BIOPHYSICS (GRADUATE FIELD)

Program Website (https://cals.cornell.edu/molecular-biology-genetics/academics/graduate/biophysics/)

Field Description

Graduate study in biophysics is interdisciplinary and highly individualized. Students majoring in biophysics are expected to obtain a broad, interdisciplinary knowledge of fundamental principles in both the biological and physical sciences. But because biophysics covers a wide range of areas, it would be unrealistic to expect to master each facet in detail. A student working in the dynamics and motions of DNA will develop a strong background in statistical physics, computational science, and instrumentation, while a student involved in enzyme dynamics studies will develop a strong background in biochemistry, X-ray scattering and crystallography, and cryo-electron microscopy.

At the point of passing the "A" exam -- usually after two years of study -- each student is expected to demonstrate competence in specific subject areas that serve as a foundation for further work. Areas of required competence are: advanced mathematics, physics (i.e., statistical mechanics and quantum mechanics), biology (i.e., biochemistry and molecular cell biology), and advanced studies in molecular biophysics and associated areas of biological and physical sciences (i.e., structural biology, computer literacy, laboratory electronics, and instrumentation).

Biophysics field members are drawn from fourteen departments in seven campus units. In addition to a rich array of instrumentation in the field members labs, shared research facilities available at Cornell to Biophysics students include: MacCHESS (Macromolecular Crystallography at the Center for High Energy Synchrotron Studies); the Biotechnology Resource Center (BRC), which has core facilities in advanced optical imaging and biomolecular analysis, genomics and epigenomics, proteomics and bioinformatics; the Cornell Nanofabrication Facility (CNF); the Cornell NMR and Chemistry Mass Spectrometry Facility; and the Cornell Center for Materials Research (cryo-EM and Surface Analysis and Characterization).

Data and Statistics

- Doctoral Program Statistics (https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/doctoral-program-statistics/?SelectGradField=68)

Field Manual

- Manual (https://biophysics.cornell.edu/graduate-students/)

Subject and Degrees

Biophysics

- Biophysics (PhD) (https://catalog.cornell.edu/programs/biophysics-phd/)

Concentrations by Subject

Biophysics

- biophysics

Faculty

Nozomi Ando (http://ando.chem.cornell.edu/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** our focus lies in understanding enzyme dynamics using a combination of biochemistry and biophysical tools

Barbara Ann Baird (http://chemistry.cornell.edu/barbara-baird/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** structure and molecular mechanisms of cell surface immunoreceptors; protein chemistry

John Woodbury Brady (http://cals.cornell.edu/john-w-brady/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** molecular biophysics; molecular dynamics simulations (MD); neutron diffraction experiments; aqueous solutions; biopolymer interactions; carbohydrates

Richard A Cerione (http://www2.vet.cornell.edu/research/faculty/richard-cerione-phd/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** signal transduction; protein structure; drug design

Peng Chen (http://chemistry.cornell.edu/peng-chen/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** single-molecule microscopy; super-resolution imaging; protein-protein/DNA interaction; single-cell studies; bacterial metal homeostasis; bioenergy conversion

Itai Cohen (http://physics.cornell.edu/itai-cohen/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Origami, origami mechanics, origami metamaterials, origami robotics, complex fluids, colloids, rheology, colloid rheology, shear thickening, tunable shear thickening, shear thinning, confocal rheoscope, SALSA, suspension stresses, cartilage mechanics, cartilage biology, biolocomotion, insect flight, insect flight control, insect neuroscience, plant root growth, most pits, physics of crowds

Brian Crane (http://chemistry.cornell.edu/brian-crane/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** bioinorganic catalysis; protein structure; electron transfer; light and redox sensing

John Brooks Crickard (http://cals.cornell.edu/brooks-crickard/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics

- **Research Interests:** Uses single molecule imaging in combination with genetic approaches to dissect molecular mechanisms of chromosome maintenance and genomic stability

Iwijn De Vlaminck (http://www.bme.cornell.edu/faculty-directory/iwijn-de-vlaminck/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** biophysics, genomics, single cell genomics, molecular diagnostics

Eric Robert Dufresne (http://www.lassp.cornell.edu/people/eric-dufresne/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Physics of biological materials, including biomolecular condensates, cytoskeletal filaments and networks, lipid membranes, and extra-cellular matrix.

Joseph Chris Fromme (http://cals.cornell.edu/chris-fromme/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** protein and membrane trafficking; GTPase signaling; organelle homeostasis; X-ray crystallography; cryo-EM

Andrea Giometto (http://www.cee.cornell.edu/faculty-directory/andrea-giometto/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics:* biophysics
- **Research Interests:** We seek to understand how ecological and evolutionary processes play out in spatially extended populations using quantitative models inspired by statistical and soft matter physics, experiments with microbial populations, genetic engineering and genetics.

Sol Michael Gruner (http://physics.cornell.edu/sol-gruner/)

- **Campus:** Ithaca - (Graduate School Professor)
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** structure and properties of soft matter; biomaterials; x-ray instrumentation and methods

Laura Helen Gunn (http://cals.cornell.edu/laura-gunn/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Study the sequence-structure-function of nature's carbon-fixing enzyme, Rubisco, using structural biology, synthetic biology and protein engineering approaches.

Toshimitsu Kawate (http://www2.vet.cornell.edu/research/faculty/toshi-kawate-phd/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Molecular mechanisms of extracellular signaling; membrane receptors; ion channels; X-ray crystallography; cryo-EM; electrophysiology; cell biology; biochemistry

Roger F Loring (http://chemistry.cornell.edu/roger-f-loring/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** nonequilibrium statistical mechanics; semiclassical approximations to quantum dynamics; nonlinear infrared spectroscopy of biomolecules

Yuxin Mao (http://cals.cornell.edu/yuxin-mao/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** X-ray protein crystallography; membrane trafficking; phosphoinositide signaling pathway

Linda K Nicholson (http://cals.cornell.edu/linda-nicholson/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** multidimensional NMR studies of the biophysical basis of protein regulation

Matthew J. Paszek (http://www.engineering.cornell.edu/faculty-directory/matthew-j-paszek/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Mechano-transduction, membrane biophysics, super-resolution imaging, cancer biophysics

Lois Pollack (http://www.aep.cornell.edu/faculty-directory/lois-pollack/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:**

Erik Henning Thiede (http://as.cornell.edu/people/erik-thiede/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** We integrate AI with physical simulation to understand protein conformational change. Particular areas of focus include: integrating Cryo-EM with molecular simulation, AI-accelerated allosteric drug discovery, and New Markov State Modelling algorithms.

Robert Edward Thorne (http://physics.cornell.edu/robert-thorne/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** materials physics problems in structural genomics, including phase behavior and interactions in protein solutions; protein purification; disorder and disordering mechanisms in protein crystals; radiation damage and its mitigation; cryopreservation techniques; development of new hardware; synchrotron-based imaging and diffraction; atomic force microscopy; light scattering; nanofabrication.

Michelle D Wang (http://physics.cornell.edu/michelle-wang/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics

- **Research Interests:** molecular motors; mechanics of gene expression; RNA polymerase; biopolymers

Zheng Jane Wang (http://physics.cornell.edu/jane-wang/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Physics of Living Organisms; Insect Flight; Fluid Dynamics; Computational and Applied Mathematics

Mingming Wu (http://cals.cornell.edu/mingming-wu/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** Directed cell migration mediated by ligand-receptor binding, cancer biology, microfluidics, and optical microscopy

Chunhui (Chris) Xu (http://www.engineering.cornell.edu/faculty-directory/chris-xu/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** biomedical imaging; fiber optics; optical instrumentation

Haiyuan Yu (http://www.bme.cornell.edu/faculty-directory/haiyuan-yu/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysic*s: biophysics
- **Research Interests:** quantitative biomedical systems biology, functional and comparative genomics/proteomics, biological networks and their changes across human populations

Warren R. Zipfel (http://www.bme.cornell.edu/faculty-directory/warren-r-zipfel/)

- **Campus:** Ithaca
- **Concentrations:** *Biophysics*: biophysics
- **Research Interests:** optical microscopy; multiphoton imaging; fluorescence spectroscopy and bioanalytical methods; chromatin conformation, nuclear structure and cancer biology