# MICROBIOLOGY (BIOMI)

**BIOMI 1100 - Locker Rooms, Kitchens and Bedrooms: The Microbiology of College Life (3 Credits)**
Microbial habitats are literally everywhere on a college campus - and college students interact with microorganisms daily. From the athlete locker room, to the kitchen, to the bathroom, to between the sheets, college students are exposed to a plethora of microorganisms that are benign, beneficial, and pathogenic. The goal of this course is for students to learn about microbiology and microbial ecology as it relates to them - in the college campus environment. Students will learn about viruses, bacteria, eukarotes and metazoans that cause common illnesses (i.e. gastroenteritis, influenza and STDs), the microbially-driven elemental cycling of alcohol production, and ecology of microorganism that spoil food. Students will take away a practical understanding of the microorganisms that they can apply to their own lives. This course is suitable for non-life sciences majors.
**Distribution Requirements:** (BIO-AG, BSC-AG, OPHLS-AG), (BIO-AS), (SCT-IL)
**Last Four Terms Offered:** Summer 2025, Spring 2025, Summer 2024, Spring 2024
**Learning Outcomes:**

- Demonstrate an understanding of core concepts of microbiology, including the evolution and diversity of microbes; cell structure and function; pathogenic and non-pathogenic lifestyles; and the role of microbes in human health and the built environment.
- Recognize the differences between pathogens, opportunists, and non-pathogenic microorganisms and have an appreciation for their roles in the college campus environment.
- Describe how microorganisms facilitate major biogeochemical cycles in natural and agricultural habitats.
- Apply the scientific method, as well as use objective observation and empirical measurement to evaluate alternative ideas concerning the underlying principles that govern biological, physical and chemical processes.
- Explain fundamental concepts of microbiology, both in written and in oral format.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 1120 - Microbes, the Earth, and Everything (3 Credits)**
We live on a microbial earth. If we happen to consider microbes in our daily lives most people conjure images of disease, but in reality we depend on microbes to sustain our world. This course showcases the vast microbial world that hides in plain sight all around us and use microbial examples to explore both fundamental biological principles and the scientific method. Course modules emphasize basic concepts from evolution, molecular biology and genetics, diversity, and ecology. Learn about the tiny titans and miniature monsters that are the life support system of our planet, how they have shaped human civilizations, and how they reveal the unifying principles of life. This course is suitable for non-life sciences majors.
**Distribution Requirements:** (BIO-AG, BSC-AG), (BIO-AS)
**Exploratory Studies:** (CU-SBY)

**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Describe the major biogeochemical cycles of the Earth.
- Recognize and identify the unifying molecular and biochemical characteristics of living organisms.
- Describe the importance of evolution as a cornerstone of biology.
- Apply the scientific method, as well as learn how science uses objective observation and empirical measurement to evaluate alternative ideas concerning the underlying principles that govern biological, physical and chemical processes.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 1400 - Antibiotics: Probing the Biology of Life and Death (3 Credits)**
Though antibiotic resistance puts millions of lives at peril from infectious diseases each year, antibiotics and other antimicrobials have played a critical role in helping scientists understand biological systems better. This class examines the biology of microbial life through the lens of antibiotics and other antimicrobials. This course is suitable for non-life sciences majors.
**Enrollment Information:** Primarily for: non-life-science majors.
**Distribution Requirements:** (BIO-AG, BSC-AG, OPHLS-AG)
**Exploratory Studies:** (CU-SBY)

**Last Four Terms Offered:** Summer 2025, Spring 2025, Summer 2024, Spring 2024
**Learning Outcomes:**

- Explain, evaluate, and effectively interpret factual claims, theories, and assumptions in the sciences.
- Find, access, critically evaluate, and ethically use information.
- Integrate quantitative and qualitative information to reach defensible and creative conclusions.
- Communicate effectively through writing, speech, and visual information.
- Demonstrate the capability to work both independently and in cooperation with others.
- Apply concepts of sustainability to the analysis of one of more major challenges facing humans and the Earth's resources.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 1720 - Biomedical Terminology (3 Credits)**
Crosslisted with CLASS 1692
A study of the Greek and Latin word elements that combine to form most of the specialized terms in medicine, law, and biology. Students learning the meanings of these elements and the rules of word formation can usually recognize the basic meaning of any unfamiliar word in these fields. This skill is especially valuable for pre-law, pre-medical, pre-dental, pre-veterinary students and for those in other health and legal fields, as well as for students who would like to broaden their general vocabulary.
**Distribution Requirements:** (BIO-AS), (OPHLS-AG)
**Last Four Terms Offered:** Summer 2025, Winter 2025, Summer 2024, Winter 2024
Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2100 - Genesis (2 Credits)**
This class will explore the current theories about the chemical origins of life on earth, and will then use these insights to discuss the search for life on other planets, inside the Solar system and outside. Topics will include origin of the Sun, the Big Bang, the formation of Earth, the origin of life, from the prebiotic synthesis of amino acids, nucleobases, and other building blocks of life, the evolution of primitive protocells, the earliest RNA-based catalysts, the evolution of protein synthesis machinery, and the origins of eukaryotic cells. We will conclude with strategies and progress in identifying life on other planets in our solar system and on planets orbiting other stars.
**Prerequisites:** BIOG 1140 or BIOG 1500 or BIOMG 1350, or equivalent college level course that addresses DNA, RNA, and protein synthesis.
**Distribution Requirements:** (BIO-AG)
**Last Four Terms Offered:** Spring 2025, Fall 2024, Spring 2024, Fall 2023
**Learning Outcomes:**
- Students will be able to summarize and evaluate knowledge and theories about the formation of a stars, the Earth, planets and a temperate hydrosphere on the surface of the primitive earth.
- Students will be able to critically evaluate experiments and theories about the abiotic formation of biologically molecules and their polymerization into macromolecules, and will identify gaps in these theories.
- Students will be able to critique theories about the RNA world and the evolution of protein synthesis machinery.
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Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2500 - Public Health Microbiology (3 Credits)**
This course will use a variety of teaching methods (including historical and current case studies and databases) to help students understand basic principles of microbiology as they apply to the emergence, transmission, pathogenicity, and control of infectious human disease. Major topics include water and food borne disease, zoonotic diseases, sexually transmitted diseases and antibiotic resistance.
**Prerequisites:** the equivalent of two semesters of majors-level biology and one semester general chemistry.
**Forbidden Overlaps:** BIOMI 2500, BIOMI 2600
**Distribution Requirements:** (BIO-AS), (BSC-AG, OPHLS-AG)
**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022, Fall 2020
**Learning Outcomes:**
- Describe and apply investigative methods to studies in public health microbiology.
- Explain core concepts in microbiology (including the basic characteristics of viruses, bacteria, fungi and protozoa) as they relate to public health issues.
- Compare and contrast models of infectious disease with respect to pathogens, reservoirs, modes of transmission and control.
- Analyze the social, economic, and cultural challenges to protecting the public by preventing infectious disease.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2600 - Microbiology of Human Contagious Diseases (3 Credits)**
This course provides an introduction to the microbiology of microbial diseases. The primary focus is on molecular mechanisms of pathogenesis, including detection of the host environment, binding of pathogenic microbes to host cell surfaces and their invasion of host cells and tissues, and the delivery and functions of microbial toxins. It will include host defenses and microbial countermeasures against these defenses. We will also study the evolution of pathogens and the co-evolution of their hosts.
**Prerequisites:** one semester of introductory biology or equivalent.
**Forbidden Overlaps:** BIOMI 2500, BIOMI 2600
**Distribution Requirements:** (BIO-AS), (BSC-AG, OPHLS-AG)
**Last Four Terms Offered:** Summer 2025, Spring 2025, Summer 2024, Spring 2024
**Learning Outcomes:**
- Explain fundamental aspects of molecular microbiology as they apply to pathogenic microorganisms.
- Explain how host defenses work against infection and microbial countermeasures to evade host defenses.
- Describe a variety of medical interventions used to fight infectious diseases.
- Instruct one another in various aspects of infectious disease, in small discussion groups and in poster sessions.
- Communicate scientific arguments and ideas verbally and in writing.
- Explain, evaluate, and effectively interpret claims, theories, and assumptions in medical microbiology, including those presented in the current scientific literature.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2900 - General Microbiology Lectures (3-4 Credits)**
Comprehensive overview of the biology of microorganisms, with emphasis on bacteria. Topics include microbial cell structure and function, physiology, metabolism, genetics, diversity, and ecology. Also covers applied aspects of microbiology such as biotechnology, the role of microorganisms in environmental processes, and medical microbiology.
**Prerequisites:** one semester of introductory biology (or AP biology) and one semester of chemistry, (or AP Chemistry).
**Distribution Requirements:** (BIO-AS), (BSC-AG, OPHLS-AG)
**Last Four Terms Offered:** Summer 2025, Spring 2025, Fall 2024, Summer 2024
**Learning Outcomes:**

- Explain the defining characteristics of the major groups of microorganisms and viruses, and their functional roles in human and environmental systems.
- Explain core concepts relating to microbial cell structure and function, microbial growth and physiology, and microbial evolution and systematics.
- Explain microbial transformations of energy and matter as they relate to microbial growth and biogeochemical processes.
- Explain how microbes manage genetic information, its expression, storage, exchange, and evolution.
- Explain how microbial adaptations facilitate their function in diverse habitats including human hosts.
- Apply microbiological principles and models in a scientific framework to analyze and solve diverse biological problems that relate to human health and the environment.
- Critically evaluate information about microbiology from various sources.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2911 - General Microbiology Laboratory (3 Credits)**
This class will introduce you to current concepts and laboratory techniques in microbiology. Our goal is to show you how scientists use experiments to learn about the microbes around us, with an emphasis on bacteria. This course complements the Microbiology lecture by providing students with hands-on investigations into the microbial world.
**Distribution Requirements:** (BIO-AS), (BSC-AG, OPHLS-AG)
**Last Four Terms Offered:** Spring 2025, Fall 2024, Spring 2024, Fall 2023
**Learning Outcomes:**

- Demonstrate an ability to formulate hypotheses and design experiments, based on the scientific method.
- Analyze and interpret results from a variety of methods in microbiology, and apply these methods to analogous situations.
- Use mathematical reasoning and graphing skills to solve problems in microbiology.
- Effectively communicate fundamental concepts of microbiology.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2950 - Biology of Infectious Disease: From Molecules to Ecosystems (3 Credits)**
A broad integration and overview of the origins, nature, and dynamics of infectious disease in humans, plants, and animals. An examination of the historical and contemporary concepts and impacts of infectious agents on hosts at multiple spatial and temporal scales and at different levels of biological organization. The ecology and evolution of pathogens, hosts, and vectors are also discussed. Consideration of newly emerging diseases in human, plant, and animal populations and the influence of human activities on global disease spread. Current and future issues and trends in disease monitoring and mitigtion will also be addressed.
**Prerequisites:** two of the three core undergraduate biology courses: BIOMG 1350, BIOG 1440, BIOG 1445, BIOEE 1610, BIOSM 1610, or the equivalent.
**Enrollment Information:** Enrollment limited to: sophomores or higher.
**Distribution Requirements:** (BSC-AG)
**Last Four Terms Offered:** Spring 2025, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Discuss their own concept of health and disease.
- Describe how infectious diseases influence human, plant, animal, and global health.
- Compare and contrast human, animal, and plant diseases.
- Explain the basic form, function, behavior, and diversity of infectious agents and their vectors.
- Identify the important details of specific diseases of humans, plants, and animals.
- Distinguish the different ways in which human, animal, and plant hosts defend themselves against infectious agents.
- Apply sound reasoning skills to identify the cause and effect in host-pathogen systems
- Formulate good questions and have the skills to answer those questions.
- Critically analyze and interpret data sets to make logical inferences from those data.
- Utilize their understanding of disease biology to predict how new diseases might emerge.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 2970 - Principles of Pharmaceutical Science (2 Credits)**
We often take over-the-counter and prescription medications to treat various acute and chronic conditions, but how does that pill in a bottle relieve symptoms? This course will allow students to appreciate the intersection of biology and chemistry driving the science behind successful therapeutics. Why does a drug work better for some people than others? Why is taking many medications with grapefruit juice ill-advised? Students will learn the fundamentals of drug action and timing using selected FDA-approved drugs as examples in these sessions. We will discuss various drugs naturally made by bacteria and how bacteria are used to produce recombinant biologics drugs. We will cover some of the clinical aspects of antibiotic prescribing and why antibiotic resistance is a significant concern in healthcare and strategies for mitigation. Students will also learn about various analytical and bioanalytical assays used to clear a manufactured drug lot for release, for monitoring drug concentrations in patients' blood, and about tests used to determine whether a certain drug is likely to successfully treat a condition or cause adverse effects (companion diagnostics.) The interactive lectures will allow students to better understand drugs marketed to consumers and gain familiarity with the terminology used in drug development and clinical application. Students will develop their critical thinking skills by exploring a drug of their choice in scientific literature and have an opportunity to practice their communication skills through open discussion of their findings.
**Prerequisites:** one semester of introductory biology (BIOG 1140, BIOG 1440, BIOG 1445, or BIOMG 1350) and general chemistry (CHEM 1560, CHEM 2070, or equivalents), or permission of instructor.
**Last Four Terms Offered:** Spring 2025
**Learning Outcomes:**

- Recognize how a drug's chemical structure affects its biological properties.
- Explain fundamental biological processes underlying drug action.
- Use terminology relevant to drug development and administration.
- Describe the clinical challenges posed by antimicrobial resistance.
- Recognize the importance of bacteria in drug production.
- Describe common analytical techniques used in drug analysis and therapeutic monitoring.
- Demonstrate their ability to organize and communicate information found in the scientific literature.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 3210 - The Gut Microbiome (3 Credits)**
The microbes on and in our bodies are as abundant as our own cells. These diverse microorganisms provide us with metabolic capacities beyond our own and are essential to good health, but can also play a role in disease.This course will introduce the microbes of the human body, discuss their origins, adaptations to the body, molecular interactions, and associations with health and disease.
**Prerequisites:** BIOMI 2900 or permission of instructor.
**Distribution Requirements:** (BIO-AS), (BSC-AG, OPHLS-AG)
**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Students will be able to describe how the gut microbiome affects host health.
- Students will be able to explain the potential impact of genetics, environment, and nutrition of the microbiome.
- Students will be able to explain what experimental tools are used to examine the microbiome and how the data those tools generate is evaluated.
- Students will be able to critically analyze news reports and popular press articles that pertain to the gut microbiome and personal/public health.
- Students will be able to evaluate the significance and shortcomings of claims made in primary scientific publications about the gut microbiome.
- Students will be able to aggregate the information needed to produce scientifically justified presentations that describe advances in gut microbiome science and offer an informed opinion about the significance of those advances.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 3500 - Marine Microbes and Disease in a Changing Ocean (3 Credits)**
Crosslisted with EAS 3555
Marine microorganisms fuel globally significant elemental cycles through their activities. They also drive diseases in multicellular life through pathogenesis, modulation of host-associated microbiomes, and through induction of stressors (e.g. toxins, hypoxia). The purpose of this course is to provide junior- and senior-level students a background in biological oceanography, marine microbial ecology, biogeochemistry, and disease pathogenesis in marine habitats. The emphasis of the course is on understanding how biology affects and is affected by the oceans, and how organisms interact to produce ocean biological phenomena. The course is divided into 4 modules: 1) Marine microbial diversity and ocean structure; 2) Ocean biogeochemistry; 3) Marine disease pathogenesis; and 4) Pollution and climate change. This course will equip students with foundations for further undergraduate courses in ocean sciences and environmental dynamics, and for graduate studies in biological oceanography and marine biology.
**Prerequisites:** BIOEE 1610, BIOEE 1780.
**Distribution Requirements:** (BIO-AS), (BSC-AG, OPHLS-AG)
**Exploratory Studies:** (CU-SBY)

**Last Four Terms Offered:** Fall 2024, Fall 2023, Spring 2023, Spring 2022
**Learning Outcomes:**

- Describe the taxonomic and functional diversity of marine microorganisms in both natural and human influenced habitats of the ocean.
- Examine the contributions of each group of marine organisms, from viruses through metazoa, to overall ecosystem function and elemental cycling.
- Access the current threats to marine ecosystems on local and global scales through pollution and climate change.
- Describe how microorganisms cause disease and how diseases influence marine ecosystems.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 3940 - Applied and Food Microbiology (3 Credits)**
Crosslisted with FDSC 3940
Food Science 3940 will focus on the origin, transmission, consequences, and management of diverse microbiota throughout the food chain. Topics in this course generally include: 1) the microbiota of different food systems, 2) the physiology, metabolism, and pathogenesis of important groups of microbes, and 3) application of food microbiology to the industrial sector. You will receive a basic education in interdisciplinary subjects that require knowledge of microbiology, food safety, epidemiology, public health, biotechnology, and cell metabolism. Knowledge and expertise gained in this course will support your qualification for a future career in food science, biotechnology, or microbiology.
**Prerequisites:** BIOMI 2900 and BIOMI 2911.
**Distribution Requirements:** (AFS-AG, BSC-AG, OPHLS-AG), (BIO-AS)
**Last Four Terms Offered:** Fall 2024, Summer 2024, Fall 2023, Fall 2022
**Learning Outcomes:**

- Identify the microbiota relevant to a given food product, process, or environment.
- Describe the causes of and mechanisms behind foodborne disease, fermentation, and spoilage.
- Determine the relevant conditions or measures needed to promote safety, fermentation, or reduce spoilage.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 3990 - Professional Skills for Host-Microbe Interactions Research (1 Credit)**
This course complements the Undergraduate Research Experience program coordinated by the Cornell Institute of Host-Microbe Interactions and Disease. The goal is to introduce students interested in research on host-microbe interactions to professional skills needed to successfully complete research projects and apply to graduate school. Course activities will address fundamental topics such as research ethics and science communication, as well as planning for graduate study, including preparing application materials and applying for opportunities.
**Last Four Terms Offered:** Spring 2025, Spring 2022, Spring 2021, Spring 2020
**Learning Outcomes:**

- Demonstrate familiarity with biology graduate programs and application process.
- Demonstrate improvement in written and oral presentation skills.
- Be able to apply scientific ethics and properly cite literature.
- Demonstrate understanding of scientific careers and their pursuit.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4040 - Pathogenic Bacteriology (2-3 Credits)**
Crosslisted with BIOMS 4040
Course in medical microbiology, presenting the major groups of bacterial pathogens important to human and veterinary medicine. Emphasizes infection and disease pathogenesis. Topics include disease causality; interactions of host, pathogen, and environment, including immunity to bacteria; and principles of antimicrobial therapy and drug resistance. Recommended for those planning to attend medical school, graduate school, or veterinary medical school, or those just interested in how bacteria cause disease. A companion seminar addresses the current and classic literature related to the pathophysiology of medically important bacterial pathogens on the cellular and molecular levels.
**Prerequisites:** BIOMI 2900 or permission of instructor.
**Last Four Terms Offered:** Spring 2025, Spring 2024, Spring 2023, Spring 2022
**Learning Outcomes:**

- Describe the biology of a variety of pathogenic bacteria and how each causes disease.
- Describe the strategies bacteria use to overcome the defenses of their hosts.
- Explain the methodologies used to identify and study the factors that allow bacteria to cause disease.
- Predict the types of disease and symptoms a bacterial pathogen would cause when given information about the virulence factors that pathogen possesses.
- Additionally for the 3 credit option: Critically read the current literature in the field.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4090 - Principles of Virology (3 Credits)**
Crosslisted with BIOMS 4090
Principles of Virology is a course designed to convey the basic principles of virus biology, to illustrate the key concepts of virus-host interactions and their consequences for virus replication and pathogenesis of viral disease. The course focuses on identifying unifying principles underlying virus biology and highlighting important differences between viruses. Viruses infecting plants, animals, and bacteria will be discussed. A graduate level component of this course will further focus on seminal virology research findings and the cutting-edge technologies used in modern experimental virology through primary literature reading assignments provided in addition to the lecture material.
**Prerequisites:** BIOMI 2900 or permission of instructor.
**Distribution Requirements:** (BIO-AS), (OPHLS-AG)
**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Identify, describe, and discuss the basic concepts of virus particle structure (including enveloped and non-enveloped viruses) and the biochemical and cell biological bases for virus entry, multiplication, and egress of different families of RNA, double-stranded RNA, and DNA viruses.
- Explain the basic principles of virus transmission in different phyla and recognize the features of viral pathogenesis and the role of host defenses in combatting viral infection.
- Understand the factors that contribute to virus evolution and emergence, and be able to apply that understanding to situations involving virus outbreaks that affect global health.
- Identify and recognize selected disease-causing viruses of animals (humans included), including COVID19, cancer, and flu.
- Identify and evaluate individual steps in a virus' replication cycle that can be effectively targeted by anti-viral drugs for pharmaceutical intervention of virus diseases.
- Discuss effective strategies for a) prevention of infection through development of viral vaccines and b) treatment of diverse human diseases by gene therapy through the design and administration of genetically engineered virus vectors.
- Be able to read about any virus and understand its replication and pathogenic strategies based on common principles of viral replication and pathogenesis.
- Identify, describe, and choose appropriate experimental approaches to address questions about virus entry, replication, and egress in cell culture.
- Identify, describe, and choose appropriate experimental approaches to address questions about viral pathogenesis and the use of animal models.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4200 - Core Concepts in Molecular Bacteriology (3 Credits)**
The goal of this course is to prepare students for advanced work in molecular bacteriology, with a special emphasis on experimental design. First year graduate students as well as senior undergraduates with an interest in understanding how bacterial cells work at the molecular level will gain the most from this course. We will cover basic molecular bacteriology and learn experimental approaches. A background in bacteriology or microbiology is not required, since we will review of fundamental concepts before digging deeper into these concepts using primary literature. Further, we will examine the foundational experiments that led to our current understanding of the bacterial world. We will also critically analyze recent primary literature in this field to advance our knowledge and will use this literature as a basis for generating new hypotheses. Students will also build a foundation in structural, genetic, and biochemical tools used in microbiology laboratories. Foundational knowledge and practical skills learned in this course will help prepare the student for advanced work in the bacteriology laboratory.
**Last Four Terms Offered:** Spring 2025, Spring 2011, Spring 2009
**Learning Outcomes:**

- Identify unifying themes common to cellular life and gain an appreciation for the ways in which bacterial species have diversified and adapted to their unique environments.
- Demonstrate a mechanistic understanding of the bacterial world.
- Critically analyze literature related to topics covered in class and be able to synthesize and discuss experimental findings.
- Apply basic computational tools to basic research questions.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4300 - Computational Approaches for Microbial Systems (3 Credits)**
High-throughput sequencing has revolutionized and become common practice across the field of microbiology. This course will prepare students for analyzing large sequencing datasets through a meaningful biological lens. Via a combination of lectures, discussions of primary literature, and hands-on, data-driven computational labs, we will learn how to organize computational projects, work in the command line, perform cloud computing, and gather, interpret, and analyze amplicon and (meta)genomic data to advance our understanding of microbial systems. We will evaluate the distribution of microbial biodiversity and gene abundances and compare the taxonomic and genomic composition of microbial communities. This course is geared towards graduate students and upper-level undergraduate students across biology. We will focus on how to use software for biological analyses while touching on broader concepts of statistical algorithms. (Note: the specifics of statistical models will not be the focus.)
**Prerequisites:** background in microbiology (e.g. BIOMI 2900 or similar), and a background in genetics and genomics (e.g. BIOMG 2800 or similar course).
**Last Four Terms Offered:** Spring 2025
**Learning Outcomes:**

- Develop proficiency in command line programming in unix and R.
- Organize, build, and practice a bioinformatics computing workflow under version control with git and GitHub.
- Perform an amplicon sequencing analysis of microbial community data.
- Evaluate various meanings of biodiversity and interpret compositional changes in microbial communities through statistical approaches.
- Build and describe the steps to generating (meta)genomes from microbial sequencing data that can be used for downstream genomic analyses.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4310 - Medical Parasitology (2 Credits)**
Crosslisted with BIOMS 4310
Systematic study of arthropod, protozoan, and helminth parasites of public health importance, with emphasis on epidemiologic, clinical, and zoonotic aspects of these parasitisms.
**Prerequisites:** one of the following courses: BIOEE 1610, BIOEE 1780, BIOEE 1180, BIOEE 2640, BIOEE 2740, BIOMI 2900, EAS 1700, or one semester college or majors-level biology, or equivalent course.
**Last Four Terms Offered:** Spring 2025, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Categorize parasites of medical importance by recognizing key morphologic characteristics (useful for identification) of basic parasite groups.
- Describe, using appropriate terminology, the life cycle of parasites of medical importance and how it related to approaches in treatment and prevention of disease.
- Delineate classical clinical signs (or importance) associated with parasites of humans in relation to the parasite's biology.
- Choose appropriate measures for treatment and control of parasitic infections Predict likely parasitic differentials by considering host signalment, exposures (history), and clinical signs.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4850 - Bacterial Genetics (2-3 Credits)**
Bacteria and archaea are the driving force behind all major environmental cycles on the planet, they are critical players in a broad range of agricultural and industrial applications, as well as being responsible for many of the greatest medical challenges and opportunities facing humanity. Additionally, the underpinning of all molecular biology basically comes from work in bacteria. Systems being discovered in bacteria and archaea are continuing to drive the latest technologies in gene modification and genetic engineering across the life sciences. This course will provide a fundamental understanding of the genetics of bacteria and archaea and how this information can be used to understand the uniquely important role they play in the natural environment and current and future applications.
**Prerequisites:** BIOMG 2800.
**Distribution Requirements:** (BSC-AG, OPHLS-AG)
**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Gain an understanding of how bacteria and archaea maintain and pass on genetic information and the unique nature of their genomes.
- Learn how bacteria and archaea evolve through mutations and the exchange of genetic information via mobile elements (e.g. bacteriophage, plasmids, transposons) and direct DNA uptake.
- Understand how the repertoire encoded in bacterial and archaeal genomes is efficiently regulated through gene and global regulation.
- Understand the bacterial and archaeal systems used across biology for gene editing and synthetic biology (e.g. CRISPR/Cas, gene assembly).
- Understand how bacterial genetics was used to answer many of the fundamental questions in biology.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 4980 - Teaching Experience (1-4 Credits)**
Designed to give qualified undergraduate students teaching experience through actual involvement in planning and assisting in biology courses. This experience may include supervised participation in a discussion group, assisting in a biology laboratory, assisting in field biology, or tutoring.
**Prerequisites:** previous enrollment in course to be taught or equivalent.
**Last Four Terms Offered:** Spring 2025, Fall 2024, Spring 2024, Fall 2023
Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 5940 - Applied and Food Microbiology (3 Credits)**
Crosslisted with FDSC 5940
The course will focus on the origin, transmission, consequences, and management of diverse microbiota throughout the food chain. Topics in this course generally include: 1) the microbiota of different food systems, 2) the physiology, metabolism, and pathogenesis of important groups of microbes, and 3) application of food microbiology to the industrial sector. You will receive a basic education in interdisciplinary subjects that require knowledge of microbiology, food safety, epidemiology, public health, biotechnology, and cell metabolism. Knowledge and expertise gained in this course will support your qualification for a future career in food science, biotechnology, or microbiology.
**Prerequisites:** BIOMI 2900 and BIOMI 2911.
**Learning Outcomes:**

- Identify the microbiota relevant to a given food product, process, or environment.
- Describe the causes of and mechanisms behind foodborne disease, fermentation, and spoilage.
- Determine the relevant conditions or measures needed to promote safety, fermentation, or reduce spoilage.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 6090 - Principles of Virology (3 Credits)**
Crosslisted with BIOMS 6090
Principles of Virology is a course designed to convey the basic principles of virus biology, to illustrate the key concepts of virus-host interactions and their consequences for virus replication and pathogenesis of viral disease. The course focuses on identifying unifying principles underlying virus biology and highlighting important differences between viruses. Viruses infecting plants, animals, and bacteria will be discussed. A graduate level component of this course will further focus on seminal virology research findings and the cutting-edge technologies used in modern experimental virology through primary literature reading assignments provided in addition to the lecture material.
**Prerequisites:** BIOMI 2900 or permission of instructor.
**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022
**Learning Outcomes:**

- Identify, describe, and discuss the basic concepts of virus particle structure (including enveloped and non-enveloped viruses) and the biochemical and cell biological bases for virus entry, multiplication, and egress of different families of RNA, double-stranded RNA, and DNA viruses.
- Explain the basic principles of virus transmission in different phyla and recognize the features of viral pathogenesis and the role of host defenses in combatting viral infection.
- Understand the factors that contribute to virus evolution and emergence, and be able to apply that understanding to situations involving virus outbreaks that affect global health.
- Identify and recognize selected disease-causing viruses of animals (humans included), including COVID19, cancer, and flu.
- Identify and evaluate individual steps in a virus' replication cycle that can be effectively targeted by anti-viral drugs for pharmaceutical intervention of virus diseases.
- Discuss effective strategies for a) prevention of infection through development of viral vaccines and b) treatment of diverse human diseases by gene therapy through the design and administration of genetically engineered virus vectors.
- Be able to read about any virus and understand its replication and pathogenic strategies based on common principles of viral replication and pathogenesis.
- Identify, describe, and choose appropriate experimental approaches to address questions about virus entry, replication, and egress in cell culture.
- Identify, describe, and choose appropriate experimental approaches to address questions about viral pathogenesis and the use of animal models.

Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 6200 - Core Concepts in Molecular Bacteriology (3 Credits)**
The goal of this course is to prepare students for advanced work in molecular bacteriology, with a special emphasis on experimental design. First year graduate students as well as senior undergraduates with an interest in understanding how bacterial cells work at the molecular level will gain the most from this course. We will cover bacterial growth and metabolism, cell structures, physiology, pathogenesis, and experimental approaches. A background in bacteriology or microbiology is not required, since we will begin each week with a review of fundamental concepts before digging deeper into these concepts using primary literature. Further, we will examine the foundational experiments that led to our current understanding of the bacterial world. We will then critically analyze recent primary literature in this field to advance our knowledge and will use this literature as a basis for generating new hypotheses. Students will also build a foundation in structural, genetic, and biochemical tools used in microbiology laboratories. Foundational knowledge and practical skills learned in this course will help prepare the student for advanced work in the bacteriology laboratory.
**Last Four Terms Offered:** Spring 2025, Spring 2024, Spring 2023
**Learning Outcomes:**

- Identify unifying themes common to cellular life and gain an appreciation for the ways in which bacterial species have diversified and adapted to their unique environments.
- Demonstrate a mechanistic understanding of the bacterial world.
- Develop hypotheses based on primary literature and understand the fundamentals of experimental design.
- Critically analyze literature related to topics covered in class and be able to synthesize and discuss experimental findings.
- Design and interpret genetic screens.
- Apply basic computational tools to basic research questions.
- Create figures, presentations, and proposals that effectively express ideas.

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**BIOMI 6300 - Computational Approaches for Microbial Systems (3 Credits)**
High-throughput sequencing has revolutionized and become common practice across the field of microbiology. This course will prepare students for analyzing large sequencing datasets through a meaningful biological lens. Via a combination of lectures, discussions of primary literature, and hands-on, data-driven computational labs, we will learn how to organize computational projects, work in the command line, perform cloud computing, and gather, interpret, and analyze amplicon, genomic, and shot-gun metagenomic data to advance our understanding of microbial systems. We will evaluate the distribution of microbial biodiversity and gene abundances and compare the taxonomic and genomic composition of microbial communities. This course is geared towards graduate students and upper-level undergraduate students across biology. We will focus on how to use software for biological analyses while touching on broader concepts of statistical algorithms. (Note: the specifics of statistical models will not be the focus.)
**Prerequisites:** BIOMI 2900/BIOMI 2911, BIOMG 2800.
**Enrollment Information:** Enrollment preference given to: graduate students.
**Last Four Terms Offered:** Spring 2025, Spring 2024, Spring 2023
**Learning Outcomes:**

- Develop proficiency in command line tools and cloud computing within the shell.
- Analyze the quality of sequencing data.
- Explain and compare the different sequencing technologies and their applications to microbial gene and genome analysis.
- Evaluate various meanings of diversity and interpret compositional changes in microbial communities through statistical approaches and analysis of amplicon sequencing.
- Build and describe the steps to generating (meta)genomes from microbial sequencing data that can be used for downstream genomic analyses.
- Develop, visualize, and statistically test biological hypotheses in R.

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**BIOMI 6850 - Bacterial Genetics (2-3 Credits)**
Bacteria and archaea are the driving force behind all major environmental cycles on the planet, they are critical players in a broad range of agricultural and industrial applications, as well as being responsible for many of the greatest medical challenges and opportunities facing humanity. Additionally, the underpinning of all molecular biology basically comes from work in bacteria. Systems being discovered in bacteria and archaea are continuing to drive the latest technologies in gene modification and genetic engineering across the life sciences. This course will provide a fundamental understanding of the genetics of bacteria and archaea and how this information can be used to understand the uniquely important role they play in the natural environment and current and future applications.
**Prerequisites:** BIOMG 2800.
**Last Four Terms Offered:** Fall 2024
**Learning Outcomes:**

- Gain an understanding of how bacteria and archaea maintain and pass on genetic information and the unique nature of their genomes.
- Learn how bacteria and archaea evolve through mutations and the exchange of genetic information via mobile elements (e.g. bacteriophage, plasmids, transposons) and direct DNA uptake.
- Understand how the repertoire encoded in bacterial and archaeal genomes is efficiently regulated through gene and global regulation.
- Understand the bacterial and archaeal systems used across biology for gene editing and synthetic biology (e.g. CRISPR/Cas, gene assembly).
- Understand how bacterial genetics was used to answer many of the fundamental questions in biology.

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**BIOMI 6906 - Prokaryotic Biology: Viral Diversity and Ecology (1 Credit)**
**Last Four Terms Offered:** Spring 2023, Spring 2022, Spring 2021, Spring 2020
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**BIOMI 7100 - Fundamentals of Environmental Microbiology (3 Credits)**
Graduate level introduction to environmental microbiology including an introduction to microbial cell physiology, overview of microbial habitats (soil, groundwater, freshwater and marine habitats), biogeochemical cycles, environmental pathogens, principals of microbial ecology and microbial/viral evolution. Emphasis on how microorganisms interact with environmental conditions, and how their communities are shaped by physicochemical conditions.
**Prerequisites:** undergraduate introductory biology.
**Enrollment Information:** Enrollment preference given to: first-year microbiology graduate students.
**Last Four Terms Offered:** Fall 2023
**Learning Outcomes:**

- Be able to demonstrate proficiency in how cells acquire nutrients and energy and how this influences microbial growth.
- Be able to articulate key differences between natural environmental habitats in terms of their physical and chemical conditions and how these impact microbial physiology and composition.
- Be able to demonstrate understanding of fundamental principles of environmental microbiology including community ecology, environmental virology, and primary productivity.
- Be able to demonstrate understanding of principles of microbial evolution.

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**BIOMI 7800 - Fundamental Topics in Ocean Studies (1 Credit)**
The oceans cover 70% of the planet and are at the center of earth's function as a habitable planet. They hold value for humans in context of cultural and natural resources, and are also sources and sinks of phenomena that affect global climate. The purpose of this graduate class is to introduce students to a breadth of topics related to the oceans through survey of contemporary and historic literature, preparation of funding proposals to facilitate future work, and sharing research ideas as they relate to the oceans. Students will share recent research findings from the peer-reviewed literature, learn about funding opportunities, prepare and peer-review funding proposals available to ocean sciences, and share their research ideas or current work performed in graduate study.
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**BIOMI 7960 - Current Topics in Microbiology (0.5-1 Credits)**
**Last Four Terms Offered:** Fall 2023, Fall 2022, Fall 2021, Fall 2020
Schedule of Classes (https://classes.cornell.edu/)

**BIOMI 7970 - Scientific Communication Skills (1 Credit)**
The ability to communicate effectively is essential for success as a scientist. The primary goal of this course is to provide students with an opportunity to develop self-confidence and refine their formal oral presentation skills. Students are asked to present topical seminars that are critically evaluated by the instructor. Feedback for improving the presentation and peer evaluations are emphasized.
**Enrollment Information:** Enrollment limited to: graduate students in Microbiology.
**Last Four Terms Offered:** Fall 2024, Fall 2023, Fall 2022, Fall 2021
**Learning Outcomes:**

- Read, analyze and critically evaluate the information in articles from the current microbiology literature.
- Organize and understand microbiology research reports well enough to discuss the information and to present it to a diverse audience.
- Explore the practice and theory of science communication, focusing on the major mechanisms (written and oral).
- Practice and improve these communication skills.

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**BIOMI 7980 - Graduate Research Seminar in Microbiology (1 Credit)**
**Last Four Terms Offered:** Spring 2024, Fall 2023, Spring 2023, Fall 2022
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**BIOMI 7990 - Microbiology Seminar (1 Credit)**
The microbiology seminar series hosts local, national, and international speakers for research seminars. Students in BIOMI 7990 gain insight into current topics and cutting-edge methods in microbiology, and are provided with networking opportunities with established scientists, as well as opportunities to present their own seminars.
**Last Four Terms Offered:** Spring 2025, Fall 2024, Spring 2024, Fall 2023
**Learning Outcomes:**

- Dialog with presenters on campus and around the globe about their research.
- Raise and hear questions related to methods, experimental design, and context.
- Network with potential colleagues and collaborators.

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