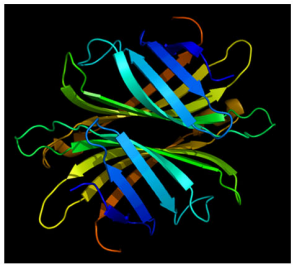
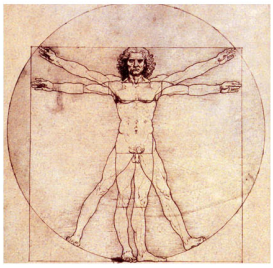
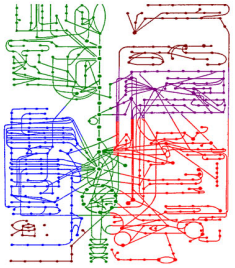
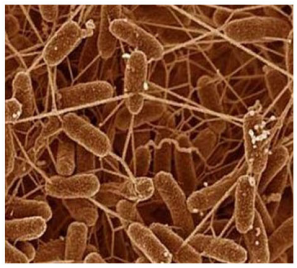
BIOL 3030 – Biochemistry – Spring 2015



What is biochemistry?

Biochemistry underlies nearly every biological process, from environmental science to medicine. When living systems are in chemical and energetic balance (homeostasis), life as we know it thrives. When those systems are out of balance (loss of homeostasis), as in disease or in unpredictable or harsh environments, life as we know it is compromised. In this course, we will learn how simple chemical and physical principles apply to the major classes of biological macromolecules that, together, maintain life.

What biochemistry is NOT?

Biochemistry is not an overwhelming set of structures, pathways and quantitative formulas to be crammed into short-term memory. Our goals are designed so that you will not only learn new knowledge, but will also practice applying that knowledge to develop an integrated view of how energy and matter are transformed in living systems. We will encounter many different molecules, discover how they integrate as cellular systems and apply quantitative relationships that describe the behavior of biological systems. This approach will provide you the tools to address new questions and solve new problems governed by biochemical principles that you may encounter in your future careers and in your life.

Learning Goals - why do we need them?

BIOL 3030 is designed to accomplish specific goals that will guide our learning. Some goals focus on seeking and gaining tangible knowledge and others aim to develop skills tied to your future professional careers. All the goals strive to promote an enduring interest in understanding "how things work" in the living world around you. Three years from now and beyond, you likely will not be asked to draw structures of the carboxylic acids of the TCA cycle, but you might well be called upon to explain to a young mother the impact of vitamin B deficiency on development of her child's brain. We will identify how biochemistry can explain and address modern and global concerns through practice and application. You are invited to suggest other learning goals as we progress through the course.

- Apply concepts of chemistry to biological molecules.
- Identify how energy, information and matter flow in biological systems.
- Deduce how alterations in biochemical processes impact human health and the environment.
- Apply knowledge of enzyme catalysis to drug discovery and therapies.
- Make connections between biochemical principles and other areas of your study at UVA and your future career.

- Interpret biochemical data, draw conclusions and predict outcomes of related, but novel explorations.
- Use bioinformatics databases and primary literature to discover how proteins work.
- Develop an enduring interest in proteins and other beautiful molecules!

How will we approach these goals and know they are achieved?

We will take a multi-pronged approach toward achieving these goals. We will use interactive lectures, practice problem solving, complete a "protein project" and use comprehensive semester tests and a final exam. Some activities will provide informal feedback aimed to help you know if you are grasping the content, concepts and ideas. Other activities will provide practice applying and connecting new knowledge and authentic data to novel situations. The semester tests and final exam will be used as a quantitative measure of what you have learned. Below is a list of the tools we will use to achieve and assess our goals.

- Pre-class reading and self-assessment. Many basic elements of biochemistry are easily learned outside of class; doing so will free up class time for deeper discussions, problem solving and clearing up the muddiest points. Therefore, you are responsible for preparing for each class in advance of our meetings by thoughtfully reading the assigned text or alternate sources to gain familiarity with foundational knowledge and key concepts. You will be able to self-assess your understanding of the pre-class readings using online questions or exercises that must be completed ~2 hours prior to class meetings. Completing the pre-class activities online will contribute 10% toward your final grade (30 points).

- In-class assessments, quizzes and homework problems: We will use *Learning Catalytics* for in-class assessment of learning and understanding and to test some aspects of learning with short in-class quizzes. Our learning goals involve applying your knowledge and understanding to solve new problems. You will gain practice applying what you have learned by tackling 2-5 authentic problems each week. Your success in working through the assigned problems will be assessed in class or as homework using the *Learning Catalytics* software. Taken together, these activities will comprise 10% of your grade. Problems similar to those assigned as practice problems will appear on the semester tests and final exam.

- The Protein Project: Working in groups, you will construct a tutorial about a biological molecule (most likely a protein) that instructs about its structure, biological function, mechanism of action, and highlights any novel or interesting biochemical features and discusses how it fits into topics discussed in class. This project will be evaluated using a rubric that will guide construction of your project. The Protein Project will contribute 15% toward your final grade.

- Tests and exams. Three cumulative semester tests and a comprehensive final exam will contribute 45% (15%/test) and 20%, respectively, toward your final grade. Biochemistry is cumulative so don't pigeon-hole your learning. Aspects of amino acid and protein structure learned early in the course will be relevant to discussions of mechanisms of enzymatic catalysis and regulation to be discussed later. Solutions to authentic problems practiced over the semester will require applying different concepts or types of information from chemistry that we'll review early on.

Tips for Success – approaching the transition state!

- *Complete the pre-class assignments.* To participate fully during class, you should come prepared. Refresh your memory and uncover what you learned in previous courses by thoughtfully reading the pre-class reading assignment and completing the online assessments before class. The online questions/problems will help you gauge your comprehension and help me identify the material that should be clarified in class.

- *Come to class.* It will be interesting! We will delve deeper and apply biochemical concepts to issues related to human health and a sustainable environment.

- *Practice, practice, practice!* We will develop our understanding of biochemical principles by applying what we learn to authentic situations. Having problems to solve will let you actively cogitate on the intricacies of biochemistry and how it defines in molecular terms how life works.

- *If you need help, get it early and often.* There are plenty of opportunities to meet with either Dr. Schafer or the T.A. at office hours, at discussion section, by asking a lot of questions and by listening to the questions asked by others.

Important Details

Where and when:

Class meeting time: MWF from 2:00 PM 3:00 PM in CHEM Auditorium, room 402.

Weekly Discussion section: An optional weekly discussion section is scheduled Tuesdays, 3:30 PM – 5:30 PM in CHEM Auditorium, room 402. Discussion section provides time to ask questions about material discussed in class and for solving practice problems. Attendance is optional, but highly encouraged. **NOTE: This timeslot will be used for administration of three semester tests, at which attendance is required.** Do not enroll in other classes or engage in other activities that conflicts with this exam time slot.

Instructional Team:

Dorothy Schafer, Associate Professor of Biology: Our research program seeks to understand how dynamic actin filaments and the higher-order cytoskeletal networks contribute to cellular processes such as cell migration, cytokinesis and protein trafficking. Outside the lab, I can be found digging in my garden, running local trails or sculling on the Rivanna River. I started rowing about 12 years ago and recently obtained my first single scull. I also enjoy cooking, hiking, rock climbing and X-country skiing.

Office: 210 PLSB Email: das9w@virginia.edu
Office Hours: Thursdays, 4:00 – 5:30 PM, in PLSB 300 or by appointment.

Laura Sipe, Teaching Assistant:
Office: 336 PLSB Email: sipe@virginia.edu
Office hours: Mondays, 12:30 – 1:30 PM
TA Contact Policy: Email Laura for questions or to set up a meeting

Textbook and *Learning Catalytics*

The textbook for this course is *Biochemistry (5th edition)* by Garrett and Grisham. Read the assigned sections and complete the pre-class assessment online in advance of each class. We will also use research articles from the current scientific literature and online sites/tutorials that

provide useful reviews of foundational information. You will be directed to these and other resources along the way.

We will also use *Learning Catalytics*, which is a student response system similar to the "clicker" system, but provides more variety in the types of problems and activities that can guide learning. You can think of it as "clickers on steroids." You can use *Learning Catalytics* on any modern web-enabled device you already have (laptop, smartphone or tablet). To use *Learning Catalytics*, you'll need to complete these steps to create an account, which costs $12 for 6 months of access or $20 for a full year (according to the company website). You may already have an account if you are using *Learning Catalytics* for other classes.

- Use your laptop, smartphone or tablet to navigate to https://learningcatalytics.com.
- Click "Register" and create a student account.
- Select the 6 months or 12 months of access and process the transaction.

Course Collab/Web site and interactive learning tools:
We will use Collab to manage class business, collect useful resources, and administer pre-class quizzes and problems. *Learning Catalytics* will be used for interactive in-class activities and for assessment of the pre-class/problem solving activities. All course material is copyrighted and may not be distributed in any way.

Pre-requisites:
BIOL 2010 (or AP), two courses in introductory chemistry and one semester of organic chemistry are prerequisites for this course. We expect you are familiar with basic concepts of chemistry, including chemistry of organic carbon and the common functional groups in organic molecules. Links to "chemistry refresher" tutorials that review these concepts is included in the resources available on Collab.

Class Policies

- Please be considerate to your colleagues in the class. **Turn off cell phones** (except the web access features). Use of electronic devices for non-class related activities (IM, tweet, facebook, shopping, etc.) is distracting to students around and behind you and therefore is strongly discouraged. Please restrict laptop use to class-related note-taking and for using *Learning Catalytics, and* individual or group assessment work and research.

- Regular attendance is strongly recommended and encouraged. Problem solving and discussions will constitute some of the activities we'll carry out in class, which requires your presence and your participation. Please arrive on time and stay for the entire class.

- Attendance at all 4 exams is *mandatory* and you *must be present at the start* of each *exam.* Semester exams will be administered during discussion sections (currently Tuesdays, 3:30 PM--5:30 PM). Alternate exam arrangements will only be scheduled for grave extenuating circumstances, such as physician-certified illness (requires a note from Student Health), or for students participating in UVA-sponsored athletic events. Having a hectic assignment/exam schedule is not a valid reason to take a make-up exam. The 4th exam date and time cannot be rescheduled for *any* reason.

- UVA policy restricts the recording of class lectures and prohibits posting of course notes and materials on 3rd party websites. This policy is posted on the Collab Homepage and can be

found here: https://policy.itc.virginia.edu/policy/policydisplay?id=PROV-016. Many of the resources provided for use in BIOL 3030 are copyright protected. Fair Use laws allow you to use this material in the context of this course, but prohibit its unlimited copying and distribution. Violation of this policy may result in disciplinary action by the University Judiciary Committee.

- **Adherence to Honor Code**
  I trust every student in this course to comply with all provision of the UVA Honor system. In addition to pledging that you have neither received nor given aid while completing homework assignments and exams, your signature also affirms that you have not accessed any notes, study outlines, problem sets, answer keys or the textbook while taking an exam. Using a cell phone for any reason during an exam will be considered an honor offense and dealt with as such. If, in my judgment, a reasonable doubt exists that a student has committed an honor violation, that student will receive an immediate and irrevocable grade of "F' (0%) for that exam or assignment, in addition to any subsequent action taken by the Honor Committee.

Course Topics, Activities and Exam Schedule

A detailed schedule of topics, exams and other class activities and assessment deadlines is available on the Activities section of the course Collab site.