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# ADVANCED BIOCHEMISTRY: NUCLEIC ACIDS – CHEM 596

FALL 2019  
SCHEDULE NUMBER 33045

## COURSE INFORMATION

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Class Days: MWF Nov 6 – Dec 13, 2019  
Class Times: 1:00 – 1:50 pm  
Class Location: P-244

Instructor: Manal Swairjo, PhD.  
Office Hours Times: MW 2:30-4 pm, or email for  
appointment mswairjo@sdsu.edu  
Office Hours Location: CSL 340

## COURSE OVERVIEW

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### Course description:

This course in advanced topics in modern chemistry focuses on recent discoveries in nucleic acid biochemistry and implications in human health and disease. Topics include DNA modifications, epigenetic disease, posttranscriptional modification of RNA, biosynthesis of modified nucleosides, epitranscriptomics, CRISPR technologies.

### Student Learning Outcomes:

Students who complete this course will be able to

- 1) List the major nucleic acid modifications, and describe their modes of action in gene expression and regulation, and human disease.
- 2) Compare the structures of nucleotidyltransferase enzymes and infer implications in their functions and evolution.
- 3) Compare the ADAR and APOBEC pathways to nucleic acid editing and their roles in cancer and viral disease.
- 4) Define and compare epigenetics and epitranscriptomics and current methods in these fields.
- 5) Describe the CRISPR pathway and related biotechnological applications.

### Real Life Relevance:

This course is an entry way to understanding modern medicine and biotechnology, and is essential for any career in these fields, including job placements in the biotechnology industry and health professions.

### Relation to Other Courses:

This course builds on concepts introduced in General Biochemistry CHEM 560 (and CHEM 365). It builds on the content of CHEM 563 (Nucleic Acid Function and Protein Synthesis).

## ENROLLMENT INFORMATION

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### Prerequisites:

CHEM 560 (General Biochemistry), CHEM 365 (Biochemistry, Cell & Molecular Biology), or the equivalent (one semester of upper-level biochemistry), CHEM 563 or concurrently with it. Maximum credit of six units of 596 applicable to a bachelor's degree. Credit for 596 applicable to a master's degree with approval of the graduate adviser.

- Adding/Dropping Procedures:  
You can drop the class within the first 10 days of the semester (university policy).

## COURSE MATERIALS

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### Required Materials:

Textbook: Voet, Voet, and Pratt: “**Fundamentals of Biochemistry**”, 5<sup>th</sup> Edition, Wiley, 2016. Most of you have used this same text for CHEM 560.

### Recommended Materials:

Additional handouts and reading material will be provided on Blackboard.

## COURSE STRUCTURE AND CONDUCT

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Style of the Course: Lecture and in-class discussion

### Technology Utilized in the Course:

Blackboard, Pymol software (free student version, Schrodinger). All students must download and install this free software on their laptops. It is needed for class discussions and homework assignments.

<https://pymol.org/edu/?q=educational/>

### Expectations:

**You must read the assigned reading material and come ready to discuss in class. Therefore, attendance at lecture is absolutely required.**

## COURSE ASSESSMENT AND GRADING

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Undergraduate students: There will be two homework assignments (25 points each) and a cumulative final exam (50 points), i.e., a total of 100 points possible for the course.

Grading scale:

90-100 points: A

80-90 points: B

70-80 points: C

60-70 points: D

<60 points: F

Graduate students: There will be two homework assignments (25 points each) and a cumulative final exam (65 points), i.e., a course total of 115 possible points. Graduate students should expect a more challenging final exam.

Grading scale:

103-115 points: A

92-103 points: B

80-92 points: C

69-80 points: D

<69 points: F

### Excused Absence Make-up Policies:

You are required to take the final exam on the university-scheduled date. No make-up final exam will be offered.

## ACADEMIC HONESTY

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The University adheres to a strict [policy regarding cheating and plagiarism](http://studentaffairs.sdsu.edu/srr/cheating-plagiarism.html). These activities will not be tolerated in this class. Become familiar with the policy and what constitutes plagiarism (<http://studentaffairs.sdsu.edu/srr/cheating-plagiarism.html>). Any cheating or plagiarism will result in failing this class and a disciplinary review by the University. These actions may lead to probation, suspension, or expulsion.

Examples of Plagiarism include but are not limited to:

- Using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work)
- Copying and pasting work from an online or offline source directly and calling it your own
- Using information you find from an online or offline source without giving the author credit
- Replacing words or phrases from another source and inserting your own words or phrases
- Submitting a piece of work you did for one class to another class

For more information on plagiarism, consult the SDSU policy (<http://www.sa.sdsu.edu/srr/conduct1.html>).

## TURNITIN

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Students agree that by taking this course all required papers may be subject to submission for textual similarity review to [Turnitin.com](http://www.turnitin.com) for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. You may submit your papers in such a way that no identifying information about you is included. Another option is that you may request, in writing, that your papers not be submitted to [www.turnitin.com](http://www.turnitin.com). However, if you choose this option you will be required to provide documentation to substantiate that the papers are your original work and do not include any plagiarized material.

## TECHNICAL SUPPORT FOR BLACKBOARD

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Student support for Blackboard is provided by the Library Computing Hub, located on the 2<sup>nd</sup> floor of Love Library. They can be reached at 619-594-3189 or [hub@mail.sdsu.edu](mailto:hub@mail.sdsu.edu)

**TEXTS AND MATERIALS: PAPERS FROM THE LITERATURE WILL BE PROVIDED BY PROFESSOR.**

## COURSE SCHEDULE

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	DATE	TOPIC	Reading
1	11/6/2019	Review of transcription and translation	Material provided by instructor
2	11/8	tRNA maturation: intron removal, end trimming, CCA addition	Material provided by instructor
	11/11	No class (Veterans Day)	
3	11/13	RNA editing, ADAR and APOBEC enzymes	Material provided by instructor
4	11/15	tRNA modifications, biosynthesis of modified nucleosides. <b>Homework assignment</b>	Material provided by instructor
5	11/18	Mitochondrial tRNA modification and disease	Material provided by instructor
6	11/20	mRNA modifications	Material provided by instructor
7	11/22	Epitranscriptomics	Material provided by instructor

8	11/25	Epitranscriptomics, methods	Material provided by instructor
	11/27-29	No class (Thanksgiving) <b>Homework assignment</b>	
9	12/2	DNA modification	Material provided by instructor
10	12/4	complex modifications of DNA	Material provided by instructor
11	12/6	Epigenetic disease	Material provided by instructor
12	12/9	CRISPR pathway	Material provided by instructor
13	12/11	CRISPR technologies	Material provided by instructor
14	12/16	<b>Final exam</b>	

## ESTIMATED TIME COMMITMENT

Module	Estimated hours
RNA maturation, editing and modification	8
DNA editing and modification, CRISPR	5
Homework assignments and exam	12

## 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 the Student Abilities Success Center at (619) 594-6473. You can also learn more about the services provided by visiting the [Student Abilities Success Center](#) website.

To avoid any delay in the receipt of your accommodations, you should contact Student Abilities Success Center as soon as possible. Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have presented your instructor with an accommodation letter from Student Abilities Success Center. Your cooperation is appreciated.

## STUDENT SERVICES:

A complete list of all academic support services is available on the [Academic Success](#) section of the [SDSU Student Affairs](#) website.

For help with improving your writing ability, the staff at the SDSU [Writing Center](#) is available in person and online. [Counseling and Psychological Services](#) offers confidential counseling services by licensed psychologists, counselors, and social workers. More info can be found at their website or by contacting (619) 594-5220. You can also Live Chat with a counselor [http://go.sdsu.edu/student\\_affairs/cps/therapist-consultation.aspx](http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx) between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

## COPYRIGHT POLICY

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