

<b>THE PHYSICS OF LIFE (PHYSICS 171)</b> <b>CRN: 16239</b>  <b>FALL 2014</b>	<b>PROFESSOR RAGHUEER PARTHASARATHY</b> (Par-tha-sa-ra-thē)  Office: 362 Willamette Hall EMAIL: <a href="mailto:raghu@uoregon.edu">raghu@uoregon.edu</a>
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## SYLLABUS

*Welcome to “The Physics of Life” – my favorite course! This is a rather long syllabus – it has a lot of detail on many components of the course that we’ve constructed to help you learn things, and to make the term run smoothly and enjoyably. Don’t memorize it, but do read it and be aware of how it’s organized. – Prof. Parthasarathy*

### INSTRUCTORS AND OTHER LOGISTICAL INFORMATION

<b>CLASS TIME</b>	TuTh 2:00-3:20 pm, Willamette 100 <i>Note that there is a “clicker-based” participation grade as well as in-class quizzes – see the Grading and Quizzes sections, below.</i>
<b>INSTRUCTOR</b>	Professor Raghueer Parthasarathy (Par-tha-sa-ra-thē) Office: 362 Willamette Hall Email: <a href="mailto:raghu@uoregon.edu">raghu@uoregon.edu</a>
<b>ASSISTANTS</b>	This course has <i>three</i> graduate student teaching fellow (GTFs)! <ul style="list-style-type: none"> <li>• <u>Keats Conley</u> <a href="mailto:keats@uoregon.edu">keats@uoregon.edu</a></li> <li>• <u>Savannah Logan</u> <a href="mailto:slogan@uoregon.edu">slogan@uoregon.edu</a></li> <li>• <u>Johan Bonilla</u> <a href="mailto:jbonilla@uoregon.edu">jbonilla@uoregon.edu</a></li> </ul> All of them are half-assistants for this course, and so will have half the “usual” office hours, etc., that a full graduate teaching fellow would have. Keats is supported by UO’s Science Literacy Program ( <a href="http://scilit.uoregon.edu">scilit.uoregon.edu</a> ), which aims to develop new & better general-education science courses.
<b>EMAIL</b>	<b>Email:</b> You can certainly ask questions of me and of the teaching assistants by email. I usually respond within 24 hours; I rarely respond to emails that begin “Hey...” or are otherwise poorly constructed.
<b>OFFICE HOURS</b>	<b>Prof. Parthasarathy:</b> Tues. 11:00-11:50am, Thurs. 11:00-11:50am, Wil. 362 <b>Keats Conley:</b> Monday 9:00-9:50am, 473A Onyx Bridge (or elsewhere, TBA) <b>Savannah Logan:</b> Wednesday 9:00-9:50am, Willamette 354C <b>Johan Bonilla:</b> Tuesday 3:30-4:20pm, Willamette 215/216 Please note that <i>office hour times may change</i> , both by request (if particular times are not good for many students) and due to scheduling conflicts that arise. <b>Make use of office hours!</b> Even if you don’t have specific questions, feel free to drop by and chat about course topics.

## COURSE DESCRIPTION AND MATERIALS

<p><b>COURSE DESCRIPTION</b></p>	<p>What are you made of? This simple question both puzzles and fascinates scientists. It is easy to make a list of your “components” – cells, bones, muscles, etc. – but this is neither interesting nor illuminating. What is it about your flesh that makes you “squishy?” How do you manage to pack a meter of DNA into a cell nucleus one-millionth of a meter wide? If you shrank a whale to the size of a bacterium, could it swim the same way? These questions, like many at the forefront of contemporary science, bring together concepts from a variety of disciplines, mixing together biology, chemistry, and physics.</p> <p>This course will explore topics in biophysics. 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. There are no scientific prerequisites, and mathematics will be at the level of basic algebra.</p>
<p><b>LEARNING OUTCOMES</b></p>	<p>Upon completing the course, students will have enhanced their abilities to:</p> <ul style="list-style-type: none"> <li>• Understand how physical principles guide and constrain life.</li> <li>• Assess and interpret graphs and quantitative data.</li> <li>• Understand the process by which science generates knowledge.</li> </ul>
<p><b>TOPICS</b></p>	<p>Introduction, Motivation, and Illustrations</p> <p>Scale and Powers of 10 – <i>In which we get a sense of the size of things</i></p> <p>Surfaces and surface tension – <i>In which we explore the consequences of surface tension on the functioning of your lungs and ask: why can't you walk on water</i></p> <p>On size and shape– <i>In which we ponder how size and shape of can affect an organism's properties</i></p> <p>Randomness and diffusion – <i>In which we explore the perpetual motion of small things, both its unavoidable causes and its far-reaching consequences</i></p> <p>DNA mechanics – <i>In which we examine the physical properties of life's most important molecule, and why they matter</i></p> <p>Soap films, cell membranes – <i>In which we examine similarities between the two, and also look more generally at materials that assemble themselves.</i></p> <p>Life at Low Reynolds Number – <i>In which we ask: Why don't bacteria swim like whales?</i></p>
<p><b>MATERIALS</b></p>	<ul style="list-style-type: none"> <li>• We'll use “iclickers,” personal response systems that allow real-time polling and assessment in class. Each enrolled student needs one clicker. Clickers can be purchased at the bookstore. Borrowing the iclicker of someone <i>not</i> enrolled in this course and using it for this class <i>will</i> work fine.</li> <li>• Some assignments will involve working with data. You should be able to navigate the internet and make simple graphs (e.g. with Excel).</li> <li>• You may find it useful to have a ruler and pencils.</li> </ul>
<p><b>READINGS</b></p>	<p>There is no textbook for the course. <b>Articles and other documents</b> will be distributed online, via <b>Blackboard</b>. Readings will largely be at the “Scientific American” level – i.e. having minimal mathematics. We'll accompany readings from more technical sources with explanatory commentaries.</p>

## **ASSIGNMENTS AND ASSESSMENTS**

<b>READING QUIZZES</b>	Reading assignments will <b>precede</b> most classes and will often have required “reading quizzes” associated with them. These will be answered in-class, usually via clickers.
<b>POST-CLASS NOTES</b>	Even briefly reviewing what one learned from a class session helps cement one’s understanding. Seeing what people think they learned or didn’t learn is also useful for the person teaching the class. Therefore: do <b>one</b> of the following: <b>(1)</b> within 24 hours of the end of <b>each class</b> , submit a short (less than 150 word) summary of what the key points of that day’s class were. You can also state things that were unclear or need further explanation. This will be simply graded on clarity – it’s not an assessment of how well you understood things, but just on your reflection on what there was to understand. You <b>can</b> write your summary together with 1-2 other people, and all submit the same text. (Be sure to indicate each person’s name.) You’ll submit these summaries on-line. <b>(2)</b> Go to any of the <u>GTF</u> ’s office hours, and chat for a few minutes summarizing the recent class (as above). Visiting once in a week counts for <i>both</i> of that week’s post-class notes!
<b>ARTICLE COMMENTARIES</b>	Throughout the term, I’ll assign various “popular” science articles and ask you to analyze and comment on them. This can (and should) be done in small groups. These assignments will be described further as the term progresses.
<b>HOMEWORK</b>	Homework assignments will cover topics discussed in class, and are intended to guide you in thinking further about the concepts we’re exploring. Your responses will typically be submitted on-line. You are encouraged to discuss homework assignments and readings with others, though your “final answers” should be your own. Office hours are an excellent place to discuss homework!
<b>CLICKER Q’S</b>	There will be in-class “clicker” questions related to the present topic, scored by <i>participation only</i> , not the accuracy of the response.
<b>EXAMS</b>	There will be two midterm exams, <i>tentatively</i> scheduled for Oct. 28 and Nov. 25. We’ll discuss the format later in the term; in brief, they will have a combination of multiple-choice and short-answer questions. There is no final exam, but there is a final project.
<b>FINAL PROJECT</b>	There will be a final project involving learning about some protein and describing how its structure and physical function are related. We’ll describe this in more detail later in the term. The project, to be done in small groups, will consist of a brief (3 minute) summary presented to the class, and a short write-up or video. The summary is due in Week 10; the write-up by 3:00 pm Wed., Dec 10.
<b>MATH DIAGNOSTIC</b>	The mathematics in this course will be very elementary, as discussed in class, but it is important to be comfortable with these basic numerical skills. Therefore there will be a diagnostic “quiz” to be taken on-line on basic mathematics. Re-taking the quiz <b>is</b> allowed – you are encouraged to learn from your mistakes, and to see the GTFs and me for help. Scoring 75% or higher by the Thursday of

	Week 2 is <b>required</b> for continuing in the course. (A score of <75% will automatically result in a failing grade for the course.)
<b>GRADING</b>	The various grade components and their weight toward the final grade are: <ul style="list-style-type: none"> <li>• <i>Reading quizzes: 10%</i></li> <li>• <i>Post-class notes: 5%</i></li> <li>• <i>Clicker questions: 5%</i></li> <li>• <i>Homework Assignments: 20%</i></li> <li>• <i>Article commentaries: 10%</i></li> <li>• <i>Midterm Exam #1, #2: 15% each</i></li> <li>• <i>Final Project: 20%</i></li> </ul>
<b>SCALE</b>	The course grading scale: A=87-100%; B=74-86.9%; C=60-73.9%; D=46-59.9%; F<45.9%.

### **OTHER INFORMATION**

<b>ABSENCES</b>	I realize that it is unavoidable that people will have to miss a few classes (due to illness, for example). Therefore I will rescale the grades of the post-class notes, clicker questions, and reading quizzes such that 90% becomes 100%. (In other words, I will divide each student's percentage by 0.9, with a ceiling of 100%. If your original score were 75%, the rescaled score would be 83%.) I will not allow "makeup" quizzes, etc. – the point of this policy is to avoid the messes created by these sorts of ad-hoc arrangements.
<b>LAPTOPS IN CLASS</b>	<u>The use of laptop computers in class is not allowed.</u> 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, ...) 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. <i>In addition</i> , however, studies have shown that non-class-related laptop use distracts and impacts the learning of <i>other students nearby</i> . (E.g. Fried, C. B. <i>Computers &amp; Education</i> <b>50</b> , 906-914 (2008).) Plus, <i>students</i> have complained to me about the environment created by their classmates laptop use.  Taking notes by hand, by the way, is more effective in cementing concepts in your mind.  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.
<b>NECESSARY CAVEATS</b>	Students are expected to abide by university policies on academic honesty, avoiding plagiarism, fabrication, cheating, and academic misconduct. The Student Conduct Code ( <a href="http://conduct.uoregon.edu/">http://conduct.uoregon.edu/</a> ) provides definitions of these terms and explanations of the university policy on the subject. The UO Library also provides a guide to avoiding plagiarism ( <a href="http://libweb.uoregon.edu/guides/plagiarism/students/">http://libweb.uoregon.edu/guides/plagiarism/students/</a> ). You are responsible for understanding these regulations and abiding by them. Students should be particularly careful to avoid plagiarism in out-of-class assignments, as well as

	<p>projects and exams. 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.</p>
<b>STUDENTS WITH DISABILITIES</b>	<p>If there are aspects of the instruction or course design that result in barriers to your inclusion, please notify Prof. Parthasarathy as soon as possible. You are also welcome to contact Disability Services in 164 Oregon Hall, 346-1155.</p>
<b>POLICY ON MISSED DEADLINES, SIGNIFICANT ABSENCES &amp; INCOMPLETES</b>	<p>Only the following unforeseen and uncontrollable emergency situations are acceptable excuses for missed deadlines:</p> <ul style="list-style-type: none"> <li>• Documented serious illness/injury;</li> <li>• Documented death in the <i>immediate</i> family.</li> </ul> <p>All of the following are <b>unacceptable</b> – note that they include “personal” as well as “technological” excuses:</p> <ul style="list-style-type: none"> <li>• Special occasions (e.g. weddings, birthdays, anniversaries etc.)</li> <li>• Work and school conflicts: “I had to work extra hours,” “I have a huge midterm tomorrow in another class...”</li> <li>• Couldn’t get to campus (alarm didn’t ring; missed the bus; etc.)</li> <li>• Being generally “busy” or having “a lot going on right now...”</li> <li>• Forgot or “mixed up” the assignment or due date</li> <li>• No access to computer or printer; assignment completed on computer is “missing,” was accidentally erased, or is inaccessible</li> </ul>
<b>SUCCEEDING IN THIS COURSE</b>	<p><b>Plan ahead and start early!</b> 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 <i>don’t</i> understand – in class lectures and discussions will build on your reading experiences. Note that the reading assignments must be done <b>before</b> 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.</p> <p><b>Make use of resources.</b> If you have questions about lectures, assignments, readings, or other matters, please visit Prof. Parthasarathy during office hours, or communicate by phone or email. Individual appointments can certainly be arranged to accommodate schedule conflicts with the regular office hours.</p> <p>The University’s Teaching and Learning Center (TLC) provides a variety of workshops, individual consultations, writing assistance labs, and more to assist UO students. For more information, see <a href="http://tlc.uoregon.edu/">http://tlc.uoregon.edu/</a>.</p>