

## Comprehensive Course Syllabus, Fall 2019 Biochemistry

### **Course Description:**

This is a one-semester course that extends fundamental concepts in chemistry, such as equilibrium, acid/base chemistry and thermodynamics into an exploration of biology. The content includes: 1) applying equilibrium processes to study biochemical reactions as well as cell structure, 2) studying the structure and function of amino acids and proteins, 3) analyzing the kinetic parameters of enzymes including different mechanisms of how drugs are used to inhibit enzymes, and 4) understanding and making connections in metabolism. The course is lab-based and students will gain experience in various bio-techniques to investigate these topics. The majority of the content is encountered through a guided inquiry process.

### **Instructor:**

Dr. Angie Ahrendt

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### **Meeting Days, Times**

**Room: A207**

AC days mods 3/4

BD days mods 1/2

**Office Hours:** C day mod 2; D day mod 3

### **Text/Materials:**

Text: Biochemistry; The Molecular Basis of Life, 3<sup>rd</sup> Edition, M<sup>c</sup>Kee & M<sup>c</sup>Kee

Additional classroom materials are posted on Moodle

Calculators and laptop computers are required

Folder/binder to keep all materials organized

### **Student Learning Objectives:**

#### 1. Water and Equilibrium

- a. Molecular Structure of Water
- b. Intermolecular Forces
- c. Thermal Properties of Water
- d. Solvent Properties of Water
  - hydrophilic, hydrophobic, and amphipathic molecules
  - osmotic pressure
- e. Equilibrium
- f. Ionization of Water
  - Acids, bases, and pH

#### 2. Amino Acids, Peptides, and Proteins

- a. Amino Acids
- b. Peptides
- c. Proteins

### 3. Enzymes

- a. Properties of Enzymes
- b. Classification of Enzymes
- c. Enzyme Kinetics
  - Michaelis-Menten Kinetics
  - Lineweaver-Burk Plots
  - Enzyme Inhibition
- d. Catalysis
  - Catalytic Mechanisms
  - The Role of Cofactors in Enzyme Catalysis
  - Effects of Temperature and pH on Enzyme-Catalyzed Reactions
  - Detailed Mechanisms of Enzyme Catalysis
- e. Enzyme Regulation
  - Genetic Control
  - Covalent Modification
  - Allosteric Regulation

### 4. Metabolism

- a. Carbohydrate metabolism
- b. Connections and regulations in metabolic pathways

### 5. Biotechnology

- a. Gel Electrophoresis
- b. Gel Filtration Chromatography
- c. Immobilized Metal Affinity Chromatography
- d. Ion Exchange Chromatography

### **Assessment**

There will be a variety of assessments consisting of homework, presentations, and in-class assessments, measured as follows:

- 1) Ability to reflect and demonstrate understanding on experiments through lab reports.
- 2) Ability to communicate their learning through presentations and class discussions.
- 3) Performance on quizzes and tests.
- 4) Ability to demonstrate understanding through writing assignments such as papers, paragraphs, and problem sets.

The grade break down will be

90% and above: A

80% and above: B

70% and above: C

60% and above: D

**Grades are weighted: Exams and Quizzes are 60% of the final grade; Labs and Homework are 40% of the final grade.**

### **SSLs and Outcomes:**

IA= Informally Assessed; FA=Formally Assessed; NA=Not Assessed; ABNA=Addressed But Not Assessed

### **I. Developing the Tools of Thought**

**A.** Develop automaticity in skills, concepts, and processes that support and enable complex thought. This is done through lab observations, data collection, graphing, analysis, use of significant figures, and using lab equipment properly. **FA**

**B.** Construct questions which further understanding, forge connections, and deepen meaning. This is done by analyzing data to draw conclusion and relate it to the concept. **FA**

**C.** precisely observes phenomena and accurately record findings. This is done through laboratory observations, data collection and analysis, using estimated digits and significant figures. **FA**

**D.** Evaluate the soundness and relevance of information and reasoning.

This is done by drawing conclusions from laboratory data. **FA**

### **II. Thinking About Thinking**

**A.** Identify unexamined cultural, historical, and personal assumptions and misconceptions that impede and skew inquiry. This is done by using Lewis dot structures and looking at Bohr models. **FA**

**B.** Find and analyze ambiguities inherent within any set of textual, social, physical, or theoretical circumstances. **ABNA**

### **III. Extending and Integrating Thought**

**A.** Use appropriate technologies as extensions of the mind. This is done by the use of calculators and computers. **IA**

**B.** Recognize, pursue, and explain substantive connections within and among areas of knowledge. This is done by making historical connections to the scientists as well as mathematical connections. **FA**

**C.** Recreate the beautiful conceptions that give coherence to structures of thought. This is done through analyzing and learning about molecular structures, atomic structures, geometry, and vectors. **IA**

### **IV. Expressing and Evaluating Constructs**

**A.** Construct and support judgments based on evidence. This is done by laboratory exploration, constructing laboratory reports as well as making generalization. **FA**

**B.** Write and speak with power, economy, and elegance. This is done through lab practicals and reports, and writing paragraphs demonstrating their understanding through discussions. **FA**

**C.** Identify and characterize the composing elements of dynamic and organic wholes, structures, and systems. This is done by applying basic electronic structures to chemical formulas, periodic trends, and properties of substances. **FA**

**D.** Develop an aesthetic awareness and capability. This is done by drawing attention to links between current content and the world around them. **ABNA**

### **V. Thinking and Acting with Others**

**A.** Make reasoned decisions which reflect ethical standards, and act in accordance with those decisions. This is done by not manipulating data to fit conclusions and preventing plagiarism in lab reports. **FA**

### **Instructional Design and Approach:**

Key to the experience of Biochemistry is a student's active participation in the process of scientific investigation. Students work individually and cooperatively to build an understanding of fundamental biochemical concepts. The essential experience is grounded in inquiry pursued through laboratory

based activities. These activities develop the habits and skills of safe and accurate data acquisition. Analysis, results and conclusions are then communicated and assessed.

### **Student Expectations:**

The experience you have in this course will be directly related to your level of participation! One cannot choose to be a nonparticipant and expect to reap all of the possible benefits. Therefore, we have established some guidelines for you:

1. Please be on time and ready for class - both mentally and physically. Students who are more than 5 minutes late will be given an unexcused absence since we will have already begun the lab/activity/discussion for that day. Refer to the Student Handbook for specific effects of excessive tardies and absences. There will be NO credit awarded for make-up work due to unexcused absences. It is the responsibility of each student to arrange for make-up work due to excused absences (preferably in advance!).
2. Besides being on time, please have all the materials you will need for the class WITH YOU! Our work on many days will require you to have your binder, calculator and pen/pencil. You should also wear closed-toed shoes on all class days.
3. Turning work in late is discouraged. When an assignment has been collected, it may be submitted for late credit at a 10% penalty per day. Once the material has been assessed and returned to any of the biochemistry sections, it cannot be submitted for late credit.
4. Any assignments that are submitted have to be in a readable format and if not, the same late policy will be applied.
5. No iPods, MP3/CD players used, sunglasses worn, or cell phones on in the classroom/lab. No eating or drinking in the lab.
6. Collaboration is encouraged throughout all facets of this course. Academic dishonesty, however, is not. It is expected that students will discuss laboratory results, and partners will share common data. It is also expected that all reports/work reflect individual thought. All other sources must be referenced appropriately.
7. If, at any point, you are experiencing some confusion - get help ***immediately***. Concepts cannot build upon each other if one is not understood. DO NOT WAIT until office hours occur. Schedule an appointment for a mutually convenient time.