Syllabus-Biochemistry I

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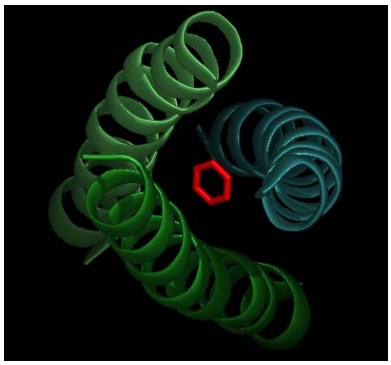
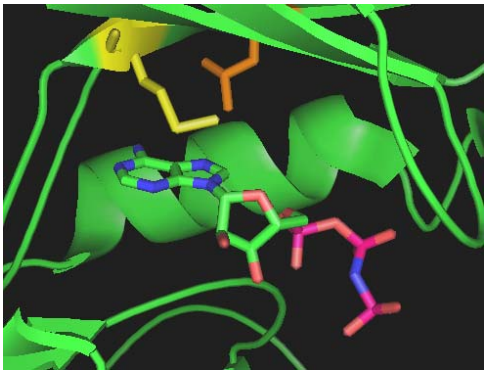
Office Hours: _____





What is biochemistry? Biochemistry is difficult to define, and the definition definitely has changed through the years. Early on, biochemistry largely dealt with *in vitro* (in a test tube) biological reactions, in so-called "ferments". More recently, in order to be called a biochemist, one still studies biological reactions in a test tube (as opposed to *in vivo*)- but the methods have revolutionized with recent (1970s-present) advances in molecular biology. The lines are now considerably blurred between cell biology, genetics and biochemistry: each field may address the same question, what defines a scientist as a geneticist, cell biologist or biochemist is the mostly what experimental techniques they are comfortable with. This class will therefore be traditional, meaning it will emphasize the chemical structure of biological molecules, the biological chemistry of enzymes, and the reactions of metabolism. Otherwise (as in the first time I taught this) lots of what we do would be redundant with genetics or cell biology courses.

Course structure

The text we will use is a new one: The Organic Chemistry of Biological Pathways, by John McMurry and Tadgh Begley, 1st edition. Get one from the bookstore or online as soon as possible. This book is the absolute best I've ever seen in explaining the chemistry of metabolism. The bad thing is that the book's treatment of protein structure and enzymology is very weak, so we'll have to rely on notes, handouts and such, I will give all this to you.

Class time will be spent by me lecturing, doing problem sets in groups and talking informally, hopefully leaning towards the latter two. Therefore, it is important to come to class. It is also very important that you come to class prepared. Even during lecture day, I am going to assume that you have read the assigned sections of the text (or a handout) so we can skip right to the cool things. To encourage you to keep up with the reading, we will have frequent (*at least weekly*) short quizzes on material that will be easy if you are prepared. I will also assign homework problems, but not grade them. You should do them in preparation for tests but it is your responsibility to keep on top of it.

Grading
There will be three in class hour exam after each section worth 100 points each and a final exam worth 200 points. Quizzes, in-class problem sets (done in groups), and group projects will cumulatively make up 100 points to give a point total slightly higher than the number of miles in the Indy 500, arguably the best car race ever.

Advice:
Biochemistry should be read with a pencil. Draw the molecules you are reading about, and be as active as possible when you study. Ask questions of me and your peers. I encourage you to work in groups in and outside of class. *Certain things should be known within a few weeks of the beginning of class including the structure of the amino acids, their one and three letter codes.*

Academic Honesty:
I broadly define cheating as taking credit for someone else's work without acknowledgement. If ever in doubt, ask if collaboration is allowed. A more precise definition can be found on pp116-118 of the student handbook. Any incidents of academic dishonesty will be dealt with according to the College guidelines and will include either a zero for the dishonest work or failure of the course.

Goals of the course:
Become proficient with the language and core concepts of biochemistry and molecular biology; develop the ability to read current biological literature.

Gain an understanding that biological chemistry in no way violates chemical principles, yet has unique characteristics that distinguishes it from non-biological chemistry.

Understand modern biochemical techniques- what kinds of experiments are possible and which are not.

Gain an appreciation of what is not yet known and under active investigation

Overview of material to be covered.

I) *Structure and Function of Proteins*
We will examine principles of macromolecular (protein) structure, chemical catalysis, examples of enzyme catalysis with special attentions to their mechanisms. A common theme of this part of the course will be the non-covalent interactions that mediate protein-protein interactions, enzyme-substrate specificity, and are the foundation of drug design.

II) Metabolism. We will learn the themes of metabolism, study the mechanisms of certain metabolic conversions, analyze the logic of their organization and see ways that metabolic pathways are engineered to get materials we'll need when the cheap oil runs out. We will <u>not, I repeat, not</u> memorize them. I think books are a great way to store information, trying to memorize things that are easily found in books is silly.

Detailed Syllabus:

Protein Structure
The amino acids: structure, properties, chemistry
Primary structure, the amide bond
Secondary structure, alpha helices and beta sheets
Non-covalent bonding
Tertiary structure and protein dynamics and folding
Supramolecular structures, protein-protein interactions

Enzymology and catalysis
Definition of catalysis
Chemical catalysis
Enzyme catalysis
The Michaelis-Menten formulation
Inhibition
Drug design and case studies thereof

Metabolism
Preview of biological chemical reactions
Lipid metabolism and polyketide biosynthesis
The emerging link between aging, NAD+ and metabolism
Glycolysis
Amino acid metabolism
Nucelotide metabolism
“Metabolomics” and metabolic engineering