Spring 2-1-2019

BIOM 410.01: Microbial Genetics

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BIOM 410 Microbial Genetics Spring 2019

Instructor: **Professor Bill Holben**
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Office hours: TR 1:30 – 3:00 p.m. and by appointment. Drop-ins are also welcome if I'm available.
E-mail: bill.holben@mso.umt.edu
Required text: L. Snyder, J.E. Peters, T.M. Henkin & W. Champness; *Molecular Genetics of Bacteria.* ASM Press, 4th Ed. Additional readings in electronic format will be distributed as PDF files on the Moodle site for the class.

Lecture: **TR 11:00 a.m. – 12:20 pm, HS 411**

Course Description – Microbial Genetics is a senior-level course. It satisfies a core requirement for the degree in Microbiology and serves (among others) to fulfill upper division requirements in the Cell & Molecular Biology and Human Biology Tracks.

The course examines the transmission of heritable traits by microbes (primarily prokaryotes) and the methods and principles used to study inheritance. The role of genetic variation in driving microbial evolution will be an underlying theme. We will also explore how knowledge of natural genetic processes in bacteria such as Horizontal Gene Transfer (HGM: conjugation, transformation and transduction) and cellular defense mechanisms such as Restriction-Modification and CRISPR-*Cas* have been utilized under controlled conditions to produce desirable/valuable traits. You will learn about state-of-the-art concepts and approaches developed in just the past few years that are revolutionizing our ability to understand core genomes (essential genes necessary for life), comparative genomics, metagenomics and various drivers of genetic and physiological biodiversity.

The major outcomes for the student will be:

- Sound understanding of the core principles, paradigms and unique aspects of microbial genetics. A key focus will be how prokaryotic genetics differs from eukaryotic genetics.
- Familiarity with historically important, contemporary, and state-of-the-art research techniques used in microbial genetics
- Development of skills in critical thinking, integration/synthesis of concepts and ideas and scientific problem-solving

Course assessment will reflect the student's performance in these areas.

Category	No. points	Total
Seminars (3)	3 * 50 pts	150 pts
Class Participation	150 pts	150 pts
Mid-term exams	3 * 150 pts	450 pts
Final exam	1 * 250 pts	250 pts
TOTAL		**1000 pts**

GRADES WILL BE ASSIGNED ON A SIMPLE PERCENTAGE SCALE WHERE;

≥ 900 pts	≥ 90 %	**A**
800—890 pts	80 – 89 %	**B**
700—790 pts	70 – 79 %	**C**
600—690 pts	60 – 69 %	**D**
≤590	≤ 59%	**F**

EXPLANATION OF CATEGORIES

Seminars (3) [3 * 50 = 150 pts]

BIOM 410 undergraduate students will receive credit for attending **three** genetics-related research seminars during the semester. Seminar announcements, schedules and locations will be placed in the relevant folder on the Moodle page as they become available. To earn credit, students will concisely evaluate seminars they attend using the rubric located in that folder. Write-ups will be worth up to 50 pts each (150 pts total).

Class Participation [150 pts] Because group interaction, open discussion, critical thinking and exchange of ideas are all important parts of being a competent scientist, and because regular attendance of lectures is important to obtain maximum benefit from this class, 150 points of the total class credit will come from this category. If you attend class, ask questions, volunteer answers, and discuss thoughts and ideas in class, you will fare well in this category.

Mid-term Exams [150 pts each] There will be three mid-term exams. Each will typically consist of short-answer (brief essay) questions. These short-answer questions will be designed to test your grasp of concepts and the supporting facts, integration and synthesis of ideas/concepts from different sessions/chapters, defining terms and use of illustrations where specifically requested or helpful.

Final Exam [250 pts] The Final Exam will be semi-comprehensive. ~ 40% of the Final will test you on material presented after Exam 3, while the remaining 60% will consist of material to which you were exposed from the beginning of class through Exam 3.

Additional General Notes

1. Course prerequisites: BIOM 360 (General Microbiology), minimum grade of C- and BIOM 361 (General Microbiology Laboratory), minimum grade of C-. These prerequisites will be checked by the Registrar or the Instructor. Under certain circumstances a student without the prerequisites may be allowed into the course following a discussion/interview with the Instructor.
2. Based on student feedback in recent years, this course covers a lot of essential material in a fairly condensed format. In particular, the lectures use PowerPoint slides to highlight key aspects of the material from the readings in the chapters. There often are a large number of slides that are challenging to get through one-by-one using a "formal lecture format. As a result, my advice for success in this class is to read all of the Chapter assignments from the required text and then look through the slides in advance of each lecture period. That way, we can focus in class on points that are complex or may be unclear, rather than painstakingly going through each slide. This means that the PowerPoint slides will be posted 24-48 hours before each lecture to allow time for this preview format. Note that just viewing the slides outside of class is no substitute for the more in-depth discussion of key elements of the material that will occur in the classroom itself. Plan to be in class each day unless an excusable illness, graduate school interview or similar situation arises.
3. Other course materials, interesting links relevant to the course, and seminar announcements will be made available via Moodle.
4. Cell phones, Smart Phones, iPods/MP3s and similar devices must be silenced and put away during lectures, quizzes and examinations. iPads/tablets/laptops can be used in silent mode as an aid during lectures, but must be put away during examinations.

Academic Honesty

Appropriate ethical behavior in the classroom is required of every University of Montana student. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All written assignments in this class must be completely original.

Definition: ***Academic Dishonesty*** "cheating" and "plagiarism", the theft of ideas and other forms of intellectual property – published or unpublished.

Definition: ***Plagiarism*** is the use of another writer's words or ideas without acknowledging the source. Plagiarism also means "passing off a source's information, ideas, or words as your own by omitting to cite them, which makes it an act of lying, cheating, and stealing."

Definition: ***Cheating*** is defined as obtaining or attempting to obtain, or aiding another to obtain credit for work, or any improvement in evaluation of performance, by any dishonest/deceptive means. All students need to be familiar with the *Student Conduct Code*, which is available for review at www.umt.edu/SA/VPSA/index.cfm/page/2585

Accommodations

I am happy to work with students and Disability Services for Students (DSS) to make accommodations that facilitate students' class participation and learning. Please see me at the beginning of the semester to plan for these accommodations.

Student Behavior

In general, students are expected to attend each class session for maximum knowledge gain and best performance on assessments. You'll also want to complete assigned readings and preview the PowerPoint lectures well before class in order to receive maximum benefit from classroom time and to be prepared for class interactions/group discussions. My intent is that the course be more interactive and discussion-based than simply a lecture-based course, so please come prepared to interact with me and with your classmates productively. All of these factors are taken into account under the "Class Participation" component of your grade.

Syllabus BIOM 410 Microbial Genetics Spring 2019

Please note that you are expected to be familiar with the concepts in Chapters 1&2, which you learned in Cellular & Molecular Biology and General Microbiology, which are both prerequisites for this class. You should read through (scan) these chapters in entirety as a review in preparation for the rest of the semester.

DATE	TOPICS	READING
Jan 10	Introduction and overview; Glossary	Intro p 1-12, review Ch1&2
Jan 15	MoBio manipulations of DNA	Ch1 p53-64
Jan 17	Genomes and genomics	Ch2 p109-116
Jan 22	Transcription; 16S/18S Phylogeny	Ch2 p 67-84; notes
Jan 24	Translation review, Operons, Replication review	Ch2 p84-105; Ch1 p13-51
Jan 29	Replication errors and repair	Ch1 p13-51; begin Ch3
Jan 31	Mutations	Ch3 p 125-153
Feb 5	Genetic analysis of mutations	Ch3 p 153-180
Feb 7	***EXAM 1 WILL TAKE PLACE ON February 7TH***	
Feb 12	Plasmids	Ch4
Feb 14	Conjugation	Ch5
Feb 19	Transformation	Ch6
Feb 21	Bacteriophage—Lytic development; Transduction	Ch7
Feb 26	Bacteriophage—Lysogenic development	Ch8
Feb 28	Mobile genetic elements	Ch9 p361-387
Mar 5	***EXAM 2 WILL TAKE PLACE ON March 5th***	
Mar 7	Site-specific recombination	Ch9 p387-402
Mar 12	Homologous recombination	Ch10
Mar 14	Regulation of gene expression	Ch12
Mar 19	Global regulation-Regulons and Stimulons	Ch13
Mar 21	Global regulation cont'd	Ch13
Mar 26	***SPRING BREAK March 25 - 29***	
Mar 28	***SPRING BREAK March 25 - 29***	
April 2	Co-evolution in ecological relationships	PDFs provided
Apr 4	***EXAM 3 WILL TAKE PLACE ON April 2nd***	
Apr 9	"Omics" (metagenomics, transcriptomics, proteomics, metabolomics)	PDFs provided
Apr 11	"Omics" cont'd	PDFs provided
Apr 16	Current microbiome research	PDFs provided
Apr 18	Current microbiome research	PDFs provided
Apr 23	Course assessment and Future Directions in microbial genetics	Open Discussion
Apr 25	In-class Review Session	

THE FINAL EXAM is scheduled for Thursday, May 2nd, 8:00 – 10:00 a.m.