MMG 833, Fall 2019

Class Meetings: 2245 BPS on Mondays and Wednesdays from 10:20 to 11:40 AM.

Instructors:

Dr. Gemma Reguera (lectures 1-20; *course coordinator*)
6190 Biomedical Physical Sciences (BPS)
Phone: 884-5401
Email: reguera@msu.edu

Dr. Lee Kroos (lectures 20-26)
422 Biochemistry Bld.
Phone: 517-355-9726
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Textbook and Lectures:

1. Reference textbook for the course is **Molecular Genetics of Bacteria** by Larry Snyder and Wendy Champness (ASM Press). We recommend using the third (2007) or fourth (2013) editions. Both books are on reserve at the Main Library and are available as online electronic copies to MSU registered users through the library's web site.
2. Readings from the textbook are listed on the syllabus. Additional reading materials are also listed in the lecture schedule and will be uploaded to D2L.
3. Other reference textbooks: as indicated by instructors during lectures.

Objectives: This course is intended to be an advanced treatise of prokaryotic genetics, with special emphasis on bacterial genetics. It builds on basic knowledge acquired in other genetics courses such as MMG431. For this reason, ***previous background in Microbial Genetics is a prerequisite***. We will reinforce basic genetic concepts and study current advances in the field.

Pre-class materials will be made available to the students prior to the lecture. Most lectures include a 10-15 minute pre-class online video that the students need to see before the lecture. When indicated, textbook assignments, other suggested reading material, and/or preclass questions (which the student will hand in to the instructor at the beginning of the class for grading) will be used as well. The pre-class assignments are intended to help the students remember basic concepts and set the foundation for the material to be covered during the lecture. Papers will also be assigned as additional reading material or to discuss in the class, as needed, to increase the depth of knowledge on a particular topic covered in the classroom.

General Information: The course is divided in four main sections, each one being evaluated with separate exams. The first section covers the core course curriculum (lectures 1 to 20) and is instructed by Dr. Reguera. Dr. Kroos will instruct the last section of the course (lectures 21 to 26), which will focus on applying the learned concepts to case studies. Each instructor will provide specific goals and requirements

for his/her part. For lecture description and examination dates see the syllabus. Please, keep in mind that exam dates are approximately.

Exams:

1. Exams often consist of a few short essay questions or problems. They can be take-home or in-class, as indicated.

   Please, keep in mind that additional exams or assignments may be imparted during the semester at the discretion of the instructor.

2. The **approximate** contribution of exams and other assignments to the final grade will be as follows:

Lectures 1-11 (exam 1, in-class)	40%	REGUERA
Lectures 12-20 (exam 2, in-class)	40%	REGUERA
Opening problems	~10 bonus points	REGUERA
Lectures 21-26 (exam 3, finals week)	20 %	KROOS
Total:	**100 %**	

3. The only acceptable reasons for missing an exam will be illness or a personal emergency. In such an event, the instructor should be contacted as soon as possible, preferentially before the scheduled time of the examination. Illness must be documented with a doctor's certificate. Other appropriate documentation should be provided in the case of a personal emergency. ***It is the responsibility of the student to contact the instructor for the scheduling and administration of an appropriate make-up exam.***

4. Assignments are designed to encourage students to keep abreast with the lectures and further develop concepts covered in the lectures and reading/paper assignments. ***Each instructor reserves the right to have in-class quizzes without any previous announcement.***

Class discipline: Late arrivals and early departures are distracting and disrupt the flow of lectures, thus should be avoided if possible. If you know ahead of time that you will be late for a lecture or that you must leave early, please inform your instructor. ***Please, turn off your phones during the lecture. Absolutely no text messaging or phone calls in the class.***

LECTURES 1 to 20: Gemma Reguera, instructor

1. Lecture description and approximate examination dates: see syllabus.
2. Pre-class assignments are shown on the syllabus. They often include a pre-class online video and a problem that will help us start the discussion for the lecture. Each opening problem includes questions, which you can answer and give to Dr. Reguera at the beginning of the lecture for grading and extra credit (usually 0.5 points). The last slide of each lecture will also include a reminder of the pre-class reading assignment for the next lecture.
3. PowerPoint slides of lectures are posted on D2L (under **Content**) the day before the lecture or earlier.
4. You will receive an e-mail as soon as the class materials (pre-class assignments and slides) are posted to D2L.
5. When indicated overviews and/or papers of particular topics will be uploaded in the corresponding lecture folder on D2L. The overviews summarize basic concepts for a particular topic and are intended to help the student review basic concepts before or after the lecture. The papers are intended to further develop concepts covered in the lectures and keep up to date with the latest discoveries in the field.
6. Evaluation: The Reguera portion of the course will evaluate students' knowledge in in-class and/or take-home assignments, as indicated in the syllabus.

Office hours for Dr. Reguera: upon request. You may schedule an appointment by e-mail, by phone or by talking to the instructor before or after class.

MMG833 | ***Fall 2019 Schedule*** | ***Where?*** | ***When?***

Microbial genetics (3 Cr.) | **Instructors:** Gemma Reguera (R) and Lee Kroos (K) | Room 2245 BPS | Mon and Wed, 10:20-11:40 am

LECTURE	Date	Day	Instructor	Topic	Textbook reading	Additional material
1	**28-Aug**	**Wed**	R	**Introduction to Genetics** *Review on DNA structure*	*Introduction, p1-11* *Ch. 1, pp13-17*	***Paper R1*** *(Z-DNA)*
2	**4-Sep**	**Wed**	R	**The bacterial chromosome** *Chromosome replication*	*Ch. 1, p17-51*	***Notes R1*** *(replication)*
3	**9-Sep**	**Mon**	R	**The bacterial chromosome** *Chromosome segregation and cell division*	*Ch. 1, p17-51*	
4	**11-Sep**	**Wed**	R	**Bacterial gene expression: transcription**	*Ch. 2, p67-83*	***Paper R2*** *(strand bias-essential genes)* ***Notes R3*** *(transcription)*
5	**16-Sep**	**Mon**	R	**Bacterial gene expression: translation and protein folding**	*Ch. 2, p84-118*	***Paper R3*** *(codon usage bias)* ***Notes R3*** *(translation)*
6	**18-Sep**	**Wed**	R	**Bacterial genetic analysis (mutations)**	*Ch. 3, p125*	
7	**23-Sep**	**Mon**	R	**Plasmids**	*Ch. 4, p 183*	
8	**25-Sep**	**Wed**	R	**Plasmids**		
9	**30-Sep**	**Mon**	R	**Regulation of gene expression** *lac operon* *Catabolite repression*	 *Ch. 12, p472-474* *Ch. 13, p526-535*	 ***Support video***
10	**2-Oct**	**Wed**	R	**Regulation of gene expression** *trp and ara operons* *Phase variation*	 *Ch. 12, p487-506*	 ***Support video*** ***Support video***
11	**7-Oct**	**Mon**	R	**Regulation of gene expression** *Alternative sigma factors* *Signal transduction; riboregulation; post-translational*	 *Ch. 12, p539-540*	
12	**9-Oct**	**Wed**	R	**PAPER DISCUSSION**		***Paper R4*** *(Intercellular nanotubes)*
	14-Oct	***Mon***		***EXAM 1 (lectures 1-11)***	***9am-12pm***	***NEW ROOM: 1425BPS***
13	**16-Oct**	**Wed**	R	**Conjugation**	*Ch. 5, p219--237*	
14	**21-Oct**	**Mon**	R	**Transformation**	*Ch. 6, p248-261*	
15	**23-Oct**	**Wed**	R	**Transduction** *Lytic phages*	*Ch. 7, pp 270-317*	***Rescheduled to Fri, Oct 25***
16	**28-Oct**	**Mon**	R	**Transduction** *Lysogeny*	*Ch. 8, pp 324-357*	
17	**30-Oct**	**Wed**	R	**Transposition/Site-specific recombination**	Ch. 9, pp 361-398	
18	**4-Nov**	**Mon**	R	**Homologous recombination**	*Ch. 10, pp 404-426*	
19	**6-Nov**	**Wed**	R	**DNA repair and mutagenesis**	*Ch. 11, pp 434-466*	
20	**11-Nov**	**Mon**	R	**REVIEW**		
	13-Nov	***Wed***	*R*	***EXAM 2 (lectures 12-20)***	***9am-12pm***	***NEW ROOM: 1425BPS***
21	**18-Nov**	**Mon**	K	**Global regulation** *Catabolite repression* *Nitrogen assimilation*	*Chapter 13* *pp 526-536* *pp 536-547*	
22	**20-Nov**	**Wed**	K	**Global regulation** *Heat shock, General stress response* *Extracytoplasmic stress* *Iron regulation*	*Chapter 13* *pp 554-562* *pp 563-567* *pp 568-570*	
23	**25-Nov**	**Mon**	K	**Global regulation** *Virulence genes* *Ribosome and tRNA synthesis*	*Chapter 13* *pp 572-577* *pp 547-553*	***Paper K1 (****Kolter 2007 Science 318: pp578-9 and 595-602)*
24	**27-Nov**	**Wed**	K	**Bacterial cell compartmentalization and sporulation** *Protein transport* *Membrane topology* *Protein secretion*	*Ch. 14* *pp 585-593* *pp 594-595* *pp 595-604*	
25	**2-Dec**	**Mon**	K	**Bacterial cell compartmentalization and sporulation** *Bacillus sporulation*	*pp 635-650* *pp 621-635*	***Paper K2*** *(Kroos 2007 Ann. Rev. Genet.)*
26	**4-Dec**	**Wed**	K	***Myxococcus*** **development**		***Paper K3*** *(Bonner 2006 Mol. Microbiol.)*
Dec 9 to 13				**EXAM 3 (in-class, finals week)**		***lectures 21-26***