**MOLGEN 5701**

**DNA Transactions and Gene Regulation**

**Time TBA**

**Format: Lecture**

**3 credit hours**

**Location TBA**

**COURSE DIRECTORS AND CONTACT INFORMATION:**

Name Name

Address Address

Phone Phone

Email Email

**OFFICE HOURS:**

Available by appointment. To set up a meeting, please email your instructor(s) using your name.# account.

**COURSE MATERIALS:**

* No textbook is required. Links to open source reading and A/V materials will be provided by the course directors on Carmen.
* Additional supplemental material will be available on closed (2hr) reserve in Biological Sciences/Pharmacy Library.

**COURSE DESCRIPTION:**

During this course, students will learn in detail the fundamental basis and molecular mechanisms that control DNA replication, DNA repair, RNA transcription, and post-transcriptional gene regulation. These processes are controlled through the actions of DNA binding proteins, chromatin architecture, epigenetics, and non-coding RNA molecules. Students will be expected to learn the details of these processes as well as the experimental methodology used to test these principles in the laboratory. Students will have to read and analyze research publications focusing on these molecular processes.

**LEARNING OBJECTIVES:**

1. **Describe and apply fundamental concepts applicable to DNA regulation**

Students will learn how DNA is replicated and repaired and be expected to understand the proteins involved in regulating these processes

1. **Explain how chromatin structure is critical to regulating activity on DNA**

The structure of chromatin and how that structure is epigenetically maintained will be described in detail. Students will learn how a cell dynamically manipulates that structure to alter protein complex accessibility to the DNA and regulate genetic processes.

1. **Understand how genes are regulated to produce RNA transcripts**

Students will learn how the cells control the relative abundance of a gene’s output and the molecular machinery used to transcribe RNA. The processes of transcriptional initiation, elongation and termination will be discussed in great detail.

1. **Learn different mechanisms cells use to alter activity of a gene after transcription**

Post-transcriptional control mechanisms including RNA processing and micro RNAs will be discussed.

**GENERAL COURSE SCHEDULE:** **(based on Au 2017 calendar = 41 class meetings)**

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| **Lecture** | **Topic** | **Lecturer** |
| **1** | DNA Replication- General Concepts | TBA |
| **2** | E. coli DNA polymerase I and associated activities | TBA |
| **3** | Pol I and other Pol I-like enzymes | TBA |
| **4** | E. coli DNA polymerase III- clamps and clamp loaders | TBA |
| **5** | Pol III and the E. coli replisome | TBA |
| **6** | Replication fork activities/Okazaki fragment maturation in E. coli | TBA |
| **7** | Eukaryotic DNA polymerases | TBA |
| **8** | Eukaryotic replisome | TBA |
| **9** | Okazaki fragment maturation in eukaryotes | TBA |
| **10** | DNA damage tolerance & Translesion polymerases | TBA |
| **11** | Regulation of polymerase activities at the replication fork | TBA |
| **12** | Reverse transcriptase and Telomerase | TBA |
| **13** | Histones and chromatin structure | TBA |
| **14** | Higher order chromatin structure | TBA |
| **15** | Histone code/regulation of chromatin structure & accessibility | TBA |
| **16** | DNA methylation and epigenetic inheritance | TBA |
| **17** | Overview of DNA repair- Base excision repair (BER) | TBA |
| **18** | Nucleotide excision repair (NER) | TBA |
| **19** | Mismatch repair (MMR) and double strand break repair | TBA |
| **20** | The fundamental unit of genome: the gene | TBA |
| **21** | Core Promoter: TATA Box and building the transcriptional complex | TBA |
| **22** | Promoter Elements and TATA-less genes | TBA |
| **23** | RNA Pol II | TBA |
| **24** | Other RNA polymerases | TBA |
| **25** | Enhancer Elements | TBA |
| **26** | Transcription Factors | TBA |
| **27** | Transcription Factors II | TBA |
| **28** | Mediator Complex and DNA looping | TBA |
| **29** | Chromatin, Epigenetics and DNA accessibility | TBA |
| **30** | Co-regulator molecules – guardians of accessibility | TBA |
| **31** | Pioneering factors and master regulators | TBA |
| **32** | Insulators and gene organization | TBA |
| **33** | Transcriptional Repression | TBA |
| **34** | mRNA production: Elongation and termination | TBA |
| **35** | Splicing | TBA |
| **36** | Splicing II | TBA |
| **37** | Post-transcriptional regulation of RNA | TBA |
| **38** | Non-coding RNAs: miRNA | TBA |
| **39** | Other non-coding RNAs | TBA |
| **40** | Editing the Genome: From Zinc fingers to Crispr/Cas | TBA |
| **41** | Semester Review | TBA |

**GRADING POLICY:**

The course is graded on an A-E basis. The grade will be based upon a student’s performance on one midterm (50%) and final (50%) exam. The mid-term examination will be held outside of regular class time tentatively scheduled for DATE TBA. As this exam is held outside of normal class hours, appropriate accommodations will be made for students with time conflicts. Any student with such a conflict must bring it to the attention of the instructor as soon as possible. The final exam will be held at the date and time assigned by the registrar. Make up examinations are only given in cases of documented emergency or illness.

**GRADING SCALE:**

Final grades will be based on your final percentage [(points accumulated/ total points for the course) x 100)]. Generally, the final grades assigned will reflect the grade scheme below, however, the instructor reserves the right to adjust the lower limits for each grade category downwards if justified by overall class performance (i.e., a 90 % is guaranteed to receive an A-, but in some cases an A- may be assigned for a performance below 90%

A 93-100% C+ 77-79.9%

A- 90-92.9% C 73-76.9%

B+ 87-89.9% C- 70-72.9%

B 83-86.9% D 65-69.9%

B- 80-82.9% E <65%

**COURSE ATTENDANCE POLICY:**

In order to be successful in this course, attendance is expected for all lectures and literature discussions, and mandatory for exams.

**STATEMENT ON ACADEMIC MISCONDUCT:**

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

**STATEMENT ON DISABILITY SERVICES:**

Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614- 292-3307, [slds@osu.edu](mailto:slds@osu.edu); <http://slds.osu.edu>.