

# Advanced Molecular, Cellular, and Synthetic Biology

## MMED 6016

FALL 2020

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**CLASS DAYS and TIME:** Mondays and Wednesdays, 9:00 AM – 11:00 AM (Classes begin Aug. 26, 2020)

**CLASSROOM:** Zoom Online Conference

**COURSE FACULTY:** Course Director: Chun-Liang Chen, Ph.D.

**OFFICE LOCATION and HOURS:** STRF 233.3 – 10:00 AM – 4:00 PM (By Appointment)

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**TELEPHONE:** 210-562-4143

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**READ THIS DOCUMENT CAREFULLY - YOU ARE RESPONSIBLE FOR ITS CONTENTS.**

### COURSE DESCRIPTION AND OBJECTIVES

Advanced Molecular, Cellular, and Synthetic Biology, (MMED 6016), Fall Semester Only- This foundational course is a study of the organization and function of the genome at the molecular level. The topics include: gene structure, transcriptional control, RNA structure and processing, translation, genome replication and repair, the regulation of cell division, signal transduction, hormone regulation, epigenetic regulation, the molecular biology of tumors, and the regulation of proteins. Also included will be the use of CRISPR-Cas and other synthetic biological methods used in research and clinical applications (*Science* 2015 349; 1564). This is an advanced course intended to introduce the student to the important molecules involved in the life processes of the cell. Their structure, function, localization, and interactions will be the focus of study. The students will also be introduced to the implications that these molecular events have in human health and disease and how research of these molecular events can form the foundation of personalized molecular medicine approaches.

**Pre-requisites** – None

**Semester credit hours** – 4.0

By the end of this course, each student should be able to:

- Explain the principles of gene structure, transcriptional control, RNA structure and processing, translation, genome replication and repair, the regulation of cell division, signal transduction, hormone regulation, epigenetic regulation, the molecular biology of tumors, and the regulation of proteins.
- Compare the use of CRISPR-Cas and other synthetic biological methods used in research and clinical applications.
- Explain the organization and function of the genome at the molecular level and how important regulatory molecules are involved in the life processes of the cell.
- Explain how the molecular pathways discussed can be used in personalized molecular medicine approaches.

### COURSE ORGANIZATION

**The main teaching modalities used in this course include:**

- 1) Didactic lectures on specific topics with the purpose of conveying important concepts.
- 2) Team based learning with students researching topics, reading the scientific literature, and leading discussions on molecular pathways.

**Materials** – Laptop for viewing the lecture notes and for reading scientific papers.

**Reading Assignments** – Course materials will be distributed to students via e-mail prior to class periods.

## **ATTENDANCE**

Attendance and participation are mandatory. One large component of the grading is class participation so if a student misses a class due to sickness, the student needs to inform the instructors and course directors as soon as possible since this may result in an incomplete for the student. Any scheduled absences must be approved by the course director prior to the absence.

## **TEXTBOOKS**

No required textbooks.

## **GRADING POLICIES AND EXAMINATION PROCEDURES**

Grades will be based on attendance, class participation, and 2 closed book examinations. Exam questions will be in the form of short answer and/or essay questions. Each faculty lecturer will be asked to provide 1-2 questions with all questions totaling 100 points. The final grade will be based on the score of the examinations as well as on class participation and attendance.

### **Grading System**

A = 90-100%      B = 80-89%      C = 70-79%      F = < 69%

## **REQUESTS FOR ACCOMODATIONS FOR DISABILITIES**

In accordance with policy 4.2.3, **Request for Accommodation Under the ADA and the ADA Amendments Act of 2008 (ADAAA)**, any student requesting accommodation must submit the appropriate request for accommodation under the American with Disabilities Act (ADA, form 100). to his/her appropriate Associate Dean of their School and a copy to the ADA Coordinator. Additional information may be obtained at <http://uthscsa.edu/eoo/request.asp>.

## **ACADEMIC INTEGRITY AND PROFESSIONALISM**

Any student who commits an act of academic dishonesty is subject to discipline as prescribed by the UT System Rules and Regulations of the Board of Regents. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an exam for another person, signing attendance sheets for another student, and any act designed to give unfair advantage to a student or the attempt to commit such an act. Additional information may be obtained at <http://catalog.uthscsa.edu/generalinformation/generalacademicpolicies/academicdishonestypolicy/>

## **TITLE IX AT UTHSCSA**

### **Title IX Defined:**

Title of the Education Amendments of 1972 is a federal law that prohibits sex discrimination in education. It reads “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.”

**University of Texas Health Science Center San Antonio’s Commitment:**

University of Texas Health Science Center San Antonio (UTHSCSA) is committed to maintaining a learning environment that is free from discriminatory conduct based on gender. As required by Title IX, UTHSCSA does not discriminate on the basis of sex in its education programs and activities, and it encourages any student, faculty, or staff member who thinks that he or she has been subjected to sex discrimination, sexual harassment (including sexual violence) or sexual misconduct to immediately report the incident to the Title IX Director.

In an emergency, victims of sexual abuse should call 911. For non-emergencies, they may contact UPD at 210-567-2800. Additional information may be obtained at <http://students.uthscsa.edu/titleix/>

#### **EMAIL POLICY**

Course information and instructions will be e-mailed to students. Additionally, students should communicate with the course director via e-mail.

#### **USE OF RECORDING DEVICES**

Recording devices during the lectures are allowed with the permission of each instructor.

#### **ELECTRONIC DEVICES**

Electronic devices such as cell phones, computers, tablets, etc. are permitted in class, but we ask that you silence your cell phones during class.

**AMCSB Fall 2020 Schedule**  
Mondays and Wednesdays, 9-11 am  
Zoom Conference

| DATE | TOPIC | INSTRUCTOR | LOCATION |
|------|-------|------------|----------|
|------|-------|------------|----------|

**Yeast Genetics**

|           |                                 |            |      |
|-----------|---------------------------------|------------|------|
| August 26 | Nucleus, Nucleolus, Chromatin I | Dave Sharp | Zoom |
|-----------|---------------------------------|------------|------|

**Mammalian Cell Nucleus, Genetics, Chromatin, and Transcription**

|              |                                   |                 |      |
|--------------|-----------------------------------|-----------------|------|
| August 31    | Genetics I                        | P. Renee Yew    | Zoom |
| September 2  | Genetics II* (time changed: 1 PM) | P. Renee Yew    | Zoom |
| September 7  | Labor day (Holiday)               |                 |      |
| September 9  | RNA Processing                    | Masahiro Morita | Zoom |
| September 14 | Epigenetics                       | Kexin Xu        | Zoom |
| September 16 | Transcription I                   | Jason Liu       | Zoom |
| September 21 | Transcription II                  | Jason Liu       | Zoom |

**DNA Replication, Repair, and Recombination**

|              |  |              |      |
|--------------|--|--------------|------|
| September 23 | DNA Replication and Telomerase* (time changed: 8 AM) | P. Renee Yew | Zoom |
| September 28 | DNA Repair (MMR, BER, NER)                           | Paul Hasty   | Zoom |
| September 30 | dsDNA Repair: DNA Recombination and NHEJ             | Sang Eun Lee | Zoom |

**Proteins: Synthesis, Processing, Targeting and Degradation**

|            |  |                 |      |
|------------|--|-----------------|------|
| October 5  | Protein Synthesis                      | Maria Gaczynska | Zoom |
| October 7  | Metabolism, Diabetes, Obesity          | Mengwei Zang    | Zoom |
| October 12 | Protein Processing and Targeting       | Maria Gaczynska | Zoom |
| October 14 | Protein Degradation and the Proteasome | Maria Gaczynska | Zoom |

**Midterm Examination**

|            |  |                         |                     |
|------------|--|-------------------------|---------------------|
| October 19 | Midterm Examination<br>Material covered from Aug. 26-<br>Oct. 14 | In Class<br>Closed Book | GCCRI Aud.<br>2.160 |
|------------|--|-------------------------|---------------------|

**Cell Structure, Cell Cycle, and Checkpoint Control**

|            |                                   |              |      |
|------------|-----------------------------------|--------------|------|
| October 21 | Cell Cycle I                      | P. Renee Yew | Zoom |
| October 26 | Cell Cycle II and Checkpoints     | P. Renee Yew | Zoom |
| October 28 | Cellular Senescence and Apoptosis | P. Renee Yew | Zoom |

**Signal Transduction and Aging**

|             |   |                    |      |
|-------------|---|--------------------|------|
| November 2  | Ubiquitin Dependent Proteolysis and Autophagy | Maria Gaczynska    | Zoom |
| November 4  | Signal Transduction I                         | Bandana Chatterjee | Zoom |
| November 9  | mTOR Signaling                                | Masahiro Morita    | Zoom |
| November 11 | Signal Transduction II: G-Proteins            | Chun-Liang Chen    | Zoom |
| November 16 | Aging   | Adam Salmon        | Zoom |

### **Cancer**

|             |  |                 |      |
|-------------|--|-----------------|------|
| November 18 | Cancer Biology I: Oncogenes and Tumor Suppressors                | Myron Ignatius  | Zoom |
| November 23 | Cancer Biology II: Tumorigenesis, Metastasis, and Cancer Therapy | Myron Ignatius  | Zoom |
| November 25 | Stem Cells and Cancer Stem Cells                                 | Chun-Liang Chen | Zoom |

Zoom

### **Special Topics**

|             |  |                   |      |
|-------------|--|-------------------|------|
| November 30 | Genome Editing                               | Katsumi Kitagawa  | Zoom |
| December 2  | Chromosome Dynamics, Kinetochores/Centromere | Katsumi Kitagawa  | Zoom |
| December 7  | Synthetic Biology                            | Dave Sharp        | Zoom |
| December 9  | Omics and System Biology                     | Masahiro Morita   | Zoom |
| December 14 | From bench to bedside                        | Josephine Taverna | Zoom |

### **Final Examination**

|             |  |                         |                     |
|-------------|--|-------------------------|---------------------|
| December 16 | Final Examination<br>Material covered from Oct. 21-<br>Dec. 14 | In Class<br>Closed Book | GCCRI Aud.<br>2.160 |
|-------------|--|-------------------------|---------------------|