

**SYLLABUS****Introduction to Biological Physics (1376)****Lectures:****Tuesday and Thursday****11:00 – 12:15 pm****103 Allen Hall****Instructor:****Hanna Salman****Office:****219B Old Engineering Hall****E-mail:**[hsalman@pitt.edu](mailto:hsalman@pitt.edu)**Office hours:****10:00 am – 12:00 pm, or with appointment by email****COURSE DESCRIPTION & AIM:**

The aim of this course is to describe the state of the art of physics of living matter. The course will focus on the application of physical methodology and techniques, such as thermal and statistical physics, to understand and describe the behavior observed in various biological systems, and will emphasize why there is a need for quantitative understanding in biology. It will also describe experimental techniques developed to study biology and provide quantitative measurements of previously inaccessible biological questions. In addition, the course will review useful physical concepts and techniques that are important for the understanding of biological phenomena.

The course is designed for students with different backgrounds, such as physics, biology, chemistry, engineering, and mathematics. Therefore, students are not required to have any previous knowledge in physics beyond what is covered in introductory physics courses. All the physics concepts used during the course will be developed from a basic level. Students are also not required to have prior knowledge in biology as all the biological systems discussed in this course will be also described extensively.

**Tentative list of topics to be covered:**

<b>1</b>	Introduction to biology: <ol style="list-style-type: none"> <li>1. The building blocks of biological systems: Nucleic acids, amino acids, phospholipids, carbohydrates, and the complex structures they form.</li> <li>2. Physical models of biological systems, their use for understanding the function of bio-molecules and the behavior of biological systems in general.</li> <li>3. The cell: Quantitative description of structure and function of its various components.</li> <li>4. Temporal scales in biology: The time scale of different processes and their function.</li> </ol>
<b>2</b>	Energy in biological systems and statistical view of biological dynamics: <ol style="list-style-type: none"> <li>1. The biological cell out of equilibrium, cellular processes.</li> <li>2. The interplay of deterministic and thermal forces in biology (e.g. motor proteins).</li> <li>3. Diffusion in biology.</li> <li>4. Cellular taxis.</li> </ol>
<b>3</b>	Entropy and free energy: <ol style="list-style-type: none"> <li>1. The roles of entropy and free energy in biology.</li> <li>2. Applications, e.g. gene expression.</li> </ol>
<b>4</b>	Two-state systems in biology: <ol style="list-style-type: none"> <li>1. Enzymatic activity.</li> <li>2. Regulation of gene expression.</li> <li>3. Signal transduction networks.</li> <li>4. Motor proteins</li> </ol>

Wherever applicable, the experimental techniques used for studying the biological system of interest will be discussed and explained.

### TEXT BOOK

The main textbook that will be used is "Physical Biology of the Cell",  
Authors: Rob Phillips, Jane Kondev, and Julie Theriot.  
However, some of the topics covered will be based on recent research papers.

### HOMEWORK

The due date of each assignment will be 10 days after the posting date.

### EXAMINATIONS

There will be 1 take-home midterm exam. Date to be determined. And a presentation of a research paper for the final.

### FINAL GRADE

Your final grade will be made of the following:

Homework	40%
Midterm	20%
Final	40%

### GRADE CHANGE POLICY:

Grade cutoffs are chosen to be as fair as possible but ultimately the line has to be drawn somewhere and it has to be drawn straight. **Extra credit opportunities will not be offered to individual students.** Once your final grade for the semester has been submitted to the Registrar it will not be changed unless there is a verifiable error in the grade book, such as a missing grade or a grade that was entered incorrectly. You can check all your course grades at any time on Canvas.

### DISABILITY SERVICES:

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services (DRS), 216 William Pitt Union, (412) 648-7890 (<https://www.studentaffairs.pitt.edu/drs/about/>), as early as possible in the term, DRS will verify your disability and determine reasonable accommodations for this course.

### STATEMENT ON CLASSROOM RECORDING:

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

### CODE OF CONDUCT

Communication is key to a productive learning environment, and we can maintain productive communication by exhibiting respect for one another. The success of the course for yourself and others depends on all our commitment to behavior that demonstrates respect for differences, understanding towards others and a willingness to listen and learn. For these reasons, it is unacceptable to harass, discriminate against, or abuse anyone because of race, ethnicity, gender, disability, religious affiliation, sexual orientation, or age. If you witness or are subject to such harassment, please report it to the instructor or to the [Office of Diversity and Inclusion](#).

### TITLE IX

Legal text: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."

As a professor I am a mandatory reporter, and I am required to report violations of Title IX that I observe or am made aware of to the [Title IX office](#). Title IX violations include, but are not limited to, sexual harassment, sexual violence and verbal or sexual abuse. Within the classroom, behavior in violation might appear as: suggestive jokes or innuendos, inappropriate touching, and unwanted sexual behavior or advances, but **my capacity and obligation to report does not end at the classroom.**

**Note: Updates and additional notes will be posted on the Canvas.**