Syllabus
Microbial Genetics and Biotechnology
MB 456/556

Winter term 2016
MWF 9:00-9:50 AM
Nash Hall 204
Instructors:
Bruce Geller. Office: 434 Nash Hall. Hours: MH 10:00-11:00. Tel: 737-1845. **gellerb@orst.edu**
Walt Ream. ALS 1081. Tel: 737-1792. reamw@oregonstate.edu
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Prereq: MB302, BB350 (or 450), BB351 (or 451)
Coreq: MB310

Text: Molecular Genetics of Bacteria. 4th Edition. Snyder, Peters, Henkin, and Champness. ASM Press.
This text is available free of charge through the Valley Library
(http://site.ebrary.com/lib/oregonstate/detail.action?docID=10883090**)**.

Learner Outcomes

Upon completion of this course, a student will

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- Compare and contrast mobile genetic elements
- Use vocabulary relevant to bacterial mobile genetic elements
- Demonstrate in writing the knowledge and vocabulary acquired in the reading and lectures
- Read articles from professional journals and be able to communicate orally and in writing the journals' findings
- Interpret data from experiments presented in the reading assignments and lectures.

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- Same as above, plus one of the following:
- Design a recombinant genetic element that can be used to solve a specific biological problem and write a research proposal to solve a specific biological problem, or:
- Review the literature on a specific mobile genetic element and critically analyze the data that are used to support the conclusions reached by the authors of the literature reviewed.

Date	Day	Topic	Reading Assignment
Jan 4	M	**Plasmid Replication.** ColE1	MGB3 p 17-23, 29-35, 197-202, 206-207, 209 (last parag)-213. MGB4 p 17-26, 31-34, 183-187, 189-193, 194 (last parag)-197 Kues and Stahl. 1989. Microbiol. Rev. 53:491-496.
Jan 6	W	**Plasmid Replication.** Iteron plasmids,	MGB3 p 219-222. MGB4 p 199-203 (1st parag) Kues and Stahl. 1989. Microbiol. Rev. 53:496-501, and 503-7.

Jan 8	F	**Plasmid Replication.** Rolling circle plasmids.	MGB3 p 202-4. MGB4 p 187-189 Espinosa et al. 1995. FEMS Micro. Lett. 130:111-120.
Jan 11	M	**Partitioning. Incompatibility.**	MGB3 p 207-209, 223. MGB4 p 193-194, 204. Ghosh et al. 2006. Ann. Rev. Biochem., Edited. Moller-Jensen et al. 2002. EMBO J21:3119-3127.
Jan 13	W	**Recombination**	MGB3 p 429-446. MGB4 p 403-416.
Jan 15	F	**Insertion sequences and transposons.** Tn*10*, Tn*3*. Conservative and replicative transposition	MGB3 p 377-383, 389-395. MGB4 p 361-366, 372-376. Mahillon & Chandler. 1998. Microb Mol Biol Rev 62: 725-9; 730-3; 734-35. Weigel et al 2003 Science 302:1569-71
Jan 18	M	MLK Holiday. **NO CLASS**.	
Jan 20	W	**Transposons and Integrons.** Tn*5* and Tn*21*.	MGB3 p 395-397, 399 (regulation)-400, 412-414 (Tn21). MGB4 p 376-378, 380 (regulation)-382 Reznikoff. 1993. Ann Rev Micro 47: 945-54, 957-59.
Jan 22	F	**Exam I**	
Jan 25	M	**Natural Competence. Transformation.** **(Ream)**	MGB3 p 277-292. MGB4 p 247-263. Science 310:1824-7 (plus supplemental section) & 1775-7 (2005)
Jan 27	W	**Conjugation. Horizontal gene transfer.** ***Agrobacterium tumefaciens.*** **(Ream)**	MGB3 p 243-276; MGB4 p 219-245. Piper & Farrand. 2000. J Bact 182:1080-8 Babic. 2008. Science 319:1533-6. MGB4 Box 5.1 (p230-232), p 600 (T4S). MGB3 Box 5.1 (p 253-7), p 627-8 (T4S). Christie et al. 2005. Ann. Rev.Microbiol. 59:451-85. Fronzes et al., 2009. Sci 323:266-8 (+suppl). Ream. 2009. Microb Biotech
Jan 29	F	CRISPR/cas **(Ream)**	
Feb 1	M	**Diversity-generating retroelements**	Liu et al. 2002 Science 295:2091-4 Arambula et al 2013. PNAS 110: 8212–8217.

Feb 3 W	**Bacterial Introns**	Lambowitz & Zimmerly. 2004. Guo et al. 2000. Science 289:452-457 Jones et al. 2005 Mol. Ther. 11:687-94
Feb 5 F	**Genetic (Genomic) and Pathogenicity Islands**	MGB3 p 414-415. MGB4 p 388-390. Dobrindt et al. 2004. Nature Rev Microbiol 2:414-24. Tormo-Mas et al. 2010. Nature 465:779
Feb 8 M	**Bacterial speciation: what is a bacterial species? (Dreher)**	MGB3 p 51-3, Box 2.7 (p 125-130), Box 8.1 (p 354), Box 8.3 (p 365). MGB4 p 50-51, Box 2.5 (p 110-114), Box 8.1 (p 336), P 349-350. Vos 2010. Trends in Microbiol.
Feb 10 W	**Attenuation Riboswitches.** **(Dreher)**	MGB3 p 530-538. MGB4 p 498-505. Breaker. 2010. CSH Persp Biol.
Feb 12 F	**Regulation of macro-Molecular synthetic capacity by growth rate and stress (Dreher)**	MGB3 p 595-602. MGB4 p 547-554. Srivatsan & Wang. 2008. Curr Opin Micro 11:100-105
Feb 15 M	**Exam 2**	
Feb 17 W	**Plasmids in molecular cloning.**pBR322, pUC, pZErO, T/A vectors	MGB3 p 66, 229-235. MGB4 p 209-215. Bernard et al 1993. JMB 234:534-5. Gabant et al 1998. Gene 207: 87-92.
Feb 19 F	**Expression plasmids** pET, His-tag. Gateway vectors.	MGB3 p 123-125, 298. MGB4 p 62, 211-212, 273. Qiagen Manuals Invitrogen web pages
Feb 22 M	**Site-Specific Mutagenesis, Allelic Exchange,** pG^{+}host.	MGB3 p 62-63, 186-190, 235-237. MGB4 p 60-61, 159. Biswas et al 1993. J Bact 175: 3628-35.
Feb 24 W	**Functional Genomic Analysis, Recombineering, and Protein-Protein Interactions.** λ Red, Single-gene knock-out library (Keio collection),	MGB3 p 446-449. MGB4 p 419-422. Datsenko & Wanner 2000 PNAS 97:6640-45. Baba et al. 2006. Mol Sys Biol 1-11. Dove et al. 1997. Nature 386:627-30. Blum et al 2000. PNAS 97:2241-46.

	2-hybrid system.	
Feb 26 F	Genome Editing. Molecular DNA surgery with **CRISPR/cas**	Hu et al., 2014. PNAS 111:11461. Wu et al., 2013. Cell Stem Cell 13:659.
Feb 29 M	**Phage display.**	PDPP p 1-4, 9, 21-42. Boruah et al, 2013. Plos One 8: e71383. Kolonin et al 2004 Nat Med 10:625-28
Mar 2 W	**Transposons as molecular tools.** Gene mapping with transposons. Transposomes. Inverse PCR	MGB3 p 403-405, 407. MGB4 p 385-387. Goryshin et al 2000 Nat Biotech18:97-100. Martinez-Garcia et al., 2011. BMC Microbiol. 11:38.
	TnPhoA	MGB3 p 621-622 MGB4 p 594-595. Seo et al 2012. Inf Imm 80:3559-69.
Mar 4 F	**Genomic Screening in vivo** Signature tagged mutagenesis In vivo expression technology (IVET).	Hensel et al 1995. Sci 269:400-3 Osorio & Camilli. 2003. ASM News 69:396-401.
	Vibrio cholerae Lactobacillus	Lee, Butler & Camilli. 2001 PNAS98:6889-94. Bron et al. 2004 J Bact 186:5721-9
Mar 7 M	**Aptamers**	Levy-Nissenbaum et al. 2008. Trends Biochem 26: 442-449. Jeon et al. 2004. J Biol Chem 279:48410-48419.
Mar 9 W	**Graduate student presentations**.	
Mar 11 F	Review for Final Exam.	
Mar 17	**Thursday Final Exam**	**14:00 (2:00 PM) Nash Hall 204**

Projects

A written project and oral presentation are REQUIRED for all students enrolled in MB 556. Students enrolled in MB 456 are NOT required to do a project or present, but are required to attend the presentation by students in 556. Students in MB 556 may chose between writing a review paper or a research proposal. The topic or the project must be related to microbial genetics.

All students enrolled in MB556 must meet with Dr. Geller and discuss plans for their term project. Please schedule a meeting early in the term (1st couple of weeks) to receive specific instructions on your concept, organization of writing, and expectations.

Reviews must include descriptions of experiments and results, and **a critical analysis of the conclusions presented by the authors of the experiments cited. Credit is given for suggestions for follow-up experiments.**

Research proposals present a plan of experiments to investigate an hypothesis. The proposal must be centered on a microbial molecular genetic approach. The project must include appropriate background information, describe the problem it attempts to answer, and specify details of the tactics and strategy being proposed. **Credit is given for discussing potential drawbacks or shortcomings of the proposal and alternative strategies.**

Each student enrolled in MB556 will present their project to the class during the last week of the course. All presenters are required to provide either a paper copy handout or an electronic file that outlines their presentation and includes any graphics that are used during the presentation. Limit of 7 pages, single-spaced (not including figures). Grading will be 10% of the final grade.

Exams

There are 3 exams. Each exam has 100 points. Exams require you to write short, written answers. Each exam covers only material since the previous exam. Students registered for MB 556 will be graded on a different scale than those registered for 456.

University and Departmental Policies:

For students with documented disabilities: "Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098."

Please note: The Department of Microbiology follows the university rules on civility and honesty. These can be found at **http://oregonstate.edu/studentconduct/regulations/index.php#acdis**. Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action. Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations.