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### BIOM 410.01: Microbial Genetics

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# BIOM 410      Microbial Genetics      Spring 2015

**Instructor: Professor Bill Holben**

Office: Health Science (HS) 503A; Phone: 243-6365

Office hours: TR 1:30 – 3:00 p.m. and by appointment.

E-mail: [bill.holben@mso.umt.edu](mailto:bill.holben@mso.umt.edu)

Required text: L. Snyder, J.E. Peters, T.M. Henkin & W. Champness (2013) *Molecular Genetics of Bacteria*. ASM Press, 4<sup>th</sup> Ed. Additional readings in electronic format will be distributed as PDF files on Moodle.

**Lecture: TR 11:10 a.m. – 12:30 pm, HS 411**

**Course Description** – Microbial Genetics is a senior/graduate 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. This course also serves as a 2/3 upper division writing course (see details of the writing component of the course below).

The course examines the transmission of heritable traits by microbes 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 conjugation, transformation and transduction have been utilized under controlled conditions to produce desirable/valuable traits. We 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
- 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 * 20 pts	60 pts
Class Participation	100 pts	90 pts
Mid-term exams	2 * 150 pts	300 pts
Final exam	1 * 200 pts	200 pts
<u>Writing Component</u>	350 pts	350 pts
<b>TOTAL</b>		<b>1000 pts</b>

**GRADES WILL BE ASSIGNED ON A SIMPLE PERCENTAGE SCALE WHERE;**

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

**EXPLANATION OF CATEGORIES****Seminars (3) [60 pts]**

BIOM 410 undergraduate students will receive credit for attending **three** genetics-related research seminars during the semester. DBS-CMMB seminars are presented Mondays at 12:10 pm in ISB 110. Other relevant seminars (e.g. WBIO or OBE seminars on conservation genetics) can be included. To earn credit, students will concisely evaluate seminars they attend using the rubric distributed during the first week of class. Write-ups will be worth up to 20 pts each (60 pts total).

**Class Participation [90 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, 90 points of the total class credit will come from this category. If you attend class, ask questions, volunteer answers, appear prepared for presentations and post-discussions, and discuss thoughts and ideas in class, you will fare well in this category.

**Mid-term Exams [150 pts each]** There will be two 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/or drawing structures.

**Final Exam [200 pts]** The Final Exam will be semi-comprehensive. ~ 50% of the Final will test you on material presented after Exam 2, while the remaining 50% will consist of material to which you were exposed from the beginning of class through Exam 2.

**Writing Component [350 pts]** You will be awarded 2/3 Upper Division Writing credit on successful completion of this course. According to DBS regulations “...we have sorted our writing courses based on % of grade based on writing and number of required pages. Some of these courses are 2/3 writing courses (at least 33% of the course grade will be based on writing; 11 – 13 total pages submitted...” As BIOM410 is a 2/3 writing course, credit will be achieved as follows: you will critically evaluate and synthesize a summary of 3-4 papers chosen from the primary literature that are centered on a single, timely and important topic of relevance to microbial genetics. Because writing courses require that you submit document, receive evaluation and feedback and then submit it at least once more for a final grade, we will proceed as follows:

1. *The topic and associated papers will be chosen in consultation with the instructor by February 10th.*
2. *A one-page outline of your synthesis paper is due by February 19th. The outline will be evaluated and returned to you with constructive comments regarding how to proceed. The outline will comprise 50/350 of your writing grade.*
3. *A complete 5- to 6-page draft of your synthesis paper is due by March 26<sup>th</sup>. This will be graded and returned to you with constructive comments on how to improve the paper (if appropriate) for its final submission. Draft 1 will comprise 100/350 of your writing grade.*
4. *The final version of your 5- to 6-page synthesis paper is due by April 30th. This will be graded with constructive comments on how to further improve the paper (if appropriate) and returned to you at the final exam meeting time. This final version will comprise 200/350 of your writing grade.*

The synthesis paper must be 5-6 pages in length, single-spaced, with 1-inch margins all around, and in 12-pt Times New Roman Font. The paper should be submitted as a Microsoft Word .doc or .docx file, or else as a .RTF file and should be submitted before midnight on the due date via email from your university account. Submit these documents to the Instructor at bill.holben@mso.umt.edu

### **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. Other course materials, interesting links relevant to the course, and communication with Professor Holben and among students will be made available via Moodle. Be aware that while rudimentary class notes (e.g. slide outlines) will be posted on Moodle, these are no substitute for the in-depth treatment and discussion given these topics in class and should not be considered a substitute for attending class.
3. 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](http://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 before class in order to receive maximum benefit from the lectures 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 2015

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 as a review in preparation for the rest of the semester.

DATE	TOPICS	READING
Wk1 Jan 27&29	Introduction/overview, DNA structure review & manipulations	Intro pp 1-12; Ch1 (scan), Ch2 (scan)
Wk2 Feb 3&5	DNA manipulation; Genomes and Genomics	Ch1 (p53-64); Ch2 (p109-116)
<b><i>SELECTED TOPIC (AND SELECTED PAPERS) FOR YOUR SYNTHESIS PAPER MUST BE APPROVED BY FEBRUARY 10TH.</i></b>		
Wk3 Feb 10&12	Bacterial genetic analysis and mutations	Ch3
Wk4 Feb 17&19	Bacterial genetic analysis and mutations (cont'd)	Ch3
<b><i>1-PAGE OUTLINE OF SYNTHESIS PAPER IS DUE BY FEBRUARY 19TH.</i></b>		
Wk5 Feb 24&26	Plasmids; Exam 1	Ch4
<b><i>EXAM 1 WILL TAKE PLACE ON FEBRUARY 26<sup>TH</sup></i></b>		
Wk6 Mar 3&5	Plasmids (cont'd); Horizontal gene transfer—Conjugation	Ch4, Ch5
Wk7 Mar 10&12	Horizontal gene transfer—Transformation	Ch6
Wk8 Mar 17&19	Phage lytic growth & genetics; Display & defense mechanisms	Ch7 (p265-292);(p292-314)
Wk9 Mar 24&26	Generalized & specialized transduction; Lysogeny & conversion	Ch7 (p314-319), Ch8
<b><i>DRAFT 1 OF SYNTHESIS PAPER IS DUE BY MARCH 26TH</i></b>		
Wk10	<b>SPRING BREAK MARCH 30 – APRIL 3</b>	
Wk11 Apr 7&9	Transposition; site-specific recombination; transposon mutagenesis	Ch9
<b><i>EXAM 2 WILL TAKE PLACE ON APRIL 9TH.</i></b>		
Wk12 Apr 14&16	Transposition cont'd; Homologous recombination	Ch9; Ch10
Wk13 Apr 21&23	DNA repair and mutagenesis	Ch11
Wk14 Apr 28&30	Regulation of gene expression; Global regulation	Ch12; Ch13
<b><i>FINAL VERSION OF SYNTHESIS PAPER IS DUE BY APRIL 30TH</i></b>		
Wk15 May 5&7	Bacterial Cell Biology; Metagenomics	Ch14 & 'handouts'

***THE FINAL EXAM IS ON THURSDAY, MAY 14, 8:00 – 10:00 A.M.***