**Syllabus- CHEM 421G Biochemistry, Fall 2014**
**Department of Chemistry**

**Instructor**: Dr. Jenq-Kuen (Jack) Huang, Currens 548B, Tel: 309-298-1207, Fax: 309-298-2180, e-mail: J-Huang3@wiu.edu

**Lecture Assistant:** David R Vanderway, email: DR-Vanderway@wiu.edu

**Lecture meeting time and place**: M, W, F., 8:00-8:50 am, Waggoner 378

**Office hours**: MWF 9:00-10:20 am; other times by appointment.

**Course prerequisite**: Chem.330 or Chem.332, or equivalent.

**Course description**: The course is intended to teach the chemistry of major cellular constituents and their metabolism.

**Course Objectives**: Upon completion of this course students are expected to know:

1. Common structure of cells and sub-organelles including their functions. Biologically important molecular structures. Covalent bond (nonpolar and polar bonds including hydrogen bonds) and ionic bond. Definition of acids and bases, dissociation constant and equilibrium constant, Le Châtelier's principle, Henderson-Hasselbalch equation, buffers, entropy and enthalpy, Gibb's free energy, and thermodynamics vs. kinetics.
2. Physical and chemical properties of proteins and enzymes, DNA and RNA, lipid bilayer membrane; relate the structure to its function.
3. Mechanisms for regulation of the metabolic processes. Bioenergetics deals with energy flow during biosynthesis (anabolism) and breakdown (catabolism) of biomolecules and how they are regulated.
4. The central dogma of information flow from DNA to RNA to protein. How genes in cell are turned on or turn off in response to stimulates such as hormones?
5. Using glucose as an example to demonstrate how chemical energy is transformed to ATP through catabolic processes.
6. Principles of common techniques used in biochemistry.

**Textbook**: "Biochemistry" 7$^{th}$ edition by Berg, Tymoczko, and Stryer. W. H. Freeman and Company. Stryer Home Page URL: http://bcs.whfreeman.com/berg7e/#t_644431 (7$^{th}$ edition) or http://www.whfreeman.com/stryer/ (6$^{th}$ edition).

**Technical support**: For any technical issue such as can't access to Westernonline please call U-Tech at 309-298-2704 or email ucss@wiu.edu.

**Grading**: This course consists of three credits of lecture work and one credit of laboratory. Therefore the semester grade will consist of 75% (750 points) from the lecture and 25% (250 points) from the lab. Lab exercises are integral parts of the course, to receive credit for the course as a whole one must complete the lab with at

least 60%. Failure to complete the lab will result in failure of the course. Your letter grade will be based on your total accumulated points.

| | |
|---|---|
| 3 exams | 330 points |
| Best 8 of 10 quizzes | 120 points |
| Research Term paper<br>Topic approval<br>Term paper | <br>10 points<br>70 points |
| 4 Homework assignments | 120 points |
| Comprehensive final (Standardized exam issued by American Chemical Society) | 100 points |
| Laboratory | 250 points |

**Grading Scale** (including plus/minus grading) **for undergraduate or bridge credits**

| | |
|---|---|
| 90.00% and above | A |
| 86.70 - 89.99% | $A^-$ |
| 83.40 - 86.69% | $B^+$ |
| 80.00 - 83.39% | B |
| 76.70 - 79.99% | $B^-$ |
| 73.40 - 76.69% | $C^+$ |
| 70.00 - 73.39% | C |
| 66.70 - 69.99% | $C^-$ |
| 63.40 - 66.69% | $D^+$ |
| 60.00 - 63.39% | D |
| 56.70 - 59.99% | $D^-$ |
| 56.66% and below | F |

**Grading Scale for graduate credits**

| | |
|---|---|
| 90.00 % and above | A |
| 80.00 - 89.99% | B |
| 70.00 - 79.99% | C |
| 60.00 - 69.99% | D |
| 59.99% and below | F |

**Exams and Quizzes**: Three 50-minutes exams and a 110-minutes final exam will be given during the semester. Short quizzes (use the first 10 minutes of the class time) and exams will be given on Wednesdays. Student who arrives late will lose that amount of time for the quiz or exam. No makeup quiz or exam will be allowed unless you have acceptable excuses such as personal illness or family emergencies or participate in University sponsored functions [i.e. WIU band trips, athletics, field trips in other WIU classes, professional meeting (not sorority/frat, or other clubs)]. In all cases, documentation is required and must be submitted to the instructor in a week prior to the event or as soon as possible in case of emergency. Makeup quiz or exam should be completed by the following Monday. It is the responsibility of the student to schedule the makeup quiz or exam with the instructor in a timely manner.

Seating will be assigned by the instructor during the exams and/or any other time deemed necessary. Please silent cell phones and put away laptops while in class. Cell phones and laptops can be very distracting and cannot be out during quizzes and exams. Also, class time is not a social hour. Please refrain from casual conversation during class time.

An incomplete grade will **NOT** be given to a student with a failing grade. No incomplete will be given to a student without documented evidence of an emergency that requires the student be away from the university or miss the final examination. The student shall notify the instructor of the emergency as soon as possible and prior to the final examination.

**Attendance**: Regular and punctual class attendance is vitally important to a student's academic achievement**.** Attendance will be taken each day and you'll receive an attendant report on Fridays. Penalty will be imposed on graduate (regardless taken as G credit or not) and bridge students who miss class (five points will be deducted for each absence. Tardy for three times will be counted as absence). Students are responsible for all information and materials given in class whether you are present or not. Excessive absences will be reported to financial aid office. Attendance at the laboratory including pre-lab lectures is required for all students.

**Invest time in this course**: Students are expected to read ahead and prepare for the class. You will probably find that this is a fast-paced course; it is highly advisable to keep up with the materials. Past experience suggests that reading the designated chapters, go over PowerPoint slides and study guides and do the homework in a timely manner are essential to succeed in this course. A daily minimum of two hours of study are needed to do well in this class. Write down any questions related to this course, you may submit the questions in class or visit my office hours or email me any time.

**Research term paper**: Research term paper must be a topic of biochemical relevance and chosen in consultation with the instructor. A topic of your term paper and the sources of the six journal research articles (provide URL links to these six full-length research articles is good enough. Do not turn in the hard copy of these sources) must be submitted to your instructor for approval no later than **October 24** via "Dropbox". The penalty for the late submission will be a deduction of 10% each day (out of the10 points). Once the term paper topic is approved please do not change it because 35 out of 70 points will be deducted if you change the topic. Any term paper submission without prior approval will not be graded, and the student will receive zero point for the term paper.

If you have difficulty to identify whether an article is a research article or review paper, look for the "Materials and Methods" and "Results" sections in the text. All research articles have these sections which are not seen in a review paper.

There are five useful websites for literature search: (1). PubMed/PMC (a service of the National Library of Medicine located in the campus of National Institutes of Health). Once in the PubMed homepage, click on the point down symbol (upper left corner) and move the cursor to PMC (PubMed Central, a NIH digital repository for biomedical

research). There are about 130 bioscience and medical related journals in this website, all are free for downloading. (2). ACS (American Chemical Society) homepage **via** WIU library to avoid “pay-per-view" charge. Once in the WIU library homepage, click on the Database (top middle on screen) and move cursor to ACS website. (3). ScienceDirect which offers more than a quarter of the world's scientific, medical and technical information online. Some articles are free for downloading; unfortunately most articles are pay-per-view. If articles are pay-per-view and are important to you, you may request them via WIU interlibrary loan. (4). Quertle, http://www.quertle.info/, the search setting is similar to the other three sites mentioned above. (5) SciFinder **via** WIU library (ID and password are required. If you are the first user you must register).

The term paper is to be approximately 8 typed, double-spaced, pages and must include the six references published from 2003 to present. . The term paper must be your own work and use your own words. Sources of ideas or information must be referenced. The paper will be graded on the basis of the format, content, construction and conciseness, and must be submitted by December 5 via “Dropbox**”.** Please keep in mind, both your term paper and the six full research articles (provide URLlinks) from which your term paper is based upon must be submitted to receive the term paper grade (your term paper will not be graded if the URL links are not provided). There is a penalty for late term paper submission- a deduction of 10% each day (out of the 70 points). The first penalty is applied 3 days after the deadline. Term paper will not be accepted after December 12.

Graduate (taking G credit) and bridge students have additional course requirements compared to undergraduates. Graduate and bridge students have to submit 12-pages term paper involving an in-depth discussion of the approved topic. In addition, graduate and bridge students will be expected to demonstrate a higher level of understanding of concept presented; a greater amount of detail and understanding of complex processes when answering exam questions; a greater independence in performing laboratory exercises.

**Statement on Ethics**: Western Illinois University, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. Students have rights and responsibilities. The following action is prohibited under the WIU “Code of Student Conduct”: Any behavior which disrupts the regular or normal functions of the University community, including behavior which breaches the peace or violates the rights of others. Plagiarism, cheating, and other forms of academic dishonesty constitute a serious violation of the Code.

You are expected to do your own work at all times such as homework, term paper, lab reports. Students may discuss assignments among themselves, with an instructor or tutor, but when the actual work is done, it must be done by the student alone. For instance, you can’t copy any lab report from your lab partner.

For details about the “Code of Student Conduct”, please visit the Website, http://www.wiu.edu/student_services/student_judicial_programs/codeofconduct.php

**Students with Disabilities**: In accordance with University policy and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. For the instructor to provide the proper accommodation(s) you must obtain documentation of the need for an accommodation through Disability Resource Center (DRC) and provide it to the instructor. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire about such particular needs of students. Students who may require special assistance in emergency evacuations (i.e. fire, tornado, etc.) should contact the instructor as to the most appropriate procedures to follow in such an emergency. Contact Disability Resource Center (DRC) at 298-2512 for additional services.

**Tentative Lecture/Exam Schedule**:
Ch1. Biochemistry: An Evolving Science
Ch2. Protein Compositions and Structure
Ch3. Exploring Proteins and Proteomes
**Tuesday, Sept. 23 by noon ---- first homework**
**Wednesday, Sept. 24 ---- first 50-min exam**

Ch4 .DNA, RNA, and the Flow of Genetic Information
Ch5. Exploring Genes and Genomes
Ch11. Carbohydrate
Ch8. Enzymes: Basic Concepts and Kinetics
**Tuesday, Oct. 21 by noon ---- second homework**
**Wednesday, Oct. 22 ----- second 50-min exam**

Ch12. Lipids and Cell Membrane
Ch 13 &14. Membrane Channels & Pumps and Signal-Transduction Pathways
Ch16. Glycolysis and Glucogenesis
**Tuesday, Nov.18 by noon ---- third homework**
**Wednesday, Nov. 19 ---- third 50-min exam**

Ch17. The Citric Acid Cycle
Ch18 and 19. Oxidative Phosphorylation and the Light Reaction of Photosynthesis
**Friday, Dec. 12 by noon ---- fourth homework**
**Monday, Dec. 15, 8:00 am- 9:50 am ---- final exam**

**Holidays and Other Important Dates:**

| **Date** | **Event** |
|---|---|
| August 25, Mon. 2014 | First Day of Classes |
| September 1, Mon. 2014 | Labor Day Holiday |
| October 10, Fri. 2014 | Fall break |
| November 24-28, Mon. -Fri. 2014 | Thanksgiving break |
| December 15-19, Mon. -Fri. 2014 | Final exam week |
| December 20, Sat. 2014 | Commencement |

**SYLLABUS IS SUBJECTED TO CHANGE WITH NOTICE**

**Last Updated on August 12, 2014 by Dr. Jenq-Kuen (Jack) Huang, Department of Chemistry, Western Illinois University**

**Syllabus- CHEM 421G Biochemistry laboratory, Fall 2014**
**Department of Chemistry**

**Lab Instructor**: Dr. Jenq-Kuen (Jack) Huang, Currens 548B, Tel: 298-1207, e-mail: J-Huang3@wiu.edu

**Teaching Assistant:** Chandra K. Ailneni (ck-ailneni@wiu.edu) for sections 21 and 22

**Laboratory meeting time and place**:

| | Meeting Time | Meeting Place | |
|---|---|---|---|
| | | Pre-lab lecture | lab |
| Section 21 | Tuesday 8:00-10:50 am | Currens 202 | Currens 535 |
| Section 22 | Tuesday 2:00-4:50 pm | Currens 202 | Currens 535 |

**Office hours**: Huang: M.W.F., 9:00-10:20am, other times by appointment.

**General**: Safety is the first concern in a chemistry lab. Material Safety Data Sheets (MSDS) information about all chemicals utilized in the laboratory can be found at http://hazard.com/msds/. Proper handling of chemicals, especially correct pipetting technique is expected. Safety glasses are to be worn at all times. A notebook is required for data recording. A copy of the raw data for each experiment is to be turned in at the end of each lab period.

- Students must wear goggles, closed-toe shoes and proper attire while working in the lab. Otherwise, the student will be asked to leave the lab, and it will be counted as a missed lab session.

- Students enrolled in this course are levied a non-refundable laboratory usage fee of $35 to cover the cost of consumable supplies utilized during the semester.

**Attendance**: Lab attendance includes the pre-lab lecture and lab exercise and both parts are mandatory. If it should be necessary to miss a lab, please notify your instructor by email before the fact if possible. No makeup lab, pre-lab quiz, or lab exam will be allowed unless you have reasonable excuses such as personal illness or family emergencies or university sponsored functions (i.e. WIU band trips, field trips in other WIU classes, WIU athletics, etc.). In all cases, documentation is required, and must be submitted to the instructor in advanced or as soon as possible. Student is only allowed to have one makeup lab per semester unless there is a special permission from your lab instructor. All other absences, the student will receive zero grade for that lab.

Student who is 1-5 minutes, 6-10 minutes, or more than 10 minutes late for the pre-lab lecture will lose 1 point, 2 points, or 3 points, respectively, for that lab.

**Grading (250 points total)**: Ten lab exercises and two lab exams are scheduled. The laboratory portion of the course will be graded based on two lab exams (52 points), pre-lab quizzes (30), lab reports (148 points), raw data (10 points). A copy of the raw data must be turned in before leaving the lab to earn 1 point. To receive credit for the course

as a whole student must complete the lab with at least 60%. Failure to complete the lab will result in failure the course.

**Lab Reports:** Each lab report is consisted of two parts: pre-lab and post-lab reports. The reports are to be typewritten (Font-12 and Times New Roman is preferred).

1). Pre-lab report: Pre-lab report must include cover page (a stand-alone page), objective, theory/background, materials, and procedures (in your own words). The pre-lab report must be completed before coming to the pre-lab lecture. Your lab TA will collect the pre-lab report, sign it, and return to you during the lab. Failure to comply will lose 5 points. The pre-lab report signed by TA must be re-submit with the post lab in the following week.

Format and points assigned to the pre-lab report:

a). A stand-alone cover page. It must include the title of the experiment, course number, your name (bold type) and the name of your lab partner, the name of your lab instructor, the name of your lab TA, and the date the lab experiment was performed. (0.4 points)

b). Objective(s). State it in two to three sentences about the objectives of the experiment. (0.4 points)

c). Theory/Background information. Give no less than a half page to summarize the basics of how the objective(s) will be realized. This may include important reactions, techniques or instrumental methods. It should not include procedures. (1.8 points)

e). Materials. All chemicals and reagents used must be recorded including their concentrations, so do the instruments, devices, and glassware. (0.4 points)

f). Procedures (methods): The details should be sufficient so that your fellow classmates can read your report without having any guessing. Any last minute change in procedures or concentration during lab session must be recorded. Use your own words and do not directly copy it from the provided lab procedure. (2 points)

- Do not place Arabic numeral at the beginning of a sentence.

- Past tense and passive voice must be used to write up the procedure because you described things that had happened, and passive voice is the standard format for a scientific writing. Several examples are pro

- The format in the following three sentences are not correct:
  - I weigh out 0.6 g glycine and put it into a 100-mL volumetric flask.

  It is not correct because a present tense is used and it is not passive voice.
  - I weighed out 0.6 g glycine and put it into a 100-mL volumetric flask.

  Although a past tense is used but it is not passive voice.
  - 0.6 g glycine was weighed out and put into a 100-mL volumetric flask.

  Although a past tense and passive voice are used, an Arabic numeral is placed at the beginning of a sentence.
- The edited format is shown below:
  - Glycine (0.6 g) was weighed out and put into a 100-mL volumetric flask.

- The amount of 0.6 g glycine was weighed out and put into a 100-mL volumetric flask.

2). Post-lab report: Post-lab report must include the results (experimental data and calculations), discussion and conclusion, and answer to the questions listed at the end of each lab procedure. All questions must be answered unless otherwise indicated by your lab instructor.

a). Results- the accuracy/quality of your data will be graded. (5 points)
- These should include tables, graphs and calculations, if any
- All data should be typed and organized into tables
- Graph generated by Excel must be copied and pasted into your report
- Tables and graphs should have self-explanatory titles
- Numbers should have appropriate units
- X and Y axes should be labeled
- All calculation should be included with appropriate units

b). Discussions and conclusion: You knew the objective(s) and the expected outcome(s) of the experiment before doing the lab exercise from writing the pre-lab report and the pre-lab lecture. During the lab exercise, you recorded any observations and collected data. In the post-lab report you have to mention what you have learned and what is(are) the conclusion(s) from the lab exercise. It doesn't matter if your results agree to or disagree to the expected outcome(s), the most important thing is that you have to discuss them. For instance, if your data agree to the expected outcome, it means your lab skills were good and no mistake was made. If unexpected result was obtained you have to give reasonable explanations, such as using dirty glassware, wrong reagent or something else. (1.8 points)

c). References- List cited references. (0.2 points)
Please visit the following website, "How to Cite Other Sources in Your Paper" which gives information and examples about how to cite sources from journals
http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWcitations.html

Do not cite any references you never read. If the content of your lab report came from the provided lab handouts from westernoline, then cite that source. The common mistake in the past is that students cut and paste the references listed at the end of each lab handout even though they did not read the article(s).

d). Answer to questions at the end of the lab handouts unless otherwise directed by your lab instructor. (2 points)

** A complete lab report must include the pre-lab and post-lab reports and must be submitted online as a single "pdf file" via the "Dropbox" prior to the beginning of the next lab session**.** In addition, a hard copy of your complete lab report (pre-lab report signed by TA and post-lad report) must be stapled together and submitted at the beginning of the next pre-lab lecture session as well. Late reports will be docked by 1 point each day, and lab reports turned in two weeks after the due date will not be graded.

Lab report should represent the individual student's work. Although much of the lab work will be done with your lab partner and it is alright to discuss and work on the calculations, however **the preparation of your lab report must be completed independently**. Using any part of the report written by your lab partner or by others commits a plagiarism. Plagiarism and other forms of academic dishonesty constitute a serious violation of WIU students conduct regulations. Any student convicts academic dishonesty could receive a failing grade and may be subject to further academic penalties.

**Tentative lab exercises and grading scale**

| Date | Lab # | Activities | Points (raw data/ pre-lab quiz/ report) |
|---|---|---|---|
| 8/26 | | (1). I'll use the lab time to cover chap 1 lecture. Go to Currens 202.<br>(2). Please register to SciFinder at you convenience and submit a prove of registration via "Dropbox" by Sept 8.<br>http://www.wiu.edu/library/databases/db_web.sphp?id=529 | 0/0/6 |
| 9/2 | | I'll use the lab time to cover chap 1 lecture. Go to Currens 202. | 0/0/6 |
| 9/9 | | (1). Go over lab syllabus. Go to Currens 202<br>(2). Online literature search. Go to Currens 529 chemistry computer lab on time to have the hands-on experience on literature search. | 0/0/6 |
| 9/16 | 1 | Titration of glycine. Watch videos:<br>- http://ocw.mit.edu/resources/res-5-0001-digital-lab-techniques-manual-spring-2007/videos/volumetric-techniques/<br>- http://ocw.mit.edu/resources/res-5-0001-digital-lab-techniques-manual-spring-2007/videos/titration | 1/3/14 |
| 9/23 | 2 | Methyl red colorimetry | 1/3/14 |
| 9/30 | 3 | Protein color reactions | 1/3/14 |
| 10/7 | 4 | (a). Isolation of β-amylase (part I- extraction and fractionation of protein from sweet potato). The extract will be stored at 4 $^{o}$C in the presence of toluene until Dec 2, lab 10.<br>(b). SDS-polyacrylamide gel and determination of molecular weight of proteins. Watch animations.<br>http://www.dnatube.com/video/4334/SDSPAGE<br>http://bcs.whfreeman.com/biochem5/cat_040/ch04/ch04xd02.htm | 1/3/-- |
| 10/14 | 5 | (a). Isolation of plasmid DNA from bacteria. Watch videos:<br>http://www.youtube.com/watch?v=8xEDEJ0DHFA<br>(b). How to use a pipetman. Watch videos:<br>- http://ocw.mit.edu/resources/res-5-0001-digital-lab- | 1/3/14 |

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|---|---|---|---|
| | | techniques-manual-spring-2007/videos/using-an-automatic-pipet/<br>-<br>http://www.bio.upenn.edu/computing/media/Instructional.Pipetman.php | |
| 10/21 | | (1). Set up Polymerase Chain Reaction (PCR) first (get ready for next week).<br>(2). Lab midterm exam follows | 26 |
| 10/28 | 6 | (a). Analysis of PCR product by agarose gel. Come to Currens 535 to load your sample to agarose gel for gel electrophoresis.<br>(b). Lab pre-lecture. Watch videos:<br>http://www.dnalc.org/resources/animations/pcr.html<br>http://www.youtube.com/watch?v=yoebmSaF_ug<br>http://www.life.illinois.edu/molbio/geldigest/electro.html | 1/3/14 |
| 11/4 | 7 | Carbohydrates (part I) | 1/3/-- |
| 11/11 | 8 | Carbohydrates (part II) | 1/3/28 |
| 11/18 | 9 | Kinetics of β-fructofuranosidase | 1/3/14 |
| 12/2 | 10 | β -amylase (Part II), continued from Lab 4 | 1/3/28 |
| 12/9 | | Comprehensive lab final exam | 26 |

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**Supplies to be provided by students**

- Safety goggles. Eye protection is required and must be purchased by the student.
- Scientific Calculator
- Notebook

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**Last Updated on August 23, 2014 by Drs. Jenq-Kuen (Jack) Huang, Department of Chemistry, Western Illinois University**