Micro/Biochem/Gen 612 2015 General Information – Fall 2015

INTRODUCTION: This course is designed for graduate students and advanced undergraduates with some background in prokaryotic molecular biology. Several other courses are offered that overlap to some extent with some of the subject areas covered in Micro 612. Micro 470 and Micro 526 are courses designed for undergraduates. Graduate courses (not available every year but with some overlap with Micro 612) are Micro 607 (Advanced Microbial Genetics; Prof. Wang, Semester I); Micro/Biochem 726
(Prokaryotic Gene Expression; Prof. K. Wassarman, Semester II); Micro 668 (Microbiology at Atomic Resolution; Prof. Forest, Semester II); Pharm/Biochem 620 (Eukaryotic Molecular Biology; Profs D. Wassarman and Ansari, Semester II).

ORGANIZATION AND RATIONALE OF THE LECTURES: The course will survey topics in prokaryotic molecular biology including transcription, translation, DNA and chromosome structure, regulation of gene expression, replication, and recombination. The object of the course will be to outline basic paradigms in molecular biology and approaches that are used to solve such problems. In general, the course emphasizes our present understanding of molecular mechanisms obtained from biochemical, structural, and genetic approaches as well as how the information was obtained. Reading of selected papers from the primary literature will be required. This is not a "methods" course: the details of specific methods will be described only insofar as necessary in order to understand how particular information is obtained. Methodology will be incorporated into the lectures as the individual topics are covered.

PREREQUISITES: There is one prerequisite: an undergraduate course in basic biochemistry (e.g. equivalent of Biochem 501 or 507/508). A course providing some background in bacterial genetics/physiology (e.g. an equivalent of Micro 470) is very helpful but not absolutely essential. If you have not had a biochemistry course, you definitely should not enroll in Micro 612. If you have not had any introduction to bacterial genetics, you may enroll in Micro 612 but you will have to do some background reading for specific topics. Feel free to come speak with Dr. Gourse if you have questions about whether your background is sufficient.

OFFICE HOURS: Your TA Angela Myers will hold office hours on Mondays from 2:00---3:00 PM or by appointment in MSB Room 5415 – this is the small conference room right next to the Gourse lab.

HANDOUTS: Hard copies of the lecture outline, lists of related references for more information, study questions, and B&W versions of the figures used for the lectures will be provided at the lecture. You will probably want to take notes during class on these hard copies. GET A BINDER OF SOME SORT TO ORGANIZE YOUR HANDOUTS. YOU WILL NEED THE HANDOUTS AND YOUR LECTURE NOTES TO REVIEW WHAT WAS DISCUSSED IN CLASS AND TO PREPARE FOR EXAMS. In some cases, a single handout will be used for more than one lecture, so please bring the handouts to class.

Electronic copies of slides (in color) and lecture notes will be made available after each lecture on Learn@UW. Other course material (syllabus, past exams, etc.) is also at Learn@UW. If for some reason you do not have access (e.g. you are not registered), let Dr. Gourse or the TA know, so they can give you access.

READING MATERIALS: Papers from the primary literature will be assigned for discussion. Since papers are available electronically, hard copies will not be handed out in class. In cases where the paper is not readily available on---line via our institutional subscription, a pdf will be provided at Learn@UW. If you are accessing journals from a campus ip address, you will be able to open articles via pubmed links or from journal web sites. If you are off campus, you will need to go to the journal via the UW Library home page link to electronic journals. This requires authentication with your net id. Being able to access original journal articles is an essential skill for this course and for learning/doing science in general!

No single textbook is required to accompany the lectures. However, many people may find it necessary or useful to read appropriate chapters in a textbook to accompany the lectures. Appropriate sections in textbooks usually will be listed in the handouts with each lecture.

Texts in Steenbock Library (hard copies only):
L. Snyder, J. Peters, T. Henkin, and W. Champness; Molecular Genetics of Bacteria. ASM Press (Fourth edition)
Nelson, and Cox M; Lehninger's Principles of Biochemistry. WH Freeman (Fifth edition)
MM Cox, J. Doudna, M. O'Donnell; Molecular Biology (second edition; Freeman)
M. Ptashne; A Genetic Switch, Phage Lambda Revisited. Cold Spring Harbor Lab Press (3rd edition)
Branden and Tooze (1999); Introduction to Protein Structure. Garland Science (2nd edition)
Lewin:
Genes XI (2012) Jones and Bartlett Learning

Each of the books has strengths and weaknesses on individual subjects.
1. The Snyder text is good for background in many areas of prokaryotic molecular genetics, especially genetics.
2. The Nelson & Cox text (Lehninger) is the one used for Biochem 501 and 507---508, the undergraduate biochemistry courses at UW---Madison. The chapters on transcription, translation, replication, and recombination are especially good.
3. Cox, Doudna, and O'Donnell text is a version of the Nelson and Cox (Lehninger) text that is focused more on molecular biology than biochemistry and thus better for the areas covered in Micro/Biochem/Gen 612.
3. The Ptashne book is a great introduction to bacteriophage lambda.
4. Brandon & Tooze is an excellent resource for thinking about protein structure.
5. The newest version of the Lewin text can be used as a resource for both this course and for Biochem 620 (Eukaryotic Molecular Genetics).

ORIGINAL PAPERS, PROBLEM SETS, DISCUSSION SESSIONS: Reading assignments and/or problem sets will be distributed for most lectures. Some of the Discussion sessions will be organized around the problem sets, some around original literature, some both. The reading and problem sets will be of use to you in developing and testing your understanding of the material. Problem sets will not be collected or corrected, but to encourage full participation in the discussion of the primary literature papers, each student will be required to write up the answer to one assigned question from the study questions that accompany each paper; the answer should be uploaded to the Learn@UW drop box before the discussion section. Working with fellow students on the reading and problem sets is encouraged and understanding of these will be essential preparation for the exams. Answers will be made available electronically. The discussion sessions will be organized by the instructor of that week's lectures and by the TA. This will be your opportunity to ask questions on the lectures and the problem sets.

GRADING: Basically, if the material is in the lecture notes (even if it gets left out of the lecture itself), you're responsible for it. Your grade is determined by the two exams and the final exam, as well as by class participation. The exams will be in---class, but open book. The exams will not be cumulative: they will cover only the material since the previous exam. The exams will emphasize problem---solving skills and will not require memorization.

You may refer to notes or whatever materials you wish to bring with you to the exam. In order to perform well on these exams, you will need to have worked on the problem sets and to have read and thought about the papers assigned for class. The exams serve a key purpose: they provide students with a structured time to review the material covered in the lectures/discussion sessions. Studying for an exam is active learning: it provides a mechanism for bearing down and thinking about the information. We will provide the previous year’s exam as a study aid. We strongly encourage you to take this in a realistic setting, timing yourself and really committing to an answer as opposed to flipping through the exam and the answer key and thinking you get it.

The first two exams will be held in the evenings. If you cannot take an exam at that time, please see Dr. Gourse so that other arrangements can be made. The third exam will be during the final exam period.

You may refer to notes or whatever materials you wish to bring with you to the exam. In order to perform well on these exams, you will need to have worked on the problem sets and to have read and thought about the papers assigned for class. The exams serve a key purpose: they provide students with a structured time to review the material covered in the lectures/discussion sessions. Studying for an exam is active learning: it provides a mechanism for bearing down and thinking about the information. We will provide the previous year’s exam as a study aid. We strongly encourage you to take this in a realistic setting, timing yourself and really committing to an answer as opposed to flipping through the exam and the answer key and thinking you get it.

Microbiology/Genetics/Biochemistry 612 (Prokaryotic Molecular Biology)
MWF 11-11:50
Schedule for 2015

Course organizer: Rick Gourse (rgourse@bact.wisc.edu, 5470 MSB, 262-9813).

Other lecturers:

Bob Landick (landick@bact.wisc.edu, 5478 MSB, 265-8475)

Tim Donohue (tdonohue@bact.wisc.edu, 5166 Wisconsin Energy Institute, 262-4663)

Katrina Forest (forest@bact.wisc.edu, 6552 MSB, 265-3566)

Jade Wang (wang@bact.wisc.edu, 6478 MSB, 263-0307)

Teaching Assistant: Angela Myers (amyers3@wisc.edu; 5455 MSB, 262-2419)

Office Hours Monday 2-3 pm, 5415 MSB

Tentative Class Schedule

TRANSCRIPTION: STRUCTURE, CATALYSIS, PROMOTER RECOGNITION, REGULATION		
Wed 9/2	RNAP structure-function	Landick
Fri 9/4	Catalysis, promoter escape	Landick
Mon 9/7	*Labor Day (no class)*	
Wed 9/9	*Discussion*	TA/Landick
Fri 9/11	Pausing, termination	Landick
Mon 9/14	attenuation, anti-termination	Landick
Wed 9/16	*Discussion*	TA/Landick
Fri 9/18	Promoter Recognition I	Gourse
Mon 9/21	Promoter Recognition II	Gourse
Wed 9/23	*Discussion*	TA/Gourse

Fri 9/25	Transcription Initiation: Positive Regulation	Gourse
Mon 9/28	Transcription Initiation: Two component systems	Donohue
Wed 9/30	Transcription Initiation: Negative Regulation	Gourse
Fri 10/2	mRNA decay and sRNAs	Gourse
Mon 10/5	*Discussion*	TA/Gourse
Wed 10/7 EVENING	**Exam 1 (10 lectures)**	
TRANSLATION: RIBOSOME STRUCTURE, MECHANISM		
Fri 10/9	Translation I: rRNA maturation, ribosome assembly, ribosome structure	Gourse
Mon 10/12	Translation II: tRNA maturation, tRNA structure, genetic code	Gourse
Wed 10/14	Translation III: initiation	Gourse

Fri 10/16	*Discussion*	TA/Gourse
Mon 10/19	Translation IV: decoding and proofreading	Gourse
Wed 10/21	Translation V: peptide bond formation and translocation	Gourse
Fri 10/23	Translation VI: Termination, Misreadings of the code, introns, and inteins	Gourse
Mon 10/26	*Discussion*	TA/Gourse
PROTEIN FOLDING, SECRETION, REGULATORY NETWORKS		
Wed 10/28	Chaperones, Protein Secretion to IM	Forest
Fri 10/30	Protein Secretion to OM	Forest
Mon 11/2	Unfolded protein response networks	Gourse
Wed 11/4	*tmRNA/6SRNA*	Gourse
Fri 11/6	*Discussion*	TA/Forest/ Gourse

Mon 11/9 EVENING	**Exam 2 (10 lectures)**	Gourse
Wed 11/11	Ribosome Synthesis: Translational control networks	Gourse
Fri 11/13	Ribosome Synthesis: Transcriptional control networks	Gourse
Mon 11/16	*Discussion*	TA/Gourse
Wed 11/18	Lambda 1 (genetic networks)	Gourse
Fri 11/20	Lambda 2 (operator control)	Gourse
Mon 11/23	Lambda 3 (SOS response)	Gourse
Wed 11/25	*Discussion*	TA/Gourse
Fri 11/28	*Thanksgiving Break (no class)*	
REPLICATION AND CELL DIVISION		
Mon 11/30	Replication I	Wang
Wed 12/2	Replication II	Wang
Fri 12/4	Replication III	Wang
Mon 12/7	*Discussion*	TA/Wang
Wed 12/9	Replication IV	Wang
Fri 12/11	Replication V	Wang
Mon 12/14	*Discussion*	TA/Wang
Thurs. 12/17	**Exam 3 2:45 PM (10 lectures)**	TA/Gourse/Wang