

General Biochemistry -- Macromolecules Fall 2009

Instructor: Thomas Kuhn, Annex I, Natural Science Facility, 474-5752, tbkuhn@alaska.edu

Office Hours: Monday and Friday following lectures. However students are encouraged to contact the instructor by phone or email at any time

Lecture: Monday, Wednesday, Friday 9:15-10:15 AM, REIC 204

Textbook: *Principals of Biochemistry* (2008) 5th Edition
David L. Nelson and Michael M. Cox
W. H. Freeman and Company, NY
ISBN-10: 0-7167-7108-X

The expression and transmission of genetic information
(2004) 3rd edition, Voet and Voet Vol II

Either book provides adequate reading material with minimal difference in detail and depth on some topics.

Course

This 3 credit course will discuss the biochemistry (structure and dynamics) of the two principal macromolecules DNA and RNA and briefly Proteins. Topics addressed include nucleotide metabolism, DNA structure and topology, DNA Replication - Repair - Recombination, Cell Cycle Regulation, RNA transcription and processing, Gene Expression, Translation, and Protein Metabolism. Biomedical relevance and contemporary techniques will be addressed if appropriate.

Paper Discussions

Research paper(s) pertinent to topics addressed in lectures will be discussed with respect to rationale, hypothesis, research data, and analysis. Students are randomly asked to explain parts of sections and/or figures. These discussions are critical to translate “book knowledge” into applied understanding of science. Papers will be distributed *one week prior* to discussion.

Course Goals:

- Develop an understanding of the biochemical processes underlying structure, function, regulation, and dynamics of DNA, RNA, and Proteins.
- Fundamental topics include are but not limited to structure-function relations of protein/DNA interactions, regulation and synchronization of complex processes, and protein quality control. All topics are discussed in the context of developmental processes and/or pathologies.
- Use of concepts to formulate hypotheses and interpret experimental data to benefit the understanding of current research through paper discussion.

Learning Outcomes

1. Understand structure-function relationship determining protein-DNA interactions
2. Aspects of synergism, cooperativity, and reciprocity relevant to macromolecular dynamics
3. Gene regulation – interplay among macromolecules and expression of phenotypes
4. Biomedical/disease-related aspects of topics
5. Critical reading of primary research literature
6. Understanding of principal methods and techniques

Instructional Methods:

The teaching methods employed in this course will consist of lectures (powerpoint) and “chalk-talk” by the Instructor. Certain topics will be explored more in depth through discussions of primary research papers. Blackboard will serve as a platform to distribute papers, other assignments, lecture material, exams, and other announcements regarding the course. It is absolutely crucial that reading (see schedule) of sections is done *in advance* and *notes are taken*.

Grading

Exams: There will be three term exams (150 points each) including the final exam (200 points each).

Papers: **Six paper** discussions over the term of the semester account for 300 points (50 points each).

Students are expected to contribute to these discussions. A single constructive (note that this not mean correct) contribution is sufficient to receive full points.

Participation: **Class participation** will be included in the final grade (50 points). This entails an active involvement into the regular lecture materials discussed.

The overall grade will be based upon a total of 1000 points. Note that participation in class and during paper discussions account for roughly 1/3 of your final grade.

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|---------------------|-------------------|
| Class Participation | 50 Points |
| Paper Discussion | 300 Points |
| Term Exam I | 150 Points |
| Term Exam II | 150 Points |
| Term Exam III | 150 Points |
| <u>Final Exam</u> | <u>200 Points</u> |
| Total | 1000 Points |

Course Policies

Attendance: Regular student attendance is expected to ensure consistent group activities and discussions. Active student participation is expected and will be taken into account in the final evaluation/grading accounting for 250 pts total (25% of final grade).

Exams: Four exams will be given. These exams will be a combination of multiple choice/short answer and essay questions (take home). Makeup exams will only be allowed with pre-approval of the instructor or with an acceptable, documented reason such as unexpected illness, family emergencies or other unavoidable events.

Papers: Students will receive adequate preparation time. **Emphasis** is put on an understanding of the rationale, hypothesis, data/experimental design, and critical analysis. Student will be randomly called on to answer questions.

Participation: Class participation entails an active interest aside from paper discussion/presentations. This includes but is not limited to answering questions during lectures, asking for clarifications, or contributing to ad hoc discussions.

Ethical Considerations: The Chemistry “Department Policy on Cheating” is as follows: “*Any student caught cheating will be assigned a course grade of F. The student’s academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.*”

Plagiarism Policy

Plagiarism is defined as the use of “other” intellectual property without proper reference to the original author. *Intellectual property includes all electronic (**Internet**), spoken or print media.* Students are expected to cite all sources used in oral and written presentations. Cases of plagiarism will be taken seriously with a grade 0 for the particular assignment. Severe cases may be referred to the Department Chair or Dean or class failing considered.

Support Services

Support services will be provided by the University of Alaska Library system, online resources and the instructor. Additional services are available through Student Support Services (<http://www.uaf.edu/sssp/>) at UAF.

Disabilities Services

Students with a physical or learning disability are required to identify themselves to Mary Matthews in the Office of Disabilities Services (203 WHIT, 474-7043) located in the Center for Health and Counseling in order to receive special accommodations. The student must provide documentation of the disability. Disability Services will then notify me of special arrangements for taking tests, working homework assignments, and doing lab work.

Special Dates pertinent to the course

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| Last day for 100% tuition refund | 9-11 |
| Last day to drop courses | 9-18 |
| Last day to withdraw from courses | 10-30 |
| Thanksgiving Holidays | 11-26 to 11-29 |
| Last day of instruction | 12-14 |
| Final Examination | 12-16 from 8am -10am |

See academic calendar on inside cover of course catalog for more important dates.

| Date | Lecture | Topic | Text |
|--------------|----------------|--|------------------------|
| 9-4 | 1 | Introduction to Course | |
| 9-7 | 2 | Nucleotides (Chemistry & Biosynthesis) | 271-77, 296-98, 883-88 |
| 9-9 | 3 | Nucleotides (Biosynthesis & Degradation) | 883-88, 892-96 |
| 9-11 | 4 | Deoxynucleotides | 883-891 |
| 9-14 | 5 | DNA Structure | 277-89, 947-54 |
| 9-16 | | DNA Topology | 954-62 |
| 9-18 | 6 | Chromosome Structure | 962-71 |
| 9-21 | 7 | Paper Discussion I (topoisomerases) | |
| 9-23 | (1-7) | Exam I | |
| 9-25 | 8 | DNA Replication | 975-92 |
| 9-28 | 9 | DNA Replication | 975-92 |
| 9-30 | 10 | DNA Replication | 975-92 |
| 10-2 | 11 | DNA Repair/Recombination | 993-1016 |
| 10-5 | 12 | DNA Repair/Recombination | 993-1016 |
| 10-7 | 13 | Paper Discussion II (repair mechanisms) | |
| 10-9 | 11 | Cell Cycle Regulation | 469-73 |
| 10-12 | 12 | Cell Cycle Regulation | 469-73 |
| 10-14 | 13 | Oncogenes | 473-479 |
| 10-16 | 14 | RNA polymerases | 1021-33 |
| 10-19 | (8-13) | Exam II | |
| 10-21 | 15 | RNA polymerases | 1021-33 |
| 10-23 | 16 | Reverse Transcription | 1050-61 |
| 10-26 | 17 | Paper Discussion III (RNA polymerase) | |
| 10-28 | 18 | RNA processing (transport, capping) | 1033-50 |
| 10-30 | 19 | RNA processing (splicing) | 1033-50 |
| 11-2 | 19 | RNA processing (splicing, poly A) | 1033-50 |
| 11-4 | 20 | Paper Discussion IV (editing/splicing) | |
| 11-6 | 21 | Gene Expression | 1115-25 |
| 11-9 | 22 | Gene Expression | 1126-36 |
| 11-11 | 23 | Gene Expression | 1136-54 |
| 11-13 | 24 | Paper Discussion V (chromatin remodeling) | |

| Date | Lecture | Topic | Text |
|--------------|----------------|--|------------------------------|
| 11-16 | (15-24) | Exam III | |
| 11-18 | 25 | Translation (Genetic Code, tRNA) | 1065-70, 1042-45, 1070-74 |
| 11-20 | 26 | Translation (Ribosomes) | 1075-85 |
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| 11-23 | 27 | Translation (Initiation, Elongation,) | 1085-99 |
| 11-25 | 28 | Translation (Termination, Degradation) | 1100-09 |
| 11-27 | | Thanksgiving (no classes) | |
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| 11-30 | 29 | Protein Folding | 1100-09 |
| 12-2 | 30 | Protein Targeting | 1100-09 |
| 12-4 | 31 | Paper Discussion VI (Folding/Degradation) | |
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| 12-7 | 32 | Protein Sorting | 1100-09 |
| 12-9 | 33 | Enzyme Kinetics | 183-228 |
| 12-11 | 34 | Enzyme Kinetics | 183-228 |
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| 12-14 | | | |
| 12-16 | (25-34) | Final Exam | |