JHU Department of Biophysics Undergraduate Newsletter Spring 2009

Welcome to the JHU Department of Biophysics Undergraduate Newsletter. We have articles about courses, programs in the department, and alumni and senior profiles.

Course Profiles

Biophysics 250.381
Spectroscopy and its application in biophysical reactions
Taught by Professor Juliette Lecomte

The goal of this course is to present the theoretical basis of the spectroscopic techniques most commonly used in biophysical research. The first part outlines the principles of quantum mechanics as they relate to the structure of simple atoms, ions, and molecules. This sets the physical and mathematical stage for the study of the interaction of light with matter. The second part emphasizes the processes of absorption, emission, and scattering occurring in the ultraviolet-visible range and at lower energies. Special effects observed with polarized light are also considered. The methods are discussed in the context of distinctive structural features of biomolecules and their dynamic properties. Topics include vibrational and rotational spectroscopy, Raman scattering, electronic transitions, optical rotation, birefringence, circular dichroism, and fluorescence.

Biophysics 250.131
Topics in Biophysics Research
Taught by Professor Karen Fleming

Recently, Topics in Biophysics Research has transformed into an interactive course designed to introduce freshmen and sophomores to the field of biophysics. It features an exciting combination of lectures, classroom activities, and computer exercises. This is in contrast to its previous structure, which consisted of a series of guest lecturers. Professor Karen Fleming states, "The course introduces modern Biophysics concepts and research areas through active student participation that includes discussions, group projects and computer exercises. The introduction of molecular graphics skills in this course has been especially well received, and this enables students to visualize and manipulate macromolecules."

Biophysics Mentoring Program

The Biophysics Mentoring Program is designed to connect students considering the biophysics major with current biophysics majors. If you are interested in learning more about biophysics, and would like to hear a current student's perspective, email Dr. Fleming (karen.fleming@jhu.edu) to sign-up for the Biophysics Mentoring Program. She will connect you with a current student, so that you can learn more about the major, ask any questions you may have, and get inside advice from current majors. All mentors and mentees meet at least once a semester as a group. Check out the pictures from out last Mentoring party!

Alumni connected by Linked-In

Join the JHU Undergraduate Biophysics Alumni group on Linked-In to connect with other biophysics majors, past and present. Dr. Karen Fleming, the new Director of Undergraduate Studies, created this group to facilitate networking, reference requests, and staying in touch, even after we leave Baltimore. This group is not only for Alumni, but for current students, as well.

Check it out online at:
http://www.linkedin.com/groups?gid=1776717&trk=hb_side_g.

Updates from Young Alumni

Leanne Stunkel
Where are you from?
Hometown: Bethel, CT
Current Residence: Bethesda, MD

What is an interesting fact about you?
I love outdoor activities, especially rock c
part of the Outdoors Club at JHU, which I rea

When did you decide to major in biophysics? How did you come to this decision, and why?

I decided to major in biophysics while I was still in high school, and it was part of the reason I applied to Hopkins. My favorite high school classes were Physics and Biology, so it seemed like a logical choice. Then, when I was visiting campus, I saw a presentation by Dr. Barrick about the major, and I was really interested in the research being done by the department!

What was your favorite thing about the biophysics major?

I don't know if I can pick one! The small class size is one of my favorite aspects of the major. It makes it easier to ask questions, find good study partners, and get to know your professor.

The other is the research requirement – every biophysics major is expected to spend at least two semesters working in a lab. It is important to work in a real lab to see what science is really like day-to-day. It makes it easier to understand the famous experiments you learn about in classes and helps you decide whether you want to be a researcher.

What are you doing now, and how did you come to that decision? How has your biophysics background come in handy?

I am doing a two-year fellowship in bioethics at the National Institutes of Health. My department is mostly focused on how to conduct ethical research on humans in clinical trials.

Although bioethics is a little different than biophysics, having a science background is really helpful when I am thinking about ethical issues in medical research. I am planning to apply to medical school after this, and I know that the biophysics major will be very helpful when I am learning all of the science at medical school.

What do you miss most about Hopkins?

My friends from the biophysics department, of course! And maybe the coffee at One World Cafe.

Any advice for those considering the major?

Biophysics majors are unique because we learn physics, chemistry, and math, and then use them as tools to understand biology. To understand a problem, like how a protein binds another molecule, biophysicists consider the chemistry of the surrounding molecules, the chemical reaction between the protein and the molecule, the physics of how the protein and the molecule can fit together, and even calculate the probability that the molecule will get near the protein at all. If you are interested in biology or medicine but also like physics, chemistry, or math, the biophysics major is a great way to learn how to use those to answer biological questions.

Senior Profiles

Claudine Jones

Claudine is from Baltimore, so when she came to Hopkins, the area was quite familiar. During her junior year, Claudine did not feel satisfied with her current major, so she decided to explore other options. After talking with a few biophysics seniors, she decided to change her major to biophysics.

For Claudine, the best aspect of the biophysics major is the professors. She says, "The professors in this department are some of the most kind, helpful, and approachable professors in the university." Although Claudine does not identify herself as a computer savvy student, her favorite biophysics course was Computational Biology, a course taught by Dr. Patrick Fleming which introduces several computational approaches to the study of biological macromolecules. Dr. Fleming ensured that the "take-home message" was clear, which helped Claudine process the material, grasp the important points, and do well in the class. Her research project was conducted in the lab of Dr. Richard Cone, who is also her academic advisor.

Claudine has lived in Baltimore for the majority of her life. She enjoys living in the city because it provides limitless opportunities to meet interesting people and experience new things. For those considering the biophysics major, Claudine offers a few words of advice: "This major is challenging, but very rewarding. The professors make sure that you understand the material. There is a genuine concern that you learn."

Gloria Sue

When Gloria left her hometown of San Jose, CA to attend college at JHU, she was unsure what major to pick. There were so many options, but it was "cool and mysterious appeal of biophysics" that led her to sign up for Topics in Biophysics Research as a freshman. It was in this class that she heard Dr. Bertrand Garcia Morena speak about his research.

Gloria reflects, "I remember being really drawn in by his lecture." A semester later, after contacting Dr. Garcia-~~Morena~~, Gloria joined the lab, where she continues to work today as a Master's student. Her research project involves making variants of staph nuclease, which have ionizable residues in buried regions of the protein, and studying the structural and thermodynamic properties of these variants using x-ray crystallography and spectroscopy.

As soon as Gloria began her lab work, the biophysics major was a natural choice. Gloria has found the broad foundation that biophysics provides extremely useful and informative, since it has its roots in both the biological sciences and the physical sciences. Plus, Gloria jokes, "It sounds impressive, especially to grandma." Over the last four years, her favorite class has been Introduction to Biophysical Chemistry, a course taught by Dr. Doug Barrick, because it taught her everything she wanted to know about protein thermodynamics.

Gloria has enjoyed living in Baltimore. Every neighborhood has something different to offer, whether it is cultural food, shopping, art, or nightlife. As Gloria notes, it is just a matter of discovering it. For those considering the major, Gloria has a few words of advice, "It's okay to not have a clue about what biophysics is when you just getting started. Approach the major with an open attitude. Talk to current students or faculty – they are all willing to share their experiences as biophysicists."

Next year, Gloria will attend medical school, where she will put her biophysics background to use.

Lisa Ely

Lisa is from Rockville, MD. Although she began majoring in public health studies, she realized that it was not the right fit for her: the only part of the major she enjoyed was biology, and she missed math. Since biophysics combined math, biology, and additional scientific disciplines, she decided to switch her major to biophysics.

As a biophysics major, she has enjoyed the opportunity to build a broad foundation in math, biology, physics, and chemistry, and the freedom to select upper-level electives from a wide range of departments. Lisa's favorite course was Bioinformatics, which is taught by Dr. Patrick Fleming. Over the course of the semester, she was able to explore her interest in genetics by using computer programs and online databases to learn more about phylogenetic trees and DNA.

After hearing Dr. Richard Cone lecture about mucosal biology in a biophysics course on reproductive physiology, Lisa contacted Dr. Cone regarding a position in his lab. She attended several lab meetings before joining the lab and starting a research project with another undergraduate. Her research project involves identifying the X Factor, a molecule secreted by Gardnerella vaginalis (bad bugs) in the vagina, which inhibits the growth of Lactobacilli crispatus (good bugs). Currently, she has taken over the project, as she continues to look for the elusive X Factor.

During her time in Baltimore, Lisa has enjoyed living close to the Inner Harbor and Fells Point – they are lively areas, so there is no lack of entertainment in Baltimore.

Chris Avedissian

As a junior in high school, Chris was set on Hopkins, in addition to pursuing a career in patent law. Although he was interested in physics, it was biophysics that jumped out at him when he was considering which major to select. To pursue patent law, he wanted to learn more about the biological sciences, and the biophysics major allowed him to pursue his interest in physics, while further developing his understanding of molecular biology, physiology, and basic science research. After making the choice to major in biophysics, Chris says he has not regretted his decision "even for a minute." Among the many things that Chris has enjoyed about the major include: the small class size, the cross-discipline material, the friendly and open professors, and the deck parties.

Chris has particularly enjoyed taking the Molecular Biophysics Laboratory course with Dr. Karen Fleming. To him, it exemplifies everything that is unique, and great, about the biophysics major. By taking the course, Chris has learned several useful and exciting experimental techniques, such as x-ray crystallography, analytical ultracentrifugation, fluorescence spectroscopy, and circular dichroism spectroscopy. Unlike most undergraduate courses, the course takes place in a professor's research laboratory, and it provides the opportunity to try experiments with these methods and interpret data derived from experiments. This course has further enhanced his understanding of basic science research, which he has also explored through his research project with Dr. Jin Zhang in the Department of Pharmacology at JHMI investigating fluorescent and bioluminescent sensors for cAMP and other molecular components of the PKA and PKC pathways.

Chris grew up in Alpharetta, Georgia. Although his mother is from Tehran, Iran, and his father from Beirut, Lebanon, he is ethnically full Armenian, and even speaks a little of the language, along with French and Japanese. For those considering the major, Chris provides a few words of advice: "Stick with it. The prerequisites might take a while to get through, but the upper level classes are well worth it, both in content as well as the professors."

Brian Corliss

Growing up, Brian enjoyed all types of science, in addition to math. Rather than focusing on a particular scientific discipline during college, Brian decided that he wanted exposure to numerous disciplines, including chemistry, physics, molecular biology and math. Based on his interest in obtaining a broad scientific foundation, Brian applied early decision to Hopkins with the intention to major in biophysics, which has proved to be the perfect combination of science and math.

Brian's favorite aspect of the biophysics major is the people, both the professors and the students. Brian says, "the students are all easy to get along with and hang out with; type-A people, but not to the exclusion of any social skills." Likewise, the professors are readily accessible and always willing to discuss class work or research. After four years as a student in the biophysics department, Brian knows many of the professors on a first-name basis, which he attributes to the small, intimate nature of the biophysics major.

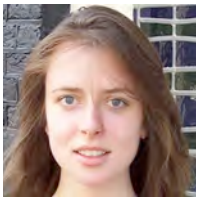
Brian has worked in the laboratory of Dr. Douglas Barrick since May of 2007, where his is attempting to gather data on diffusional coefficients of disordered peptide fragments in order to determine their intrinsic structure. These experiments are designed to provide information regarding the entropy change associated with the binding of a disordered peptide to a transcription factor localized in the nucleus. This particular interaction occurs within the Notch signaling pathway, which is a ubiquitous pathway involved in metazoan cell differentiation.

Although he was extremely busy at the time, attempting to balance several other difficult classes and medical school interviews, Brian recalls enjoying the challenges of Wave Phenomena with Biophysical Applications, his favorite biophysics class. Reflecting on the collaborative spirit among students, he remembers how students joined forces to complete problem sets and study for exams, a process through which he formed several close-knit friendships.

Regarding life in Baltimore, Brian says, "the best thing is that there are a ton of restaurants for all kinds of appetites and tastes." An avid runner, Brian has enjoyed running around the harbor, Fells Point, and Federal Hill, which has helped him get to know the city. For those considering the biophysics major, Brian encourages taking advantage of the flexibility for upper level electives. Brian says, "I'd recommend you try and focus those credits on one area you really like and go for a double major."

This fall, Brian will attend Tufts University School of Medicine on an Army scholarship.

Molly Plovanich



Molly grew up in Hamlin, NY. When she came to Hopkins, she was interested in pursuing the biophysics major because it seemed to have a bit of everything that she liked during high school – chemistry, physics, math, and biology. As a freshman, she enrolled in an introductory biophysics course called Topics in Biophysics Research. The opportunity to learn more about biophysics further confirmed her interest in pursuing the major.

Within the curriculum, Molly has enjoyed learning how techniques and modalities of thought from the physical sciences can be used to enhance our investigation of biological problems, whether it be from a the computational or experimental angle. Her favorite aspects of the biophysics major are the professors, who are extremely dedicated to teaching students, and the research requirement, which provides an opportunity to pursue an independent project under the supervision of a faculty member. Over the last four years, Molly's favorite biophysics course was Introduction to Biophysical Chemistry taught by Dr. Doug Barrick, which provides an introduction to statistical thermodynamics, protein folding, and chemical kinetics.

Molly has worked in the laboratory of Dr. Barrick since the fall of 2007. Her research involves exploring the tolerance of the Notch ankyrin domain, a particular repeat protein, to ankyrin consensus substitution. The results of these experiments should help elucidate the mechanism by which consensus repeats act to stabilize naturally-occurring protein domains**.**

For Molly, living in Baltimore has been a wonderful experience. She has particularly enjoyed exploring different parts of the city, including Mt. Vernon, Mt. Washington, and Hampden, and finding the perfect yoga studio – Charm City Yoga! For those considering the major, she suggests, "Use the first two years to build a solid scientific foundation. During your final two years, pursue advanced electives in areas that fascinate you."

This fall, Molly will attend medical school.

Neil Neumann

Neil grew up in Des Moines, Iowa, where he was captain of his high school football team. When Neil arrived at Hopkins, it wasn't biophysics that first caught his eye. Instead, his path to biophysics was rather circuitous. Undertaking study in a different major, he did not consider biophysics until he took Introduction to Biophysical Chemistry, a biophysics course taught by Dr. Douglas Barrick, during the spring of his sophomore year. Based on his experience in this class, Neil decided that biophysics was more suited to a rigorous undergraduate education. Neil reflects, "I learned how to think in biophysics."

For Neil, the best aspect of the biophysics major is the "amazing" people, both the students and the professors. He has enjoyed every biophysics course he has taken, as each one has offered something unique. He was particularly intrigued by the material presented in Spectroscopy and its Application in Biophysical Reactions, a course taught by Juliette Lecomte, which explored the fundamentals of quantum mechanics underlying absorbance, circular dichroism, fluorescence, and NMR, in addition to the application of spectroscopy to characterize nucleic acids and enzymes.

Outside of the classroom in his research project, Neil is using surface plasmon resonance and fluorescence resonance energy transfer to determine the strength of the interaction and the 3D conformation of the AraC protein. He began working on this project during his freshmen year after contacting and interviewing with a few professors.

Neil has enjoyed living in Baltimore, which he sees as a collection of interesting neighborhoods, each with its own flavor. He jokes, "It does have its charm, somehow." For those considering the biophysics major, Neil advises, "work hard and get involved, but always remember to have some fun and participate in outside activities."

Currently, Neil is applying to MD/PhD programs.

Geoff Nunns

A New Zealand dual citizen, Geoff was born in Los Angeles, and grew up in Danville, CA. In addition to studying biophysics, Geoff ran Cross Country and Track during his four years at Hopkins. Based on his interest in biotechnology, Geoff decided to major in biophysics, which he has enjoyed for its focus on critical thinking and unique course offerings.

Geoff's favorite aspect of the biophysics major is the small class sizes, which allow for direct interaction with professors. He also likes the Jenkins Computer Room, which has a few perks, including free printing.

For his research project, Geoff is working with Dr. Raimond Winslow, a professor in the BME Department, to model cardiac myocytes, specifically the B1-Adrenergic Receptor mediated signaling pathway, and the interaction of CaMKII and PKA in that pathway. He arranged his research project after spending a summer at the Auckland Bioengineering Institute, where he conducted computational research. Following graduation, Geoff plans to return to Auckland Bioengineering Institute for a year, after which he will attend medical school.

For those considering the major, Geoff offers a few words of advice: "By the time you are a sophomore, I recommend taking one of the lower level courses in the department, and I think you will be sold. As for students in the major, take lots of courses because I think you will like lots of them."

Students at the Biophysics Mentoring Party.