

SAN DIEGO STATE UNIVERSITY  
CHEMISTRY 563 -- Nucleic Acid Function and Protein Synthesis  
Fall 2016

PLEASE SEE THE BLACKBOARD WEB SITE FOR FUTURE ANNOUNCEMENTS  
AND TO DOWNLOAD POWERPOINT SLIDES

**Lectures:** TTh 11:00-11:50 in SH-119 (Storm Hall Room 119)

**Textbook:** Voet, Voet, and Pratt: “**Fundamentals of Biochemistry**”, 4<sup>th</sup> Edition, Wiley, 2012.  
(Most of you have used this same text and edition for Chem 560.)

**Instructor:** Professor William Stumph, Ph.D.  
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Phone: (619) 594-5575  
Office hours: T,Th, 12:00-13:00 or **just about anytime by appointment.**

**Prerequisite:** Chemistry 560 or the equivalent (one semester of upper-level biochemistry).

**Expected Student Learning Outcomes:**

- 1) To be able to explain in molecular detail how living cells synthesize DNA, RNA, and proteins.
- 2) To recognize and explain how macromolecules such as DNA, RNA, and proteins interact with each other, and to be able to predict the outcomes of such interactions.
- 3) To recognize and explain how the structure of macromolecules relates to their function, and to be able to rationalize macromolecule biochemical function based upon structure.
- 4) To explain how the expression of genetic information is regulated at the molecular level.
- 5) To explain the theory behind important technologies utilized in the biochemistry/biotechnology/forensic research laboratory.
- 6) To discuss the correspondence of molecular abnormalities with cancer, aging, and genetic disease.

**Expectations:** Regarding Powerpoints and your lecture notes: The Powerpoint slides will be available for download from the SDSU Blackboard web site. Essentially all of the slides will be available as PDF files. **It is recommended to the strongest degree that you print out those pages before class and that you write your lecture notes directly on the pages with the Powerpoint images.** If possible, you should print the Powerpoint images in color.

You are not responsible for knowing everything in the textbook. **Unless noted otherwise, you are responsible for everything presented in the Powerpoint slides and for everything written on the physical blackboard during lecture, as well as what is said in lecture. There will definitely be additional material presented in lecture and written on the board that is not in the Powerpoints. Thus, attendance at lecture is important!**

**Examinations:** There will be three mid-term exams of 100 points each and a comprehensive final exam worth 150 points. There are thus a total of 450 points possible for the course. The final examination will have approximately 60 points on material covered after the third mid-term, and approximately 90 points on material previously tested upon in the first three mid-terms.

<b>Grading scale:</b>	405-450 points (90-100%):	A
	360-404 points (80-90%):	B
	315-359 points (70-80%):	C
	270-314 points (60-70%):	D
	<270 points (<60%):	F

Exams will contain primarily multiple choice, but also some short answer, questions.

### **No calculators or electronic devices of any kind are allowed at the exams.**

The multiple choice questions on the exams will be answered on SCANTRON forms.

**On Thursday, September 15, bring four completely blank SCANTRON forms No. 882-E to class and give them to me. Do not put your names or any marks on them.** Be sure that I check off your name so that there is a record that I have received them from you. I will distribute blank Scantrons back to you for your use on the days of the exams.

Examples of past exam questions from previous years will be provided on the Blackboard Web Site.

The lecture schedule on the next page is approximate and subject to change.

**However, the dates for the three mid-terms and the final exam are fixed and will not change.**

SYLLABUS STATEMENT for Students with Disabilities:

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at [\(619\) 594-6473](tel:6195946473). To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Disability Services. Your cooperation is appreciated.

CATALOG DESCRIPTION of the course:

CHEM 563. Nucleic Acid Function and Protein Synthesis (2)

Prerequisite: Chemistry 365 or 560.

DNA replication, RNA transcription, RNA processing, and protein translation, including chemical mechanisms of synthesis; cellular mechanisms of regulating gene expression; genomics, recombinant DNA, and DNA topology. Not open to students with credit in Chemistry 361.

# Chem 563: Nucleic Acid Function and Protein Synthesis -- Fall 2016

(Tentative Lecture Schedule; Exam Dates Are Firm)

	DATE	TOPIC	Reading
1	August 30	Nucleotides, Nucleic Acid Structure	Chapter 3 pp 40-49
2	September 1	Chemical properties of DNA and RNA; RNA enzymes and the RNA World; the size of DNA molecules.	Chapter 24 pp 838-846
3	September 6	The Central Dogma; DNA/Genome sequencing, Molecular Evolution and derivation of phylogenies from molecular sequence data; Prokaryotic DNA replication.	Chpt.3 pp 49-51, pp 58-62; Chapter 25 pp 867-884
4	September 8	Prokaryotic DNA replication.	Chapter 25, pp 867-884
5	September 13	Restriction Enzymes; Gel Electrophoresis of nucleic acids; Recombinant DNA and PCR; practical applications	Chpt. 3, pp 52-54; pp 847-851 Chapter 3 pp 62-65, 67-72
6	September 15	Nucleic acid purification, fractionation, geometry of DNA	Chapter 24 p 846; 848-855
7	September 20	DNA Supercoiling and Topoisomerases	Chapter 24 pp 830-838
8	September 22	DNA Supercoiling, Topoisomerases; Transcription, Bacterial RNA polymerase, Promoters	Chapter 24 pp 830-838 Chapter 26 pp 919-930
<b>9</b>	<b>September 27</b>	<b>FIRST MID-TERM EXAMINATION</b>	
10	September 29	Transcription: Bacterial RNA polymerase; Promoters, Initiation; Elongation and termination;	Chapter 26 pp 919-930
11	October 4	Eukaryotic RNA polymerases and eukaryotic promoters	Chapter 26 pp 929-937
12	October 6	Eukaryotic General Trxn Factors and Preinitiation Complex Assembly	Chapter 26 pp 937-942
13	October 11	Post-transcriptional RNA processing: eukaryotic mRNA capping, polyadenylation, and splicing; Group II and Group I self-splicing introns	Chapter 26 pp 942-959
14	October 13	Alternative Splicing; RNA editing; rRNA and tRNA processing;	Chapter 26 pp 942-959
15	October 18	Translation: the genetic code; tRNAs and aminoacylation	Chapter 27 pp 962-974
16	October 20	Translation: Codon-anticodon interactions; Wobble; Ribosomes	Chapter 27 pp 974-984
<b>17</b>	<b>October 25</b>	<b>SECOND MID-TERM EXAMINATION</b>	
18	October 27	Polypeptide chain initiation, elongation, and termination.	Chapter 27 pp 984-1004
19	November 1	Protein synthesis inhibitors (antibiotics); posttranslational processing	Chapter 27 pp 1000-1009
20	November 3	Regulation of prokaryotic gene expression; the lac operon and its repression and activation; helix-turn-helix DNA-binding motif ; Riboswitches	Chapter 28 pp 1023-1028 Chapter 24 pp 851-852; 1030-1032
21	November 8	Regulation of Eukaryotic Gene Expression: Activators and Repressors of Transcription; DNA binding domains in eukaryotic transcription factors	Chapter 28 pp 1043-1049 Chapter 24 pp 854-857
22	November 10	Eukaryotic chromosomes and chromatin structure; histones; nucleosomes	Chapter 24 pp 858-863
23	November 15	Role of Chromatin in eukaryotic gene regulation; RNA interference; Genomics	Chapter 28 pp 1032-1043 1049-1055; 1013-1023
24	November 17	Cell Cycle, Cancer and Apoptosis (programmed cell death)	Chapter 28 pp 1059-1068
<b>25</b>	<b>November 22</b>	<b>THIRD MID-TERM EXAMINATION</b>	
<del>26</del>	<del>November 24</del>	Happy Thanksgiving!	
27	November 29	Eukaryotic DNA Replication	Chapter 25 pp 884-891
28	December 1	Retroviruses; Reverse Transcriptase; Telomerase; Aging	Chapter 25 pp 884-891
29	December 6	DNA damage and repair; DNA recombination	Chapter 25 pp 891-904
30	December 8	Antibodies and DNA rearrangements for antibody production.	Chapter 7, pp 208-213 Chapter 28 pp 1056-1059
31	December 13	Catch-up	
33	<b>December 20</b>	<b>FINAL EXAMINATION – Tuesday, Dec. 20, 10:30-12:30, SH119</b>	<b>Comprehensive Exam</b>