Microbiology and Immunology 3400A: Bacteriology

Draft – Course Description:

Bacteriology, essential for understanding diseases, guiding medical interventions, and advancing biotechnology, critically influences human health and environmental sustainability. Lectures will focus on bacterial cell structure and function; bacterial culture, growth, development, and division; bacterial genetics and information flow; bacterial metabolism and diversity; and roles of bacteria in the environment.
Antirequisite(s): the former Microbiology and Immunology 3100A
Prerequisite(s): Biochemistry 2280A, Biology 2581A/B and Microbiology and Immunology 2500A/B.
Pre- or Corequisite(s): it is recommended, but not required, that Biochemistry 3381A be taken previously
Extra Information: 3 lecture hours
Course Weight: 0.5 course

Draft - Course Summary:

Upon successful completion of this course, students will be able to:

- describe essential and/or unique structures of bacteria and understand the basics of bacterial phylogeny and taxonomy
- evaluate factors and mechanisms essential for bacterial growth and division, including their various metabolic abilities
- examine how gene regulation is achieved in bacteria, and how it related to physiology and virulence
- explain genetics mechanisms underlying bacterial evolution and apply this understanding to biotechnology and research applications
- describe the mechanisms and epidemiology of bacteria that cause food- and water-borne diseases
- examine modern techniques used for the characterization of microbiome composition, activity, and output (genomics, transcriptomics, metabolomics) with examples from specific niches, and
- explain mechanisms of antimicrobial resistance, the issue it poses for pandemic preparedness, and current/emerging therapies.

Draft - Anticipated Grading Structure:

- Oral Presentation: students will work in groups of 4-5 to prepare presentations on topics selected by course instructors. Presentations will be delivered in-person with 12 minutes for the presentation and 3 minutes for questions/discussion. (10%)
- Written Report #1: as a group, students will collaboratively prepare a two-page written report on their assigned presentation topic. (10%)
- Written Report #2: students will independently identify an area of interest that extends on a key topic from presentations given by their peers and write a half page report. Students will complete five of these reports on five separate presentations delivered by their peers. (3% each for total of 15%)
- Midterm test: multiple choice and short answer (30%)
- Final exam: multiple choice and short answer (35%)

Draft Course Schedule

Lecture #	Topic	Instructor
UNIT 1: INTRO		
1-2	Course organization plus lecture: Relevance of microbes to hea industry and the environment.	Dr. Carole Creuzenet
UNIT 2: BACTERIAL CELL		
3	Bacterial cell structures and function- General	Dr. Carole Creuzenet
4-5	Bacterial carbohydrates synthesis and function: lipopolysaccharide, capsule, teichoic acids, and glycoproteins	Dr. Carole Creuzenet
6	Bacterial protein secretion throughout the cell envelope	Dr. Carole Creuzenet
7	Bacterial appendages and cell locomotion: pilus and/or flagella	Dr. Carole Creuzenet
8-9	Bacterial growth and division	Dr. Carole Creuzenet
10	Adaptation of host structures to environment. Ex: Helicobacter /	Dr. Carole Creuzenet
UNIT 3: BACTERIAL GENETICS		
11	Bacterial genome organization and DNA replication	Dr. Veronica Guariglia
12	Bacterial gene transcription and protein translation	Dr. Veronica Guariglia
13	Regulation of gene transcription 2 component systems, reporter systems, RNASeq	Dr. Veronica Guariglia
14	Regulation of bacterial competence and sporulation	Dr. Veronica Guariglia
15	Biofilms regulation, structure, function	Dr. Veronica Guariglia
16	Quorum sensing	Dr. Veronica Guariglia
17-19	Bacterial genetics for DNA movement and evolution - Transformation and mutations - Plasmids and conjugation - Transduction and transposition	Dr. Carole Creuzenet
UNIT 4: BACTERIAL METABOLISM DIVERSITY AND MICROBIOMES		
20-21	Energetics and Catabolism (Metabolism, fermentation, respiration, electron flow, metabolic diversity)	Dr. Jeremy Burton
22	Phylogeny and taxonomy	Dr. Jeremy Burton
23	Practical methods for taxonomy	Dr. Veronica Guariglia
24	Microbiome, transcriptome, metabolome	Dr. Jeremy Burton
25	Odonto-Microbiome as a specialized microbiome	Dr. Veronica Guariglia
UNIT 5: BACTERIA AS THREAT IN FOOD OR THE ENVIRONMENT		
26	Epidemiology of water- and food-borne bacterial diseases	Dr. Carole Creuzenet
27-28	Etiology and mechanisms of water- and foodborne bacterial dis	Dr. Carole Creuzenet
29	Clinical Microbiology and Epidemiology	Dr. Veronica Guariglia
30	Antimicrobial resistance: epidemiology and mechanisms	Dr. Veronica Guariglia
31	Pandemic preparedness and bioterrorism: don't forget the bacte	Dr. Veronica Guariglia