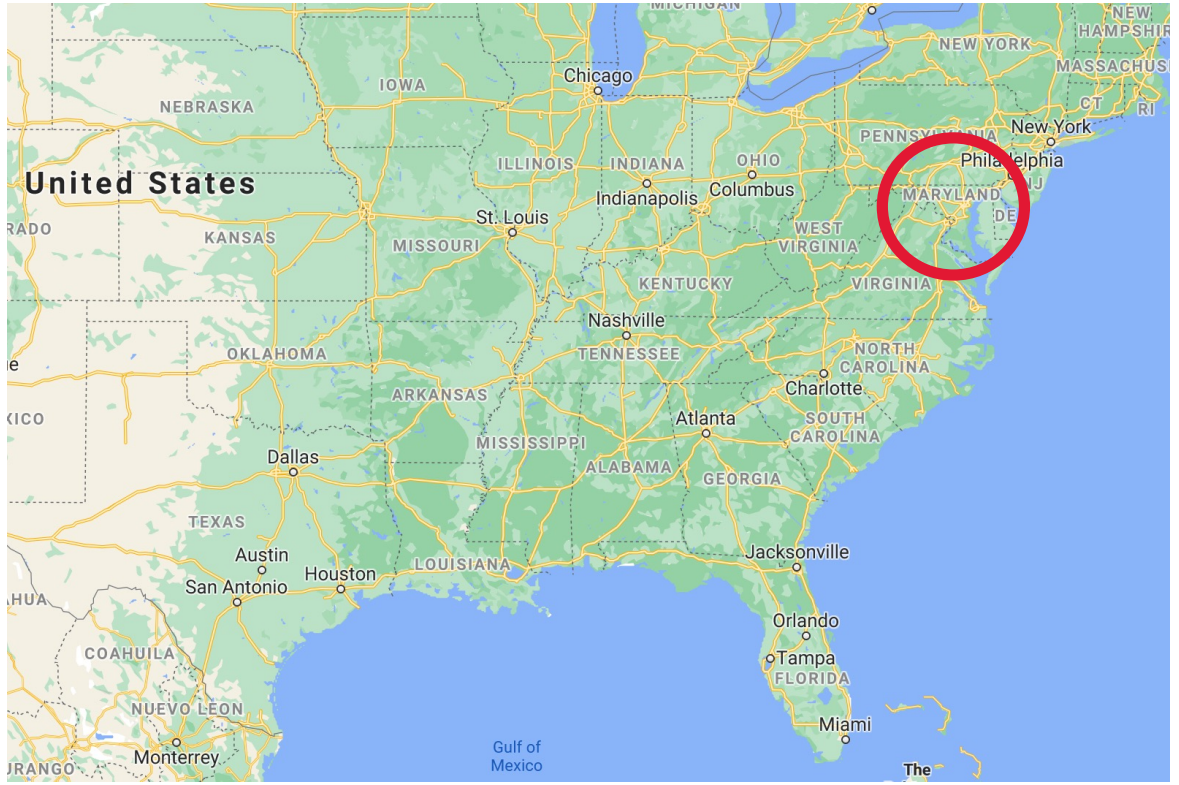
Biophysics & Chemical Physics

GRADUATE PROGRAMS

2023 VIRTUAL OPEN HOUSE

WHY UMD? LOCATION

- Monuments & museums in DC (free!)
- Seasonal, but comfortable climate year-round
- Beaches (MD/DE) and mountains (VA) are just 2-3 hours drive away
- Mid-Atlantic cities: NYC, Philadelphia, Washington DC



WHY UMD? CONNECTIONS

- UMD is less than 5 miles from Washington, DC
- Funding agencies (NSF, DOE)
- Defense contractors (DoD)
- Chemical industry (DE, PA, NJ, NY)
- Medical & drug research (NIH, FDA, CNMC, WRAIR)

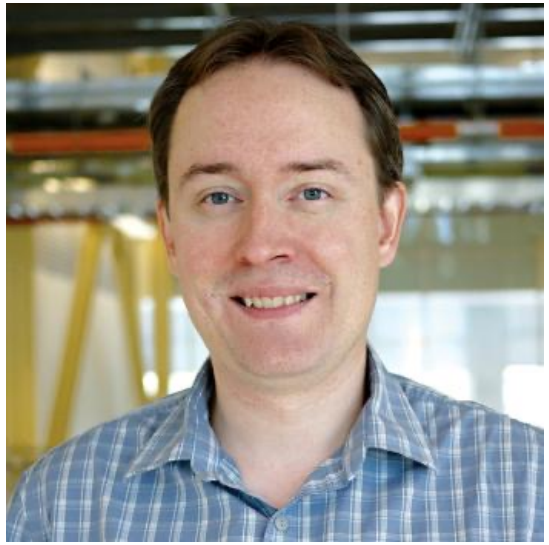
BIOPHYSICS ›

BIOPHYSICS DIRECTORS

Arpita Upadhyaya

Co-Director of BIPH

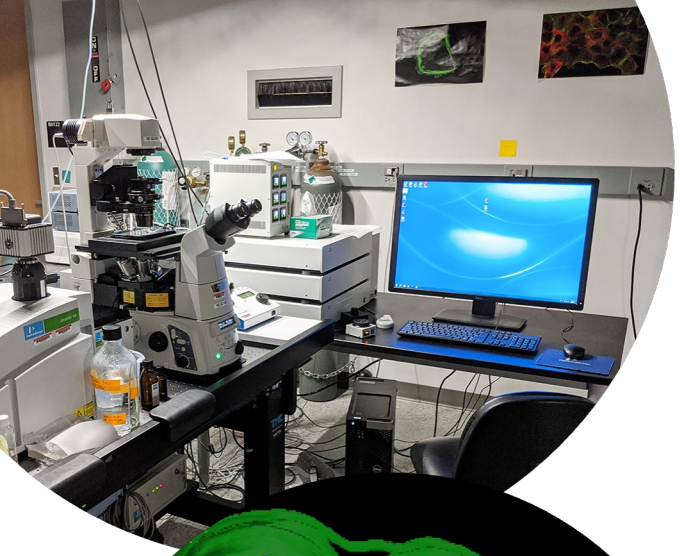
Professor in **IPST** and **Physics**

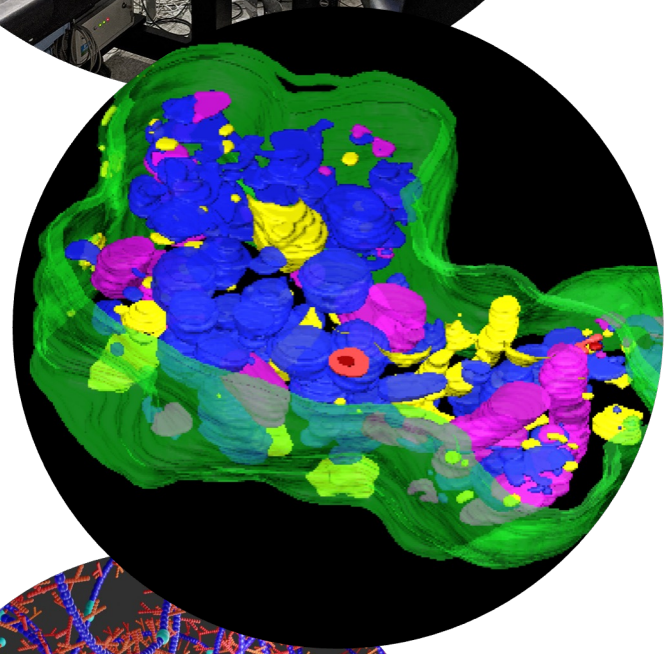


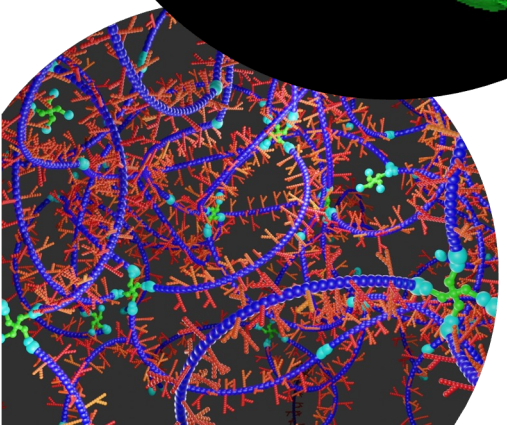
Jeffery Klauda

Co-Director of BIPH

Professor in **IPST** and **Chemical & Biomolecular Engineering**







BIOPHYSICS

- **Faculty from many different departments:**
  - College of Computer, Mathematical, and Natural Sciences: **Biology**, **Cell Biology**, **Chemistry & Biochemistry**, **Mathematics**, **Physics**
  - A. James Clark School of Engineering: **Bioengineering**, **Chemical & Biomolecular Engineering**
- **Research areas span a broad range of topics.**
- Graduate students use **theoretical and computational methods** in combination with **cutting-edge experimental techniques** to solve outstanding problems in **biology**, **biomedicine**, and **bioengineering**.

BIOPHYSICS

TYPICAL TIMELINE

Average time to degree is 6 years

YEAR 1	Fall & Spring	• Take courses, TA, and do lab rotations
	Summer	• Full-time focus on research (work hard and make initial progress) • Qualifying Exam (August - September)
YEAR 2	Fall & Spring	• Continued focus on research
	Summer	• Make significant headway on research
YEAR 3	~End of Semester 5	• Write & defend Preliminary Research Paper (PhD Proposal) • Advance to Candidacy
	• Submit manuscripts and go to conferences	
YEARS 4-6	• Finalize research, write, and defend dissertation • Find a job	

BIOPHYSICS

PROGRAM REQUIREMENTS

Candidacy Requirements:

- Courses:
  - Laboratory Rotations
  - Biophysics Seminar
  - Cell Biology
  - Chemical Thermodynamics
  - Statistical Mechanics
  - Elective related to research area
- Oral Qualifying Exam
- Write & defend Preliminary Research Paper (Ph.D. Proposal)

Ph.D. Requirements:

- 12 credits of BIPH899 (2 semesters of dissertation research)
- Written dissertation and oral defense

BIOPHYSICS LABORATORY ROTATIONS

Format:

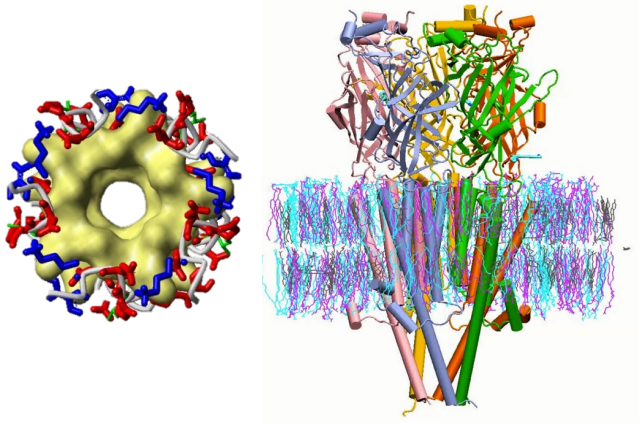
- 3 lab rotations in the first year: Fall, Winter, Spring
- Research presentations at the end of each rotation
- Students contact Biophysics faculty that they are interested in doing rotations with
- Summer research advisor is determined after last rotation

Why?

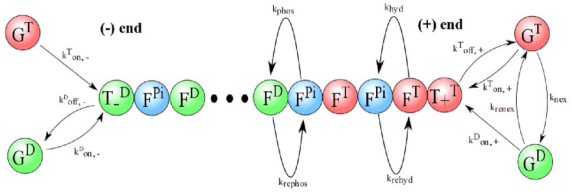
- Hands-on experience working in a potential advisor's lab
    - Better understanding of lab culture and research
- Faculty will get to know you
- Help you decide between experimental vs. computational research

Research Activities in the Biophysics Program

Protein/Membrane Structure/Dynamics



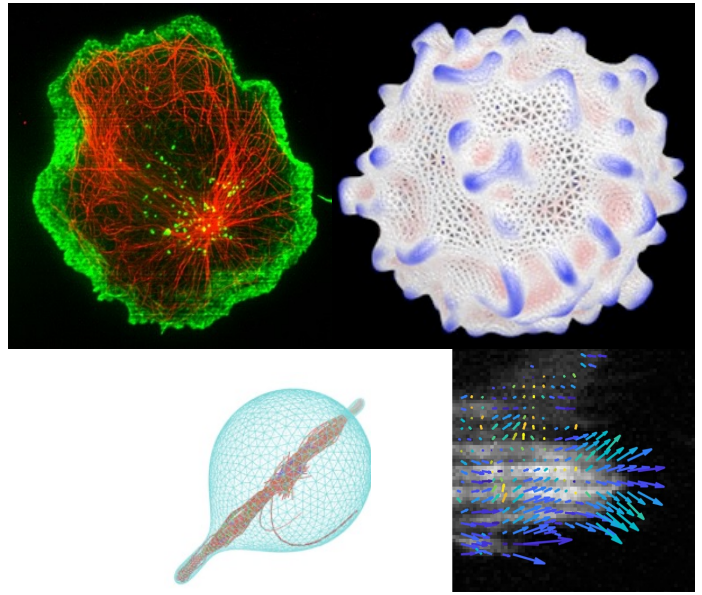
Statistical Physics



$$S_{\text{prop}}(\lambda, \delta\lambda) = \frac{1}{|\delta\lambda|}(\langle f^{\text{sim}}\rangle_{\lambda+\delta\lambda} - \langle f^{\text{sim}}\rangle_{\lambda})$$

$$= \frac{1}{|\delta\lambda|}\left(\frac{\langle f^{\text{sim}} e^{-\beta(U_{\lambda+\delta\lambda}-U_{\lambda})}\rangle_{\lambda}}{\langle e^{-\beta(U_{\lambda+\delta\lambda}-U_{\lambda})}\rangle_{\lambda}} - \langle f^{\text{sim}}\rangle_{\lambda}\right)$$

Cell Mechanics and Dynamics



National Lab Partnerships

NIH

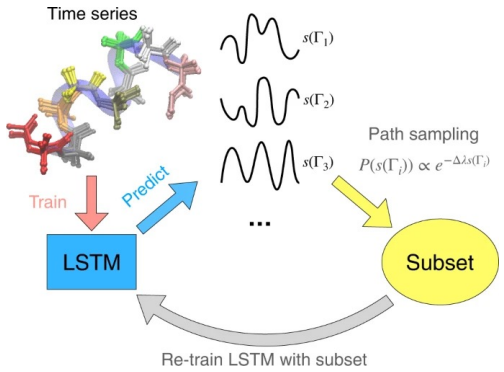
NIST National Institute of Standards and Technology U.S. Department of Commerce

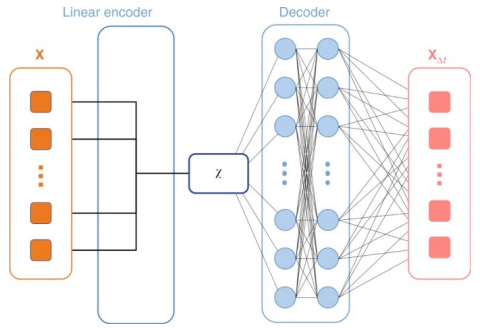
NATIONAL CANCER INSTITUTE

Collaborations with other institutes: NHLBI, NICHD, etc.

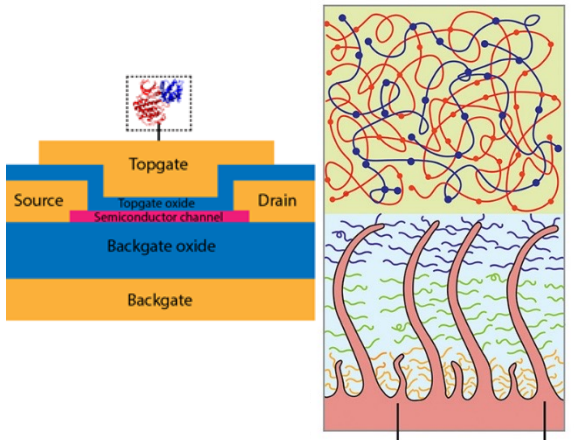
BIPH @ UMD

Machine Learning/Artificial Intelligence





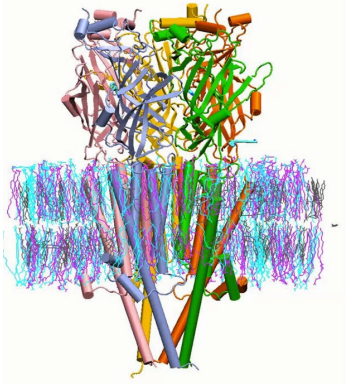
Nanomaterials/Biosoft Matter



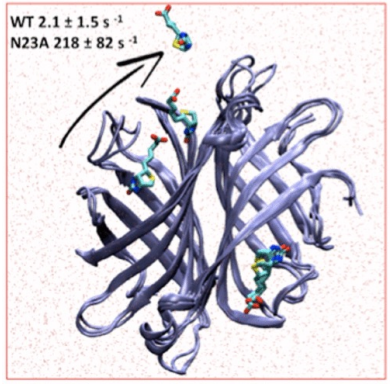
BIOPHYSICS

COMPUTATIONAL RESEARCH

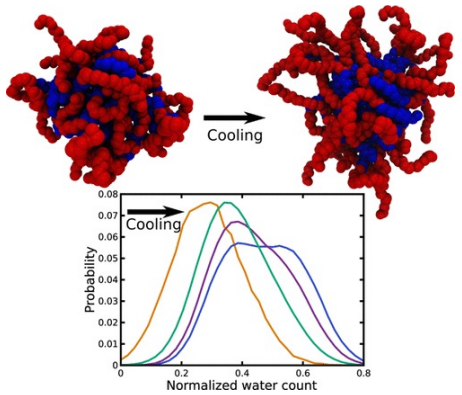
High Resolution: Quantum, atomic detail, and molecular levels



Jeff Klauda

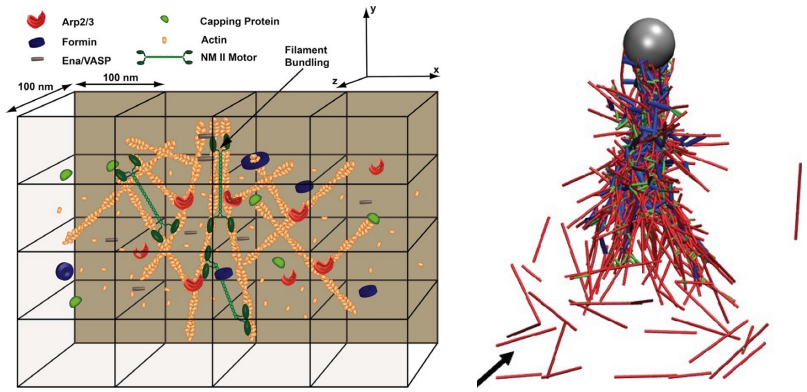


Pratyush Tiwary

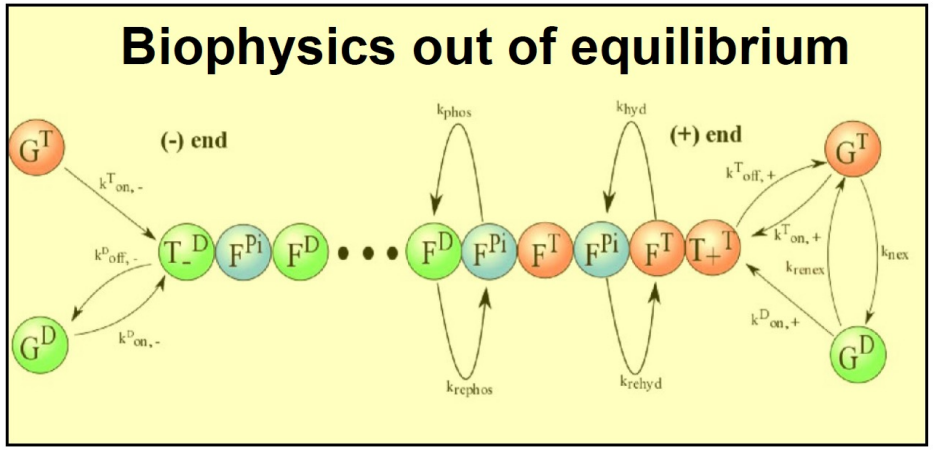


Silvina Matysiak

Coarse Resolution & Theoretical: Cell mechanics, systems-level biology, and developing theories across levels



Garegin Papoian



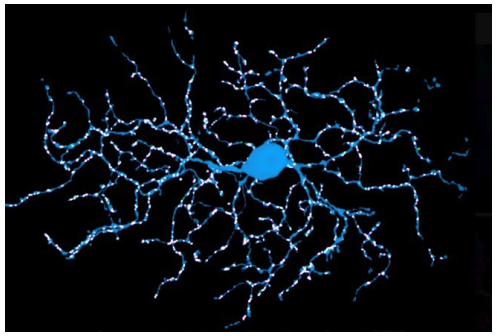
Chris Jarzynski

BIOPHYSICS EXPERIMENTAL RESEARCH

Biophysics research at the interface: across multiple scales

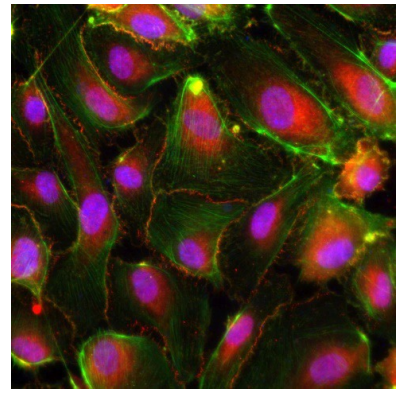
Colenso Speer

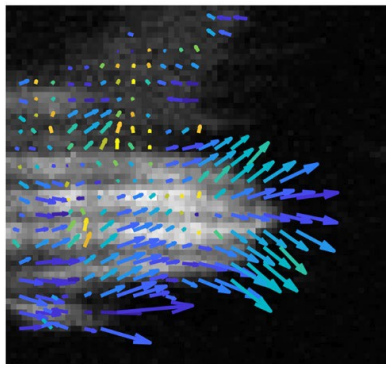
- Molecular and structural basis of developing neural circuits
- Super-resolution imaging of synaptic connectivity and function in neurons



Kimberly Stroka

- Cellular microenvironment engineering
- Interplay of chemical and mechanical cues in disease



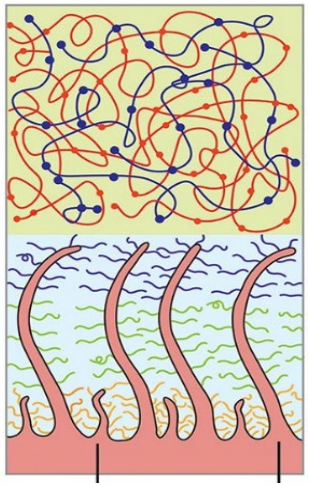


Wolfgang Losert

- Dynamics of complex biological systems
- How topography and electric fields modulate cell migration

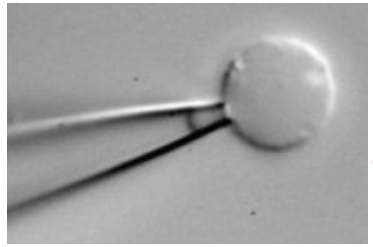
Gregg Duncan

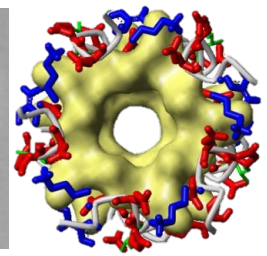
- Lung airway microphysiology
- Nanomaterials and soft matter approaches for interfacial interactions in lung airway surfaces



Sergei Sukharev

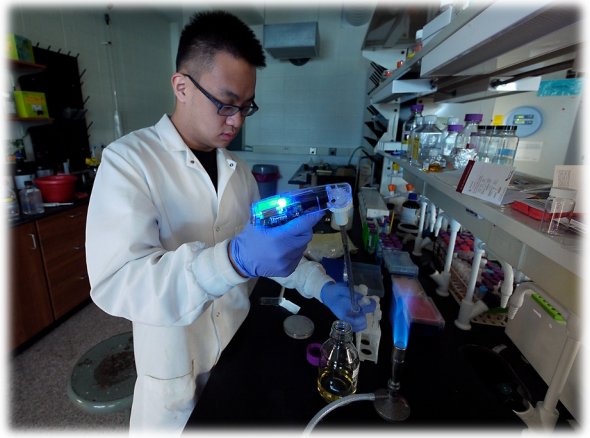
- Biophysics of mechano-sensation and osmoregulation
- Structure function relationships in mechanosensitive channels





BIOPHYSICS

RESEARCH IN & AROUND UMD



NIH NATIONAL CANCER INSTITUTE

NCI-UMD PARTNERSHIP FOR INTEGRATIVE CANCER RESEARCH

WRAIR
Walter Reed Army Institute of Research
Defense Health • Global Health

Children's National

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

BIOPHYSICS

WEEKLY SEMINAR

- Biophysics Seminars on cutting-edge research topics from top scientists in the field
- Student lunch with speaker on the day of seminar
- Opportunity for students to interact with national and international scientists from many institutes

BIOPHYSICS ALUMNI INITIAL PLACEMENTS

Hongdian Yang – Faculty member at University of California, Riverside

Ruillang Bai – Faculty position at Zhejiang University, China

Shaon Chakraborty – Faculty position at National Center for Biological Sciences, India

Kyemyung Park – Faculty member at Yonsei University, Korea

Xue Fei – Postdoctoral Fellow at MIT

Eleanor Ory– Postdoctoral Fellow at University of Maryland School of Medicine

Huong Vu – Postdoctoral Associate at University of Texas, Austin

Jonathan Cwik – Postdoctoral Associate at MRC Laboratory of Molecular Biology, UK

Haiqing Zhao – Postdoctoral Associate at Columbia University

Alison Leonard – Postdoctoral Associate at University of Delaware

Hongcheng Xu – Software Engineer at Google

Hao Wu – Postdoctoral Position at Cornell Medical School

Stephanie Miller – Postdoctoral Researcher at University of California San Francisco

Simona Patange – Postdoctoral Research Associate at NIST

Deborah Hemingway – CEO at Leon Scientific

John Giannini – Postdoctoral fellow at National Eye Institute

BIOPHYSICS

APPLICATION PROCESS

General Requirements:

- Transcripts
- CV/Resume
- 3 Letters of recommendation
- GRE (optional)
- TOEFL/PTE/IELTS (international students)
- Statement of purpose
- Description of research/work experience
- Description of courses, including textbooks used

Timeline:

- December 15, 2023 – Priority application deadline
- January 5, 2024 – Final application deadline
- February-March - Decisions announced
- April 15, 2024 – Deadline to accept offers of admission