Overview

Molecular Biophysics Program

Department of Physics         Emory University
The common aim of the members of the Molecular Biophysics Group is to understand how structure and dynamics at the molecular level contributes to the observed function of biological systems.

Summary of our General Approach:

- **Molecular Structure & Dynamics**
- **Physical Parameters**
  - distance
  - force
  - lifetime
  - chemical potential
- **Interpretation**
  - Chemistry
  - Biochemistry
- **Data**
  - Signal
  - Energy
  - Time
- **State-of-the-Art Instrumentation**
- **Application of Physical Theory**
- **Computer Simulation, Fitting**
Faculty Members

Keith Berland
Associate Professor
U. Illinois, 1995

Laura Finzi
Associate Professor
U. New Mexico, 1990

Vincent Huynh
S.C. Dobbs Professor
Columbia U., 1974

Ivan Rasnik
Assistant Professor
Campinas (Brazil) 2000

Kurt Warncke
Associate Professor, Director of Graduate Studies
U. Pennsylvania, 1990
Molecular Biophysics Program

Faculty Research Areas
and Principal Techniques

Keith Berland
Protein dynamics; protein-protein binding in cells
Fluorescence correlation spectroscopy & imaging

Laura Finzi
DNA structure & dynamics; DNA-Protein interactions
Light & Atomic Force Microscopy; Single molecule methods

Vincent Huynh
Iron-Sulfur Protein Structure & Function
Mössbauer, Electron Paramagnetic Resonance (EPR) spectroscopies

Ivan Rasnik
Protein dynamics; DNA-protein interactions
Fluorescence resonant energy transfer; Single molecule methods

Kurt Warncke
Enzyme catalysis; β-Amyloid protein structure; Photosynthesis
Time-resolved and steady-state EPR and optical spectroscopies
Molecular Biophysics and the Graduate Program in Physics
at Emory University

Students who desire a PhD in the area of Molecular Biophysics can enroll in the Graduate Program in Physics. The organization and requirements of the Graduate Program in Physics are described on the “Graduate” pages of the Department of Physics web site, at the following url: www.physics.emory.edu/graduate

The Molecular Biophysics track overlays the following features with basic Graduate Program:

- **Coursework**: A sequence of elective graduate courses, designed to introduce fundamentals and advanced topics in biophysics, is offered.
- **Research Training**: Students engage in two one-semester research projects in faculty members' laboratories.
- **Current Topics**: New systems and techniques in molecular biophysics are presented for group discussion at the Biophysics Journal Club each week.
- **Colloquium Series**: External speakers are invited to present their work in Molecular Biophysics. Each semester, graduate students select and host a speaker.

These features of the Molecular Biophysics Program are briefly summarized on the following pages...
Molecular Biophysics Coursework

Molecular Biophysics is an intensely interdisciplinary area. We offer elective courses that efficiently integrate learning about the fundamental physical properties (structure, dynamics) of biomacromolecules (proteins, nucleic acids) with an understanding of biochemical and chemical features that are necessary for meaningful interpretation of the results of physical measurements. Physical techniques and several systems that are paradigms for biophysical inquiry are addressed.

**Phys 552: Biomacromolecules**
This course is aimed at providing the basic tools for the understanding of the biochemical and biophysical behavior of macromolecules as a function of their environment.

**Phys 554: Molecular Biophysics**
The course focuses on how structure and dynamics at the molecular level contribute to the observed function, with a specific emphasis on proteins.

**Phys 556: Single Molecule Biophysics**
This course covers the fundamental single-molecule techniques and illustrates how they are used in biophysics.

**Phys 558: Biomolecular Spectroscopy** (under development)
Principles and applications of electric dipole and magnetic resonance spectroscopies to biological systems.
Molecular Biophysics Program

Graduate Research Rotations

As part of the requirements for the Graduate Program in Physics, students complete two “Research Rotations”, which are 12-14 week research projects performed in a faculty member’s laboratory. The faculty supervisor is selected by the student. Students obtain advanced research training in experimental biophysics, gain in-depth understanding of a sub-area of biophysics, and are able to assess the match between their interests and the faculty member’s research for possible future dissertation work. At the end of a rotation, the students present their work in the Rotation Presentation Session, which is attended by all faculty and students, and has become a highly-anticipated Department event.
Biophysics Journal Club

Wednesdays, 1pm, N215 MSC

The Biophysics Journal Club meets weekly at lunchtime during the semesters and into the summer. A student or faculty member selects a paper for reading by the group, and then leads a discussion of the work. The informal atmosphere provides for a lively and informative exchange of critical commentary and ideas.

<table>
<thead>
<tr>
<th>Date</th>
<th>Presenter</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/04/2006</td>
<td>Chen Zhu</td>
<td>The Ubiquitin Binding Domain ZnF UBP Recognizes the C-Terminal Diglycine Motif of Unanchored Ubiquitin, F. E. Reyes-Turcu et al. 2006</td>
</tr>
<tr>
<td>Fall Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/18/2006</td>
<td>Dan Ortizio</td>
<td>Spectroscopic Methods in Bioinorganic Chemistry: Blue to Green to Red Copper Sites, Edward I. Solomon. 2006</td>
</tr>
<tr>
<td>10/25/2006</td>
<td>Olivia Groover</td>
<td>Poly(A) binding protein (PABP) homeostasis is mediated by the stability of its inhibitor, Paip2, Madoka Yoshida et al. 2006</td>
</tr>
<tr>
<td>11/01/2006</td>
<td>Ivan Rasnik</td>
<td>Altered TCR Signaling from Geometrically Repatterned Immunological Synapses, Kaspar D. Mossman et al. 2005</td>
</tr>
<tr>
<td>11/08/2006</td>
<td>Chianjiang You</td>
<td>Light-switching excimer probes for rapid protein monitoring in complex biological fluids, Chaoyong James Yang et al. 2005</td>
</tr>
<tr>
<td>Thanksgiving Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/29/2006</td>
<td>Suzette Pabit</td>
<td>Probing mucin-type O-linked glycosylation in living animals, Danielle H. Dube et al. 2005</td>
</tr>
<tr>
<td>12/06/2006</td>
<td>Miao Wang</td>
<td>Electric Fields at the Active Site of an Enzyme: Direct Comparison of Experiment with Theory, Ian T. Suydam et al. 2006</td>
</tr>
</tbody>
</table>
For more information about the Graduate Program in Physics...

...visit the Graduate web pages: www.physics.emory.edu/graduate

...contact: Kurt Warncke, Director of Graduate Studies: kwarncke@physics.emory.edu