## Syllabus

**Instructors and Logistical Information**

| Class Time      | Tues 14:00 – 15:50 pm, Willamette 318 / 375  
|                 | Thurs 14:00 – 15:50 pm, Willamette 318 / 375 |
| Instructor      | Professor Tristan Ursell  
|                 | Office: 375 Willamette Hall  
|                 | Email: tsu@uoregon.edu |
| Assistants      | The graduate teaching fellow (GTF)  
|                 | • Ben Strickland bds@uoregon.edu |
| Email           | We will try to respond to emails in a timely manner. Emails written in a disrespectful tone (e.g. starting with “Yo Prof Ursell”), with slang (e.g. “ur” instead of “your” or “you’re”), or without full sentences will receive no response. |
| Office Hours    | Prof. Ursell: Friday 11 – 11:50 am, Willamette 375  
|                 | Ben Strickland: Weds. 9:30 – 11:30 am, Willamette 371 |
|                 | Make use of office hours! |

## Course Description and Materials

| Course Description | This course will focus on topics in molecular biophysics, employing techniques from classical mechanics, thermodynamics, statistical mechanics, and molecular biology. We will use readings, discussions, and hands-on exercises to study the physical aspects of biological materials and the constraints that physics places on living organisms. The required mathematics will be at the level of calculus and ordinary differential equations. We will also occasionally make use of functional calculus and partial differential equations. |
|                   | |
| Learning Outcomes | Upon completing the course, students will have enhanced their abilities to:  
|                   | • Understand how physical principles guide and constrain Life.  
|                   | • Understand how the molecules of the cell help give it Life.  
|                   | • Apply classical and statistical mechanical principles to living systems.  
|                   | • Build toy models of biological processes on multiple length and time scales. |
| Topics            | Introduction, Motivation, and Illustrations  
|                   | Scale and Powers of 10 – In which we get a sense of the size and time scales of things. |
Molecular Narrative – In which we dissect how information is stored and read at the molecular scale, how that information builds the micromachines of the cell, and what is special about those micromachines.

Randomness and diffusion – In which we explore the perpetual motion of small things, both its unavoidable causes and its far-reaching consequences.

Transport – In which we discuss how molecules in a cell get where they need to be when they need to be there.

Bending and stretching – In which we explore the consequences of forces, tensions, stiffness, mechanical ensembles, and material properties affect biological processes.

DNA mechanics – In which we examine the physical properties of life's most important molecule and understand how temperature and mechanics affect gene expression.

Equations of State in Biological Systems – In which we examine how temperature interacts with mechanics to dictate the equilibrium behavior of many biological sub-systems.

Membranes and Sequestration – In which we explore how membranes and their attendant proteins regulate flow of material into and out-of the cell, as dictated by their material properties, densities, and thermal effects.

**MATERIALS**
- You should be able to navigate the internet and make simple graphs (e.g. with Excel).
- In general, lectures will not be posted online, you will need to attend class to take notes.
- Readings, problems, and exam questions will come from a mixture of the book and material from Prof. Ursell.

**READINGS**
The textbook for the course is *Physical Biology of the Cell 2nd Ed.* (available on Amazon, new and used). Other documents will be distributed online, via the course website at [http://canvas.uoregon.edu](http://canvas.uoregon.edu).

**ASSIGNMENTS AND ASSESSMENT**

**HOMEWORK**
Homework sets are usually assigned on Thursday and are due, in class, by the start of class the following Thursday, unless otherwise noted (e.g. if Thursday is a holiday).

Homework assignments will cover topics discussed in class, and are intended to guide you in thinking further about the concepts we’re exploring. Some homework questions will be open-ended or will not have a strict right or wrong answer, but will depend on the clarity of your logic and analysis. The goal is to get you thinking using concepts from class rather than rote regurgitation of class material.
Your responses will typically be submitted on paper in class. You are encouraged to discuss homework assignments and readings with others, though your final answers should be your own – direct copying is not allowed, and evidence of such will result in a 0% score on the offending homework. Office hours are an excellent place to discuss homework!

**GRADING**
The grading scheme for this course will be simple. Each week there will be a challenging problem set. There will be a final exam worth 20% of the course grade. Prof. Ursell reserves the right to modify this grading scheme, including the number and type of assignments and exams, as necessary.

**IN-CLASS WORK**
Students will often tackle equation-based problems in small groups and discuss their results with the class.

**SCALE**
The course grading scale: A=90-100%; B=80-89.9%; C=70-79.9%; D=60-69.9%; F<60%.

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**Other Information**

**ABSENCES**
I realize that students will miss a few classes (due to illness, for example). Assignments are based heavily on what we cover in class and readings, and it is your responsibility to ensure you have the notes and preparation you need. That said, office hours are a good time to make sure you are tracking with class material.

**LAPTOP AND CELLPHONE POLICY**
At no point are cell phones to be used in class, **put them on airplane mode before coming into class**.

The use of laptop computers in class is not allowed. Why? Several studies, plus past experience, show that students using laptops in class spend a great deal of time on non-class-related activities (surfing the web, playing games, Facebook, etc) and that these distractions negatively impact both learning and grades. This alone isn’t a reason to ban laptops — you’re responsible for your own performance in class. In addition, however, studies have shown that non-class-related laptop use distracts and impacts the learning of other students nearby. (e.g. see Fried, C. B. *Computers & Education* 50, 906-914 (2008).) Plus, students have complained about the environment created by their classmates’ laptop usage.

Incidentally, taking notes by hand is more effective at cementing concepts in your mind, than blithely following along on a screen.

In summary, laptops are not allowed in class. The only exceptions will be for people with documented medical needs; please see me if this is the case.

**NECESSARY CAVEATS**
Students are expected to abide by university policies on academic honesty, avoiding plagiarism, fabrication, cheating, and academic misconduct. The Student Conduct Code ([http://conduct.uoregon.edu/](http://conduct.uoregon.edu/)) provides definitions of these terms and explanations of the university policy on the subject. The UO Library also provides a guide to avoiding plagiarism ([http://libweb.uoregon.edu/guides/plagiarism/students/](http://libweb.uoregon.edu/guides/plagiarism/students/)). You are
responsible for understanding these regulations and abiding by them. Academic dishonesty will be dealt with severely, as it is disrespectful to your fellow students and your instructor, as well as being against both university regulations and state laws. If you are questioning the integrity of what you’re doing, it probably falls under the umbrella of academic dishonesty. If you have questions or concerns, come see me.

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<th>STUDENTS NEEDS</th>
<th>If there are aspects of the instruction or course design that result in barriers to your inclusion, please notify Prof. Ursell as soon as possible. You are also welcome to contact Disability Services in 164 Oregon Hall, 541-346-1155.</th>
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| POLICY ON MISSED DEADLINES, SIGNIFICANT ABSENCES, INCOMPLETES, AND SNOW DAYS | Only the following unforeseen and uncontrollable emergency situations are acceptable excuses for missed deadlines:
  - Documented serious illness/injury;
  - Documented death in the immediate family.

All of the following are unacceptable – note that they include “personal” as well as “technological” excuses:
  - Special occasions (e.g. weddings, birthdays, anniversaries etc.)
  - Work and school conflicts: “I had to work extra hours,” “I have a huge midterm tomorrow in another class…”
  - Couldn’t get to campus (alarm didn’t ring; missed the bus; etc.)
  - Being generally “busy” or having “a lot going on right now…”
  - Forgot or “mixed up” the assignment or due date
  - No access to computer or printer; assignment completed on computer is “missing,” was accidentally erased, or is inaccessible

If a class is canceled due to external factors (e.g. inclement weather), we will have a makeup class at a suitable date and time.

| SUCCEEDING IN THIS COURSE | Plan ahead and start early! The reading assignments are a vital part of this course, and it is important to start reading them early not only to understand the subject matter but also to be able to articulate what you don’t understand – in class lectures and discussions will build on your reading experiences. Note that the reading assignments must be done before the days at which their topics are discussed in lecture. In general, it will be crucial to keep up with the course and not fall behind; later topics will build on earlier ones.

Make use of resources. If you have questions about lectures, assignments, readings, or other matters, please visit Prof. Ursell during office hours, or communicate by email. Individual appointments can be arranged to accommodate schedule conflicts with the regular office hours. |