

GENE 486 – Genes and Genomes Syllabus Spring Semester 2021

Lecture: 12:00 – 1:15pm TU and TH synchronously online via Canvas/Zoom

Instructor: Dr. Ian Ray Rm N342, Skeen Hall email: iaray@nmsu.edu
Phone: 646-3819 (if I am not in my office your call will forward to my mobile phone)

Office Hours: M, 4:30-6:00 pm; W, 5:30-6:30 pm and by appointment.

Recommended Resources: Genomes IV (2018), T.A. Brown [**primary resource**]. Focus on the following chapters in the following order: Chapters 8, 15, 10, 7, 17, 9, 18, 3 & 4.
Genetics: Analysis & Principles 6e (2018) R.J. Brooker [secondary resource]
Multiple original research and review articles from the scientific literature.

Course Goals: To provide advanced coverage of genome replication and structure in prokaryotes and eukaryotes, eukaryote chromatin architecture and organization, eukaryote chromatin remodeling and gene expression, eukaryote genome organization and restructuring, eukaryote homologous recombination during meiosis, eukaryote comparative genomics, and genome sequencing.

Prior Knowledge: Students should already be familiar with the basic concepts of DNA structure, replication, repair, transcription, and translation, as this course will build upon various aspects of these concepts. You are encouraged to review notes from AGRO/ANSC/BIOL/HORT 305 or GENE 315.

Preparing For Each Class: Detailed lecture notes will be available via Canvas modules for each section of the course. These have many figures and tables incorporated into them which I think clarify/summarize key concepts. So, the notes will serve as our guide during class. In this regard, I will be providing two set of notes for each lecture. The first set represents my original “clean copy” PDF document with many figures in color. The second set (“instructor notes”) represents scanned copies (black/white) of my own notes in which I provide supplemental handwritten information and diagrams that are missing in the original notes. If you wish, you can incorporate information from the instructor notes into the clean copy color notes. **PRIOR TO EACH ZOOM CLASS** students are expected to read these materials (see attached course schedule). To guide your preparation time at home, we will typically cover 4 to 5 pages of lecture notes per class period. **While documents can be viewed in Canvas, sometimes information does not display properly. Hence, I recommend that you download each document file and view directly as a PDF.** For questions about Canvas, contact NMSU Academic Technology (<https://learning.nmsu.edu/>).

I will record attendance for each of our Zoom lectures. If you will attend class from a different time zone, be sure to account for the fact that all meetings times refer to U.S. Mountain Time. **If computer/internet problems prevent your attendance, notify me as soon as possible for an excused absence, and be sure to take quick action to resolve the problems you are encountering (e.g. use of Ethernet hardline, WiFi hotspots, or contact Student Technology <https://studenttech.nmsu.edu/>).** My purpose in requiring you to attend this course synchronously with me (i.e. “virtually face-to-face”) is to encourage you to participate, connect with fellow classmates, and to ask questions about subject matter that requires clarification. I also hope that attending class regularly will help you stay up-to-date on studying course content. **Past experience indicates that most students who don’t regularly attend class will either withdraw from the course or fail the course.** During class as we review a given topic, I will “randomly” select students and ask questions related to a particular concept or process. So, think of our class time as an informal quiz time. If you have questions about course content, please feel free to unmute your microphone, interrupt me, and ask your question(s). I welcome your interaction! Also, please take advantage of my Zoom office hours (see above).

Grading: There will be **four essay-type exams**, each comprising 18% of the total course grade. A **research paper** worth 18% of the course grade is also required. A **PDF copy** of the paper must be emailed to Dr. Ray by 5pm on May 7th. **In-class participation** will be worth 10% of the course grade as described above.

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Examinations: Exam content will focus ONLY on material covered in class and will consist primarily of essay type questions with a few short answer, multiple choice, and matching questions. Exam answers should provide sufficient detail to clearly demonstrate that you fully understand the concept being queried. Canvas will administer each exam and you will have 75 minutes to complete it. Before taking your first exam, you need to select the Lockdown Browser menu tab in this Canvas course and install the necessary software (including Respondus Monitor). For all exams you will be required to use both the lockdown browser and a webcam monitor. **Make sure you have access to a webcam on the 4 exam dates.** I realize that many students do not need to have such security constraints imposed because you recognize the importance of honesty and integrity in everything that you do. I am reminded of the words of legendary UCLA basketball coach John Wooden — 'The true test of a [person's] character is what they do when no one is watching'. However, I will be using the lockdown browser & monitor security measures to help increase the overall credibility of all online courses that NMSU offers.

Missed exams may be taken within one week from the exam date provided a valid excuse is presented. You must notify Dr. Ray by phone, voicemail, or email **BEFORE** the exam is missed, & subsequently present a valid justification (e.g. illness requiring doctors care or school-related activity). You will receive a zero for any missed exams.

Research Paper Topics: Please choose one topic from among those listed below:

1. Interphase nucleus chromosome territories: what are they and how are they organized, including mechanisms of this organization (i.e. roles of specific proteins, nuclear matrix, nuclear lamina, long noncoding RNAs etc.)?
2. Chromosome territories and gene expression: how does the position of a gene within a chromosome territory and within the nucleus influence its expression?
3. Chromatin remodeling and gene expression: focus on a specific gene, or subset of genes that may be coordinately regulated, in response to an environmental or metabolic stimulus.
4. Transcription factories and coordinated regulation of genes on different chromosomes. Focus on a subset of two to four genes regulated in this manner, associated mechanisms, and outcomes.
5. Impact of Mediator complex on chromatin architecture and gene expression: chromatin remodeling, formation of DNA loops that impact gene expression, interaction with non-coding RNAs, etc.
6. Impact of chromosome rearrangements on gene expression/disease development: how can chromosome translocations influence cancer or other diseases? Focus on one phenotype in detail.

Research Paper Grading: All research papers should address some aspect of genome/chromatin architecture/organization. The core document must be 9 to 10 pages in length (Note: title page and references are NOT included in page limit). The document must be typed using 12pt Roman font with double-spaced lines, 1-inch page margins, and all pages numbered. Within the core document, you should include pertinent figures or tables that will help you discuss your topic of interest (be sure to cite their sources appropriately). **One PDF electronic copy must be delivered to Dr. Ray before 5pm on May 7th.** Note: Minus 5 points for each page below, or beyond, the 9 to 10 page limit.

Grading of term papers will be based on the following:

- Introduction (i.e., overview of relevant literature - 10pts)
- Materials/Methods that **briefly** summarize approaches/methods used in the papers discussed (10pts)
- Discussion that demonstrates understanding of the literature (i.e., critical thinking and analysis – 30pts)
- Conclusions (i.e., most important findings – 10pts)
- Evidence for good use of library/web (i.e., minimum of 6 **peer-reviewed** journal articles of which 4 must be original research articles [not review articles], and a maximum of 4 websites -10pts)
- Correct use of citations in document text (10pts)
- References in acceptable format. Reference pages are NOT included in the 9 to 10 page limit (10pts)
- Grammar, spelling, flow and organization of document, punctuation, and neatness (10pts)

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Research paper writing guidelines: Addressing the following five criteria will help you write an excellent paper.

- 1. Purpose and audience:** Purpose is clearly stated and writing is appropriate for a professional audience.
- 2. Content and critical thinking:** Exhibit critical thinking skills by developing ideas through logic, evidence and analysis in such a way as to demonstrate that you clearly understand the material, and implications of the research. Be sure to use vocabulary that is appropriate to this discipline (i.e. genetics).
- 3. Flow and Organization:** Document should flow smoothly from point to point and use headings to organize. Paragraphs are well-developed and include the use of topic sentences and transitions between paragraphs and sections.
- 4. Documentation:** As you incorporate information from various resources into your paper, you should usually paraphrase the information rather than relying on excessive quoting. Either way, be sure to cite the sources of information. Be sure to follow style guidelines (see top of this page). Make sure that citations in document match references. Make sure that references are from current, relevant, credible (i.e. peer-reviewed) sources.
- 5. Mechanics:** Proper punctuation and spelling. Correct sentence structure, subject/verb agreement, capitalization, etc.

Academic misconduct: The Student Code of Conduct defines academic misconduct, non-academic misconduct and the consequences or penalties for each. The Student Code of Conduct is available in the NMSU Student Handbook online: <http://studenthandbook.nmsu.edu/>. Academic misconduct is explained here: <http://studenthandbook.nmsu.edu/student-code-of-conduct/academic-misconduct/>.

COVID-19 Safe Practices: Although this course is only being offered online in spring 2021, you must view the information provided in the following links. If you are taking classes on campus, you must also submit a signed COVID classroom safety acknowledgement statement.

<https://provost.nmsu.edu/faculty-and-staff-resources/syllabus/NMSU-NOW---Spring-2021---The-Crimson-Commitment-3-Pillars2.pdf>

<https://provost.nmsu.edu/faculty-and-staff-resources/syllabus/COVID-Classroom-Safety-Acknowledgement-Statement.pdf>

Discrimination and Disability Accommodation: Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendments Act (ADA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact: Main Campus Student Accessibility Services (SAS) Corbett Center Student Union Room 208 Jesse Haas, Interim Director, 575-646-6840, sas@nmsu.edu.

New Mexico State University, in compliance with applicable laws and in furtherance of its commitment to fostering an environment that welcomes and embraces diversity, does not discriminate on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex (including pregnancy), sexual orientation, spousal affiliation, or protected veteran status in its programs and activities, including employment, admissions, and educational programs and activities. Inquiries may be directed to Laura Castille, Executive Director, Title IX and Section 504 Coordinator, Office of Institutional Equity, P.O. Box 30001, E. 1130 University Avenue, Las Cruces, NM 88003; 575.646.3635; 575-646-7802 (TTY); equity@nmsu.edu. Title IX prohibits sex harassment, sexual assault, intimate partner violence, stalking and retaliation. For more information on discrimination or Title IX, or to file a complaint contact: Laura Castille, Executive Director and Title IX Coordinator Office of Institutional Equity (OIE) – O'Loughlin House, 1130 University Avenue Phone: (575) 646-3635 E-mail: equity@nmsu.edu Website: <http://equity.nmsu.edu/>.

For additional information please view the link below:

<https://provost.nmsu.edu/faculty-and-staff-resources/syllabus/policies.html>

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COURSE SCHEDULE

DATE	TOPIC(S)	(Affiliated Textbook Material)
Jan. 26	Module 1: Prokaryote Genomes	(Brown, Chpt.8)
28	Module 1: Prokaryote Genome Replication	(Brown, Chpt. 15)
Feb. 2	No class	
4	Module 1: Prokaryote Genome Replication	(Brown, Chpt. 15)
9	Module 2: Eukaryote Organelle Genomes	(Brown, Chpt. 8)
11	Module 3: Eukaryote Nucleus: Genome Replication Overview	(Brown, Chpt. 15)
12	Last day to drop course with "W" (refund)	
16	Module 3: Eukaryote Nucleus: Genome Replication Overview	(Brown, Chpt. 15)
18	Module 4: Eukaryote Chromatin: Replication & Transcription through Nucleosomes and Chromatin Remodeling	
23	Module 4: Eukaryote Chromatin: Replication & Transcription through Nucleosomes and Chromatin Remodeling	(Brown, Chpt. 10)
25 Exam I (Through Feb. 18 lecture; 12:00 – 1:15pm Lockdown Browser/Respondus Monitor)		
March 2	Module 5: Eukaryote Chromatin Organization: Nuclear Matrix, Structural and Functional Domains, Gene Regulation in Three Dimensional Space	(Brown, Chpt. 10)
4	Module 5: Eukaryote Chromatin Organization: Interphase Chromosome Territories, Chromatin Repositioning, Transcription Factories	(Brown, Chpt. 10)
9	Module 5: Eukaryote Chromatin Organization: Long noncoding RNAs, Chromosome Inactivation, Formation of Nuclear Spatial Compartments	
11	Module 6: Eukaryote Chromatin and Chromosomes during Mitosis: Mitotic Chromosomes, Metaphase Scaffold, Kinetochores	(Brown, Chpt. 7)
16	Module 7: Eukaryote Genome Features: Gene Arrangement and Gene Duplication	(Brown, Chpt. 7)
***** 16 Notify Dr. Ray of Research Paper Topic		
18	Module 7: Eukaryote Genome Features: Retrotransposons	(Brown, Chpt. 17; Brooker, Chpt. 20)
23	Spring Break (ONE DAY ONLY)	
25 Exam II (Through March 16 lecture; 12:00 – 1:15pm Lockdown Browser/Respondus Monitor)		
25	Last day to drop course with "W" (no refund)	
April 30	Module 7: Eukaryote Genome Features: Transposable Element Discovery	(Brown, Chpt.9; Brooker, Chpt. 20)
1	Module 8: Eukaryote Chromosome Features & Alterations: Duplication, Deletion, Inversion, Translocation	(Brooker, Chpt. 8; Brown, Chpt. 18)
6	Module 8: Eukaryote Chromosome Features & Alterations: Aneuploidy & Polyploidy	(Brooker, Chpt. 8; Brown, Chpt. 18)
8	Module 9: Animal & Plant Comparative Genomics: DNA Sequence Analysis, Synteny, Gene Density, Genome Size	(Brown, Chpts. 7 & 18)
13	Module 9: Functional Genomics: Yeast, Animals, Plants	(Brown, Chpt. 7)
15	Module 10: Eukaryote Homologous Recombination during Meiosis: Molecular & Cytological Events	
20 Exam III (Through April 13 lecture; 12:00 – 1:15pm Lockdown Browser/Respondus Monitor)		
22	Module 10: Eukaryote Homologous Recombination during Meiosis: Molecular & Cytological Events	
27	Module 11: First Generation Genome Cloning & Sequencing: Human Genome Project	(Brown, Chpts. 3 & 4)
29	Module 11: First Generation Genome Cloning & Sequencing: Human Genome Project	(Brown, Chpts. 3 & 4)
May 4	Module 12: Next Generation, Massively Parallel DNA Sequencing (Illumina platform)	
6	Module 12: Next Generation, Massively Parallel DNA Sequencing (Illumina platform)	
7 Research paper due by 5pm		
May 13 Exam IV (Through May 6 lecture; 10:30am – 12:30pm Lockdown Browser/Respondus Monitor)		