

MBG 303 Molecular Genetics of Prokaryotes
Course Syllabus, Fall/2024

Instructor: Prof. Dr. Ferda Soyer
Office: MBG Building Room D209

Lecture: 08:45-10:30 Wednesday- G109
08:45-09:30 Thursday- G109

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Office hours: Thursday 9:45-10:45
and by Appointment

Recommended Textbooks:

Molecular Genetics of Bacteria 3/e by Larry Snyder, Wendy Champness, 2007, ASM Press
Microbial Genetics 2/e by Stanley Maloy, John Cronan, David Freifelder, 1994, J. & B. Pub.

Course Objectives: This course aims to give you an understanding of the fundamentals of the genetics of bacteria from the perspective of molecular biology, genetics, and biochemistry. Upon completion of this course, you should have a better understanding and knowledge of fundamental microbial processes such as gene regulation, mutagenesis; the transmission of genetic material by conjugation, transduction, and transformation; genomic plasticity: movable genes and phase variation; genetic techniques for investigating bacteria.

My Assumptions: I assume you have a basic knowledge of Bacteria (MBG102) and Molecular Biology (MBG202). Before beginning this course, you should know the following concepts:

- ❖ DNA structure (antiparallel double-helix, Watson-Crick base pairing)
- ❖ DNA replication (DNA polymerase, primers, 5' and 3' ends, origins, Okazaki fragments)
- ❖ Transcription (RNA polymerase, promoters, terminators, sigma factors)
- ❖ Translation (ribosomes, mRNA, tRNA, start and stop sites)
- ❖ Basic molecular biology tools (restriction enzymes, DNA ligase, hybridization, PCR)
- ❖ Basic properties of prokaryotes (Archaea and Bacteria)

Grading Policy:

Midterm I	%30	November 7 th 2024- Thursday
Midterm II	%30	December 19 th 2024- Thursday
Final Exam (cumulative)	%40	January 8 th 2025- Wednesday

Attendance Policy: Class attendance will be monitored. According to the IYTE regulations, 70% attendance (max. 12 lectures of absence) is required to pass the course; less than that will result in a grade of NA if your grade is below DD. If you miss a class on the day of an exam, and I don't hear from you before the class starts, and you don't have a legitimate excuse, you will receive a zero for the exam and will not be able to make it up! Class starts at the designated time; late arrivals will not be tolerated. In general, you will be expected to participate in class discussions both as an active discussant and as a respective listener.

Academic Integrity: All relevant University policies regarding Academic Integrity must be followed. This includes cheating, plagiarism, fabrication, falsification, and failing to report knowledge. This means that your homework assignments must be written in your own words. Please consult the Student Handbook or the appropriate web page.

Copying from a source or website, even if referenced, is considered plagiarism.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others/electronic devices/papers/books, or collaborate in any way. Use of any kind of material or any collaborative behavior during the examinations will fail the exam and lead to failure of the course and disciplinary action by the university.

Class etiquette: Cell phones must be turned off or silenced during class. If you must be available via cell phone for emergencies, set your phone to vibrate mode. Please be considerate and avoid distractions such as carrying on conversations or entering/exiting during lectures.

What I expect from you: It is very important that the communication is kept upright. Therefore, I want to make sure that you realize what is expected of you. This is a university course, and you are an adult. Therefore, you are a responsible person. It is your responsibility to make sure you have enough time for this class.

a. Time Commitment:

You should recognize that this course requires active student participation. You should expect to spend at least 3 hours per week participating in class discussions and activities for a fourteen-week course. Then, about 6-7 hours will be spent studying, assigned reading, and working on the questions of each chapter outside of class. Active participation is required in lectures.

b. Study and Work Habits:

- Go over your notes after each lecture while the material is still fresh on your mind.
- Be sure your in-class behavior enhances the learning environment during the class.
- Ask questions in and after class if material confuses you.
- Schedule adequate time to do the work
- Ask for help when needed
- Be self-motivated
- A major purpose of studying is to discover what you don't understand so that you can do something about it.
- Since we cover a great deal of material in a short time, study on a regular basis, not just before the exams.
- Understand that there are many levels of “knowing”. You may completely “know” the material in the sense that you could recite it back but not be able to use the material to evaluate, predict, or analyze. It is this more complex type of knowing that will be important on the tests.

CONTENTS OF THE COURSE

Part I: Gene Expression & Regulation

Operons and regulons

The *lac* operon

The catabolite regulon system

The *trp* operon and regulation by attenuation

Part II: Mutations and Mutagenesis

Types of mutations

Mutator strains

Repression and Suppression

The usefulness of bacterial mutants

Part III: Mechanisms that create genetic variability in bacteria

Plasmids

Types of plasmids and characteristics of some well-known bacterial plasmids

Origin of replication and copy numbers

Plasmid incompatibility

Transformation

Artificial competency and transformation

Natural competency and transformation

Transfection

Conjugation

The F and the R factor

Conjugation machinery

F, Hfr, F-prime

Mobilization of non-conjugable plasmids by R and F

Transposition

Transposons structure

Replicative transposition

Non-replicative transposition

Site-specific recombination

Bacteriophages and transduction

Structure and Life cycle of bacteriophage

Regulation: Lysis or lysogeny

Generalized versus Specialized transduction