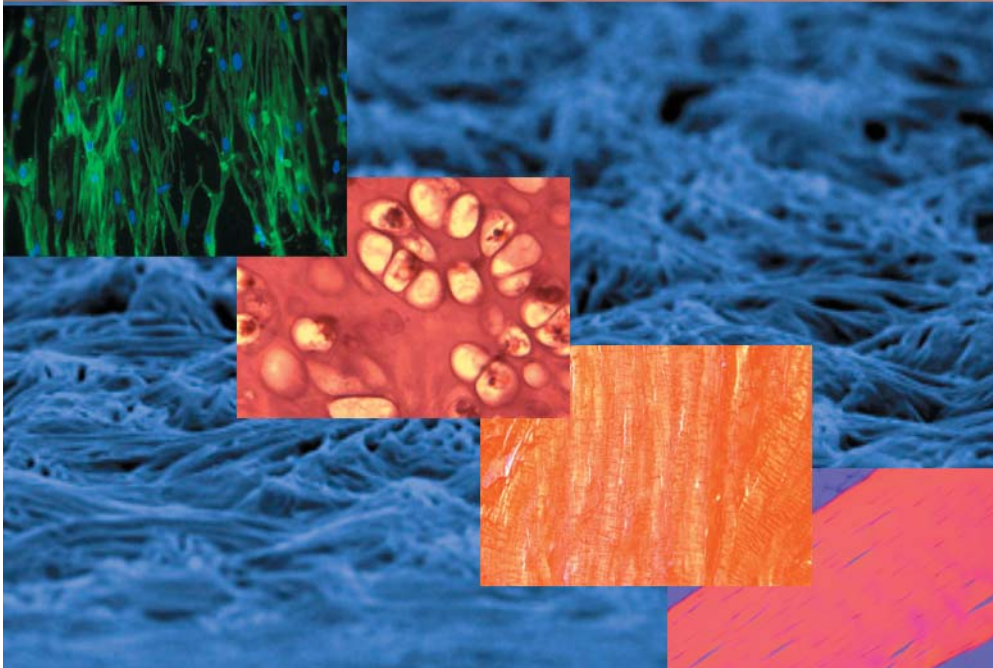
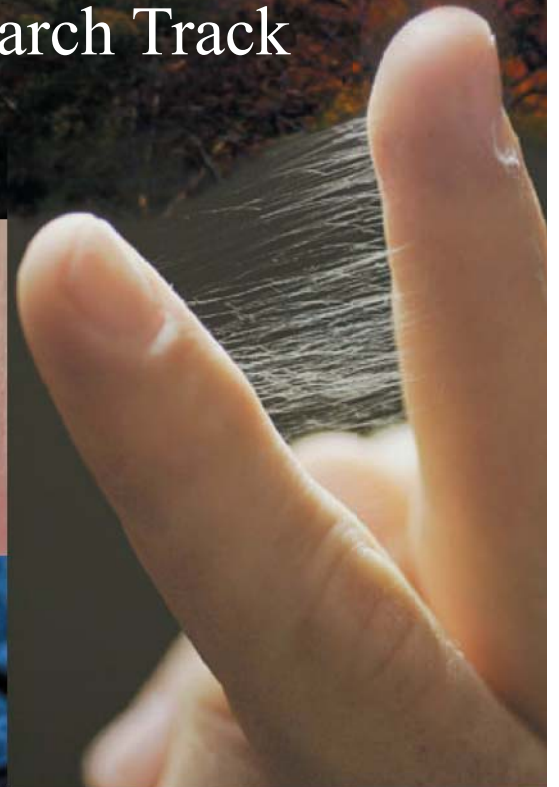




# Penn

## McKay Orthopaedic Surgery Research Laboratory Six Year Residency Research Track



## Message from the Research Director



Dear Resident Applicant:

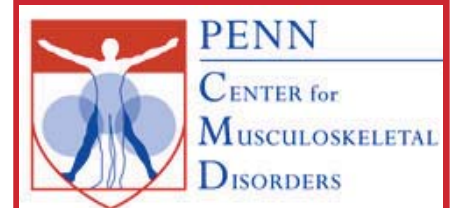
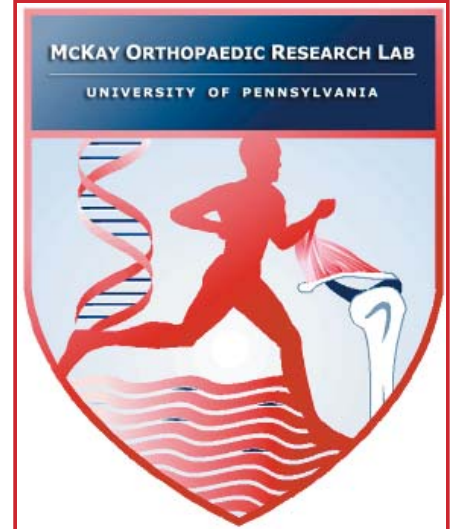
It is my pleasure to introduce you to the many opportunities and varied research activities in the Department of Orthopaedic Surgery at the University of Pennsylvania through the McKay Orthopaedic Research Laboratory. In particular, our Department offers a "six year" residency program which includes a full year of research after the PGY2 year. The areas of concentration in

the lab include bioengineering, biomechanics, biochemistry, cell and molecular biology, tissue and cell culture, histology and microscopy, in vivo human and animal studies along with many others to provide you with endless possibilities. Our dedicated facilities and personnel are committed to fostering an inviting, intellectually thriving, clinically motivated, and fun environment for resident trainees. The "six year" program represents an outstanding opportunity, particularly for the applicant who is seriously considering a future in academics. With a distinct focus on education and research training, our faculty is dedicated to providing you with a range of experiences in research methods, principles and practice in order to share the building blocks for modern orthopaedic practice with you. You will learn to conduct high quality publishable research in an area of your choosing and have experience with grant and paper reviewing and writing, presentations, research ethics, principles of clinical research, etc. Anchored in the world-renowned University of Pennsylvania School of Medicine, the laboratory is a part of the larger University setting offering limitless opportunities and experiences. I invite you to explore our lab's website at <http://www.uphs.upenn.edu/orl>, our News & Awards section at <http://www.uphs.upenn.edu/orl/news.shtml> and the department's site for our residents at <http://www.uphs.upenn.edu/ortho/residents> as well as contact us for a personalized view of our program. I look forward to speaking with you further.

With best regards,

Louis J. Soslowsky, Ph.D.  
Professor of Orthopaedic Surgery and Bioengineering  
Vice Chair for Research, Dept. of Orthopaedic Surgery  
Director of McKay Orthopaedic Research Laboratory  
Director of Penn Center for Musculoskeletal Disorders

McKay Orthopaedic Research Laboratory



## Brief History

The McKay Orthopaedic Research Laboratory was established in 1960, through the efforts of Dr. Edgar L. Ralston, Chair of the Department of Orthopaedic Surgery. One of the cornerstones of the laboratory has always been the education and training of orthopaedic surgery residents in basic science and clinical research.

During its formative years, the lab experience was a requirement for all residents. As the challenges and demands of modern orthopaedic practice have changed, the laboratory experience has evolved to offer an additional year of laboratory training for two orthopaedic residents annually. The year of 1997 marked a period of advancement in the laboratory with the recruitment of Louis J. Soslowsky, PhD from the University of Michigan. Dr. Soslowsky joined Dr. Frederick S. Kaplan as Director of the McKay Orthopaedic Research Laboratory. With the direction of Dr. Soslowsky and the establishment of the Center for Research in FOP and Related Disorders under Dr. Kaplan, the musculoskeletal research opportunities at McKay continued to advance on multiple levels. Through the efforts of a dedicated faculty, generous benefactors and in conjunction with the larger University community, the educational and research training efforts in the laboratory have experienced sustained growth in programs, faculty, facilities and opportunities.

Funding for the McKay Orthopaedic Research Laboratory comes from a variety of sources including the National Institutes of Health, National Science Foundation, National Aeronautic and Space Administration, Orthopaedic Research and Education Foundation, the American Society for Surgery of the Hand, the American Orthopaedic Society for Sports Medicine, International Fibrodysplasia Ossificans Progressiva Association, several companies (orthopaedic, biotech, pharmaceutical), private donations and the Department of Orthopaedic Surgery. The Department of Orthopaedic Surgery at Penn is currently ranked 5th in NIH funding for orthopaedic surgery departments nationally. In July 2006, the University of Pennsylvania School of Medicine received a \$3.2 million grant to create the Penn Center for Musculoskeletal Disorders with Dr. Soslowsky as the Founding Director. Penn joins only four other such centers in the United States.

Currently, there are two major groups in the McKay Laboratory; Bioengineering, led by Dr. Soslowsky, and the Center for Research in FOP and Related Disorders, led by Dr. Kaplan. The Bioengineering group is further categorized into research teams that focus on rotator cuff pathology and tendon healing, articular cartilage and meniscal functional tissue engineering, and intervertebral disc injury and healing models.

From the humble beginnings of a two room laboratory in 1960, the McKay Laboratory evolved to its current site with over 11,500 square feet of space encompassing twelve research suites, each with one or more labs, offices and storage space and annual extramural budget of over \$5,000,000. The multidisciplinary efforts of the dedicated basic science and clinical faculty have helped to shape the vision and establish the programs which have helped to make The McKay Orthopaedic Research Laboratory one of the preeminent orthopaedic laboratories in the country.

# The Faculty

There are many collaborative research faculty within and outside the Department of Orthopaedic Surgery. These include orthopaedic surgeons, cell and molecular biologists, bioengineers, geneticists, radiologists, and others. The following faculty have full-time appointments in the McKay Orthopaedic Research Laboratory.

Louis J. Soslowsky, PhD  
Professor of Orthopaedic Surgery and Bioengineering  
Vice Chair for Research – Department of Orthopaedic Surgery  
Director of Penn Center for Musculoskeletal Disorders  
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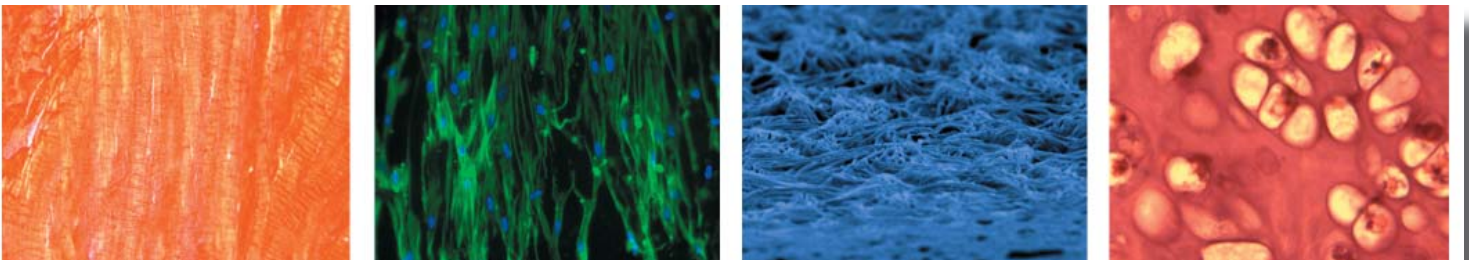
## Research Summary

Dr. Soslowsky is a bioengineer whose research is focused on orthopaedic biomechanics and functional tissue engineering. In particular, he evaluates mechanisms of injury, healing, repair, and regeneration of tendons and ligaments and has an active program on the biomechanics of the shoulder joint. Recent projects include the use of transgenic mouse models for structure-function and healing studies, understanding mechanisms of scarless healing in fetal tendons, and use of the rat model to investigate fundamental mechanisms of rotator cuff injury and repair.

Dawn Elliott, Ph.D.  
Associate Professor of Orthopaedic Surgery and Bioengineering  
[delliott@mail.med.upenn.edu](mailto:delliott@mail.med.upenn.edu)

## Research Summary

Dr. Elliott is a bioengineer whose research is focused in orthopaedic biomechanics. Her particular research interest is degeneration and restoration of the intervertebral disc. Dr. Elliott uses mathematical modeling and mechanical testing of human and animal disc tissue to study mechanisms for the initiation and progression of disc degeneration, the role of mechanical factors in degeneration, and structure-function relationships in normal and degenerative discs. Recent advances include a rat model of degeneration that isolates mechanical factors in the disorder, quantifying fiber re-orientation under load and nucleus pulposus compression mechanics, and fiber orientation changes with disc degeneration. Advances in constitutive modeling demonstrate the functional significance of these experimental findings in disc structure-function.



Robert Mauck, Ph.D.  
Assistant Professor of Orthopaedic Surgery and  
Bioengineering  
[lemauck@mail.med.upenn.edu](mailto:lemauck@mail.med.upenn.edu)



#### Research Summary

Dr. Mauck is a bioengineer whose research is focused on the tissue engineering of orthopaedic soft tissues. His particular interests are in the production of engineered articular cartilage and meniscus constructs with functional mechanical properties designed to withstand the demanding *in vivo* loading environment of the joint. Dr. Mauck specializes in the design of mechanical bioreactor systems for optimizing growth of these constructs *in vitro*, with particular focus on instilling fiber anisotropy with mechanical stimulation. In addition, he focuses on the incorporation of mesenchymal stem cells for fibrocartilaginous tissue engineering. Recent advances in this area include demonstrating that mesenchymal stem cells in hydrogel culture that have undergone chondrogenic differentiation are less efficient at producing functional mechanical properties compared to fully differentiated chondrocytes, but are sensitive to the mechanical loading environment. Dr. Mauck has also recently developed a novel method for creating three-dimensional biodegradable nanofiber meshes, which have controlled anisotropic fiber alignment and mechanical properties, for use in meniscus tissue engineering.

Frederick S. Kaplan, MD

The Isaac and Rose Nassau Professor of Orthopaedic Molecular Medicine  
Chief of the Division of Metabolic Bone Diseases and Molecular Orthopaedics  
Director of the Center for Research in FOP and Related Disorders  
[Frederick.Kaplan@uphs.upenn.edu](mailto:Frederick.Kaplan@uphs.upenn.edu)

#### Research Summary

Dr. Kaplan is an academic orthopaedic surgeon/molecular biologist whose research is dedicated to understanding the molecular genetics of normal and disordered bone induction and to designing rational molecular diagnostic and treatment strategies for a wide range of developmental disorders of the skeleton in humans. Research is currently focused on the inherited disorder of ectopic bone formation in humans called fibrodysplasia ossificans progressiva (FOP).

Eileen M. Shore, PhD

Research Associate Professor of Orthopaedic Surgery and Genetics  
Co-Director of the Center for Research in FOP and Related Disorders  
[shore@mail.med.upenn.edu](mailto:shore@mail.med.upenn.edu)

#### Research Summary

Dr. Shore is a molecular biologist whose research investigates the genetics and molecular biology of normal and misregulated osteoblast differentiation. Her goals, through studies on human genetic diseases of extra-skeletal bone formation (FOP and POH), are to identify the genetic causes and cellular pathways that induce bone development and formation in these disorders. Recent advances include discovery of mutations in the *GNAS* gene in patients who have progressive osseous heteroplasia (POH) and identification of altered gene expression and protein function. Continued studies of the genetics of POH and the role of *GNAS* in osteoblast differentiation are a major focus of her current work. Additional areas of research include determining gene mutations in FOP through genetic and genomic approaches, investigating differential expression of altered BMP receptor-mediated signal transduction in FOP, and identifying cells that abnormally differentiate into cartilage and/or bone in FOP and POH.

## Program Overview for Orthopaedic Resident Six Year Program

Each year the Orthopaedic Surgery Residency Program at the University of Pennsylvania accepts eight applicants; six residents match to enter the 5-year program and two match into the 6-year track. Each resident applicant has the option to rank the 6-year research track as a separate, additional match number. The lab year begins at the conclusion of the PGY-2 year and is considered dedicated research time with no clinical or call responsibilities. Each lab resident has the opportunity to choose which division of the lab is most suited for his or her career development and interests. The minimal requirement is involvement as an active member of one research team. If residents choose to design their own projects in addition to participating in ongoing research, mentorship and guidance can be sought out from the several principal investigators at McKay.

*"The lab year was, hands down, the most valuable, most inspiring, and most diverse year I was afforded as a resident. Not only did I participate in a number of basic science and clinical research projects, but I had the opportunity to lay the foundation for a CAREER in orthopaedic surgery. I truly believe that I have been able to build both my personal and professional life, in large part, due to the immense mentoring, responsibility, and skill set I was a part of during my year in the lab. As I embark on an academic career in orthopaedictraumatology, I would choose to do the extra year again in a heartbeat!"*

*"The lab experience was a valuable one because it opened my eyes to avenues in orthopaedics that were previously unknown or unavailable. There are very few programs where both biomechanics & molecular orthopaedics are such a focus of an orthopaedic residency."*

*"I could not have asked for a better experience during my research year. What stood out most to me was the diversity of opportunities I was exposed to. On the research side, I was able to become heavily involved in both basic science and clinical research and develop my skills in areas such as grant writing, project design, and data interpretation. This led to multiple opportunities to present on a national and local level, in both basic science and clinical venues. What was most unique about this dedicated year, however, was the opportunity it provided me to pursue areas of academic orthopaedics beyond traditional research, including journal editorial work, teaching, and involvement in both the medical school and residency selection process. Outside of my professional development, the year provided time for my personal life and development not normally afforded during residency training."*

The McKay Orthopaedic Laboratory, located on the University of Pennsylvania campus within the School of Medicine, offers an abundance of opportunities as it is part of the larger University community. The research year, while centered in the lab, affords you the time to explore and develop interests and activities outside of the McKay Laboratory. Residents in the past have pursued clinical research projects, classes at the Wharton School of Business, Penn's Masters program in epidemiology and biostatistics, healthcare policy fellowships through the AAOS, clinical research certification within the Department of Epidemiology and Biostatistics, professional development and educational programs through the Office of Faculty Affairs and Professional Development, the AAOS Clinician Scientist Development Program, AOA-OREF-Zimmer Resident Leadership Forum, OREF grants, healthcare consulting, and University of Pennsylvania Health System administrative fellowships. The depth and breadth of experiences during the lab year is extraordinary, providing a once in a lifetime opportunity. Involvement in such a diverse offering of activities allows residents to develop professionally and acquire the skill sets necessary to become effective leaders at the forefront of orthopaedic surgery.

## Recent Orthopaedic Laboratory Residents

Lab Year	Resident	Current Position	Projects
1996 1997	David Glaser, MD Cornell University	Assistant Professor, Orthopaedic Surgery, University of Pennsylvania	BMP4 Gene Expression in FOP
	Matthew Pepe, MD Georgetown University	Assistant Professor of Orthopaedic Surgery at Thomas Jefferson University Hospital	
	Rich Seldes, MD University of Pennsylvania	Private Practice, New York, NY	
	Virak Tan, MD University of Pennsylvania	Associate Professor, Department of Orthopaedics, New Jersey Medical School	
1997 1998	Kirk Wong, MD Loma Linda University	Private Practice, Vancouver, WA	
1998 1999	George Yeh, MD Yale University	Private Practice, Potomac Valley MD	Cbfa1 Gene Expression in a Patient with Osteoma Cutis
1998 1999	Adil Esmail, MD University of Pennsylvania	Clinical Instructor, UCLA, Orthopaedic Surgeon, Kaiser Permanente	Shoulder Animal Model: The Role of Etiologic Factors for Tendon Degeneration
	Ricky Placide, MD Eastern Virginia Medical School	Private Practice, Richmond, VA	A Repair of the Hip's Short External Rotators with a New Suture Anchor
1999 2000	Kevin McGuire, MD, MBSE University of Pennsylvania	Instructor, Harvard Medical School	Structure Function Relationships in Tendon using a Transgenic Mouse Model
	Paul Reynolds, MD University of Virginia	Private Practice, Colorado Springs, CO	
2000 2001	Joseph Abboud, MD Georgetown University	Clinical Assistant Professor, University of Pennsylvania	Structure-Function Relationships in Tendon: Role of Tissue Organization
	Rajesh Patel, MD Northwestern University	Private Practice, Beckley, WV	
2001 2002	Selene Parekh, MD, MBA Boston University School of Medicine	Assistant Professor, University of North Carolina	Overuse Tendon Injury in a Rat Rotator Cuff Model
	Samuel Young, MD University of Texas, SW	Assistant Professor, University of Florida College of Medicine	

Lab Year	Resident	Current Position	Projects
2002 2003	Samir Mehta, MD Temple University	Assistant Professor, University of Pennsylvania	The Role of Structure and Function in Mouse Tail Tendon Fascicle Model
	Nader Hebel, MD University of Pennsylvania	Assistant Professor, University of Pennsylvania	BMPRIA Expression in Peripheral Blood Cells in FOP
2003 2004	David Pedowitz, MD Hahnemann University	Foot & Ankle Fellow, Dr. Roger Mann	<ul style="list-style-type: none"> <li>• Achilles Tendon Healing without Adhesions Using No-React Patch</li> <li>• MRI and Gross Morphology Comparisons in Disc Degeneration</li> </ul>
	Brett Gibson, MD University of Pennsylvania	Sports Medicine Fellow	Origin of Cells in Fracture Healing and Cell Lineage Participation in Fracture Healing
2004 2005	Josuha Auerbach, MD Mt. Sinai Medical College	Orthopaedic Surgery Resident	Mechanical Loading of Total Disc Replacements
	Sudheer Reddy, MD Albany Medical College	Orthopaedic Surgery Resident	Role of IL-10 on Tendon Healing
2005 2006	Eric Richetti, MD University of Pennsylvania	Orthopaedic Surgery Resident	Roles of IL-10 and HA on Tendon Healing
	Neil Sheth, MD Albany Medical College	Orthopaedic Surgery Resident	Fixation of Tissue Engineered Scaffolds to the Native Meniscus
2006 2007	Jonathan P. Van Kleunen, MD University of Pennsylvania	Orthopaedic Surgery Resident	Effect of Crosslinking on Tendon Mechanics
	Meira Z. Yeger-McKeever, MD University of Medicine and Dentistry, NJ	Orthopaedic Surgery Resident	Influence of Inflammatory Cytokines on Development of Stem Cell Based Engineered Cartilage
2007 2008	Andrew Kuntz, MD University of Virginia	Orthopaedic Surgery Resident	
	Albert Gee, MD Washington University St Louis	Orthopaedic Surgery Resident	

On Sunday, April 23, 2006 at 6 PM GMT, a brief article was published online by the prestigious journal *Nature Genetics* (*Nat Genet.* 2006 May;38(5):525-7), and marked the moment that a team of researchers from the University of Pennsylvania Department of Orthopaedic Surgery and their international collaborators from five continents (North America, South America, Europe, Asia, and Australia) discovered the gene responsible for inherited and sporadic fibrodysplasia ossificans progressiva (FOP). This article, which represents the fruit of 15 long years of labor, marks a landmark discovery in the genetic understanding of bone formation. As Dr. Thomas Einhorn, the chairman of Orthopaedic Surgery at Boston University wrote: "The contribution of this discovery to the understanding of FOP and the ripple effects this will have on our understanding of bone biology in general are enormous."

# Participation in the Orthopaedic Resident Six Year Program

Application to the 6-year program has been streamlined and is incorporated into your interview experience. Each year, the individuals interested in the opportunity of a dedicated research year make their desire known in a number of ways. Many individuals contact Dr. Soslowsky or other faculty in advance of their interview day to ask questions, explore the opportunities and refine their options. Others make a personal visit to the lab before, during or after their interviews. Individuals interested in the lab experience are also frequently connected with faculty members and residents, providing a friendly and insightful experience.



When you arrive for your interview, you will be afforded the opportunity to identify your interest in the six year program. We invite you to visit the McKay Orthopaedic Research Laboratory web site for more detailed information [www.uphs.upenn.edu/orl](http://www.uphs.upenn.edu/orl) about the lab and the Department web site for residents at [www.uphs.upenn.edu/ortho/residents](http://www.uphs.upenn.edu/ortho/residents) .

## Contact Information

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