

# GENETICS (GENETICS)

## GENETICS 133 – GENETICS IN THE NEWS

3 credits.

The science of genetics is at the heart of many issues facing our society, and as such, genetics is often in the news. Explores the underlying genetics and methodologies to gain a deeper understanding of the science behind the headlines so that we can make more informed decisions as citizens, and you can be part of a movement to help educate those around you.

**Requisites:** None

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level – Elementary

L&S Credit – Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Describe the methodologies used in genetics to gain a deeper understanding of the science behind the headlines

Audience: Undergraduate

2. Apply foundational scientific knowledge to be informed, versed and up-to-date on current genetic topics

Audience: Undergraduate

3. Critically evaluate genetics in the news for credibility, validity, and merit

Audience: Undergraduate

4. Discuss how genetics is relevant to our everyday lives

Audience: Undergraduate

5. Discuss ethical concerns related to genetics and the applications of biotechnology

Audience: Undergraduate

6. Describe how genes influence inherited traits and how genetic variation leads to specific diseases

Audience: Undergraduate

## GENETICS 155 – FRESHMAN SEMINAR IN GENETICS

1 credit.

Introduction to the discipline of genetics, to the UW Laboratory of Genetics, to some of the research projects the faculty are pursuing, to resources available at UW-Madison, and to the career options open to an individual with a genetics undergraduate degree.

**Requisites:** None

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Discuss the broader role genetics plays in shaping societal issues and future career paths.

Audience: Undergraduate

2. Demonstrate team-work, interpersonal and problem-solving skills to address societal, ethical and scientific issues related to genetics, and communicate their findings through written, oral and multi-media reports.

Audience: Undergraduate

3. Discover academic, campus and community resources that assist in their transition to the university and increase their chance of success as an undergraduate.

Audience: Undergraduate

4. Engage in meaningful genetics-related dialogue that addresses inclusivity, diversity and identity in science.

Audience: Undergraduate

5. Understand how experiential and classroom learning can help them integrate, synthesize and apply knowledge that explores big questions and big ideas in genetics.

Audience: Undergraduate

### **GENETICS 234 – GENOMES AND SOCIETY**

3 credits.

The sequencing of genomes has transformed our understanding of the evolution of species and human history, our approaches to improve health and medicine, as well as how we tackle global environmental challenges. Explore the many ways in which the sequencing of genomes is revolutionizing our world, and dive into DNA from viral to human genomes. Understand how genomes are expressed, the impact on phenotype, as well as how it can change over time and in different conditions, are processes that are essential for life and the evolution of species.

**Requisites:** GENETICS 133

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Elementary

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Learning Outcomes:** 1. Describe ways in which the sequencing of diverse genomes including viral, bacterial, fungal, plant and animal species has impacted our understanding of the origins of life and evolution of species  
Audience: Undergraduate

2. Describe how gene expression can change, and why this is essential for life

Audience: Undergraduate

3. Discuss the applications of genomic sequencing on the development of biotechnological advances and their impacts on society

Audience: Undergraduate

4. Discuss ethical concerns related to genetics and the applications of biotechnology

Audience: Undergraduate

5. Apply foundational scientific knowledge to be informed, versed and up to date on current genetic topics

Audience: Undergraduate

6. Engage in meaningful genetics-related dialogue about the global nature of genetics and genomics at the ethical, societal, legal, and scientific levels

Audience: Undergraduate

### **GENETICS 289 – HONORS INDEPENDENT STUDY**

1-2 credits.

Research work for Honors students under direct guidance of a faculty member in an area encompassing Genetics. Students are responsible for arranging the work and credits with the supervising instructor.

**Requisites:** Consent of instructor

**Course Designation:** Honors - Honors Only Courses (H)

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2010

### **GENETICS 299 – INDEPENDENT STUDY**

1-3 credits.

Research work for students under direct guidance of a faculty member in an area encompassing Genetics. Students are responsible for arranging the work and credits with the supervising instructor.

**Requisites:** Consent of instructor

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

### **GENETICS 375 – SPECIAL TOPICS**

1-4 credits.

Specialized subject matter of current interest to undergraduate students.

**Requisites:** None

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

### **GENETICS 399 – COORDINATIVE INTERNSHIP/COOPERATIVE EDUCATION**

1-8 credits.

An internship under guidance of a faculty or instructional academic staff member in Genetics and internship site supervisor. Students are responsible for arranging the work and credits with the faculty or instructional academic staff member and the internship site supervisor.

**Requisites:** Consent of instructor

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Workplace - Workplace Experience Course

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

### **GENETICS 400 – STUDY ABROAD IN GENETICS**

1-6 credits.

Provides an area equivalency for courses taken on Madison Study Abroad Programs that do not equate to existing UW courses.

**Requisites:** None

**Repeatable for Credit:** Yes, unlimited number of completions

**GENETICS 466 – PRINCIPLES OF GENETICS**

3 credits.

Genetics in eukaryotes and prokaryotes. Includes transmission genetics, molecular genetics, evolutionary genetics, genetic engineering, and societal issues associated with genetics. Illustrative material includes bacteria, plants, insects, and vertebrates.

**Requisites:** (ZOOLOGY/BIOLOGY/BOTANY 151 or BIOCORE 381 or BOTANY/BIOLOGY 130 or ZOOLOGY/BIOLOGY 101 and 102) and (CHEM 104 or CHEM 109 or CHEM 115). Not eligible to enroll if credit earned for GENETICS 467 or 468

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Recall basic genetics terminology

Audience: Undergraduate

2. Understand central concepts in genetics

Audience: Undergraduate

3. Use concepts to solve qualitative and quantitative problems

Audience: Undergraduate

4. Interpret data from experiments

Audience: Undergraduate

5. Apply knowledge of experimental genetics to research problems

Audience: Undergraduate

**GENETICS 467 – GENERAL GENETICS I**

3 credits.

Genetics of eukaryotes and prokaryotes. Includes transmission genetics, probability and hypothesis testing, genetic mapping, molecular genetics, gene expression, and genetic engineering. Illustrative material includes viruses, bacteria, plants, fungi, insects, and humans.

**Requisites:** (ZOOLOGY/BIOLOGY 101 and 102, or ZOOLOGY/BIOLOGY/BOTANY 151, BIOCORE 381, or BOTANY/BIOLOGY 130) and (CHEM 104, 109, or 115). Not open to students with credit for GENETICS 466.

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Employ Mendel's laws of inheritance and rules of probability to predict the outcome of genetic crosses

Audience: Undergraduate

2. Demonstrate how genes are mapped along chromosomes based on an understanding of meiosis and recombination

Audience: Undergraduate

3. Describe the power and limitations of genetic explanations for trait variation

Audience: Undergraduate

4. Highlight milestones in the history of genetics

Audience: Undergraduate

5. Recall core principles that govern the structure and function of DNA, RNA, and protein

Audience: Undergraduate

6. Explain how molecules and molecular processes carry out accurate information flow from DNA to RNA to protein in bacteria and eukaryotes

Audience: Undergraduate

7. Describe mechanisms that control expression of selected genes in cells

Audience: Undergraduate

8. Solve problems by applying techniques for quantifying the expression, interaction, and cellular localization of DNA, RNAs, and proteins

Audience: Undergraduate

**GENETICS 468 – GENERAL GENETICS 2**

3 credits.

Genetic analysis, population genetics, evolution and quantitative genetics.

Includes mutant screens, pathway analysis, mosaic analysis, reverse genetics, genomics, Hardy-Weinberg linkage equilibrium, inbreeding, genetic drift, natural selection, population structure, inheritance of complex traits, domestication and human evolution.

**Requisites:** GENETICS 467

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Describe the molecular mechanisms that contribute to expression regulation in bacteria and eukaryotes.

Audience: Undergraduate

2. Apply the tools of forward genetics, reverse genetics and mosaic analysis to investigate the regulatory networks that control growth, development and responses to the environment.

Audience: Undergraduate

3. Explain the genetic and molecular basis of immunity.

Audience: Undergraduate

4. Discuss the molecular mechanisms that contribute to somatic mutations and the progression to cancer.

Audience: Undergraduate

5. Calculate genetic parameters in populations using the tools of population genetics.

Audience: Undergraduate

6. Analyze the inheritance of complex traits using quantitative genetic analyses.

Audience: Undergraduate

7. Apply the methods of evolutionary genetics to predict how genes and genomes evolve in the long-term.

Audience: Undergraduate

**GENETICS 470 – BASIC CYTOLOGY AND LABORATORY PROCEDURES**

1 credit.

A comprehensive review of cellular biology, the study of optical methods with emphasis on the light microscope and the various techniques used in preparation and staining of specimens for cytologic and histologic study.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Relate cell and tissue structures to their functions in the context of human health and disease

Audience: Undergraduate

2. Explain how the morphologic findings of injury or inflammation relate to its causes and consequences

Audience: Undergraduate

3. Illustrate how cell cycle regulation and growth factor signaling contribute to inflammation, wound healing, injury, neoplasia, and cancer therapy

Audience: Undergraduate

4. Apply principles of fixation and staining to best practices in the laboratory

Audience: Undergraduate

5. Recommend appropriate ancillary studies based on specimen type, fixation, and other pre-analytic factors

Audience: Undergraduate

**GENETICS 471 – ADVANCED LABORATORY PROCEDURES**

1 credit.

Preparation of non-gynecologic cytologic specimens using several different instrument methodologies. Application of universal precautions and safety in the handling of unknown biologic hazards. Introduction to histologic preparatory techniques and special staining methods.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Demonstrate competence in cytopreparatory techniques.

Audience: Undergraduate

2. Recognize and correct pre-analytical, analytical, and post-analytical errors.

Audience: Undergraduate

3. Recommend best practices for specimen collection, transport, and processing for the relevant ancillary studies performed on cytology specimens.

Audience: Undergraduate

**GENETICS 520 – NEUROGENETICS**

3 credits.

The genetic basis of nervous system development, structure, function, and dysfunction. Will emphasize both current research findings on the genetic basis of specific neurological disorders, as well as genetic methodologies and experimental approaches used in neurobiological research.

**Requisites:** GENETICS 466, 467, BIOCORE 587, ZOOLOGY/PSYCH 523, or PSYCH 454

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Identify and summarize key concepts that underlie the genetic basis of nervous system development and function.

Audience: Undergraduate

2. Explain specific examples of how genetic variation/mutation can alter cellular and molecular pathways to impact nervous system development and function, behavior, as well as cause neurological disorders and diseases.

Audience: Undergraduate

3. Analyze and interpret primary data, discuss how this data supports current neurogenetic hypotheses, and formulate research questions that build on this data and address remaining uncertainties.

Audience: Undergraduate

4. Summarize experimental genetic and genomic techniques employed in neurogenetic research that utilize various model organisms, as well as humans.

Audience: Undergraduate

**GENETICS/BIOLOGY 522 – COMMUNICATING EVOLUTIONARY BIOLOGY**

2-3 credits.

Exposure to diverse topics in contemporary evolutionary biology and development of critical thinking and communication skills. Most weeks guest lecturers present their own primary research on a specialized topic in evolutionary biology. Seminars include perspectives from genetics, ecology, geoscience, zoology, botany, microbiology, systematics, molecular biology, and integrative research. Some weeks feature special topics and discussions on pedagogical, legal, outreach, or other issues in evolutionary biology. Includes thinking critically about methodology, experimental design and interpretation, and how conclusions are reached in evolutionary biology by reading primary and secondary literature, attending seminars, discussing topics with speakers and other students, and preparing a written report. The 3-credit version of the course delves deeper into communication of evolutionary biology to researchers, undergraduates, K-12 students, and the general public.

**Requisites:** GENETICS 466, 468, ZOOLOGY/ANTHRO/BOTANY 410, or BIOCORE 381, or concurrent enrollment

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Demonstrate the ability to critically read and comprehend primary scientific literature from diverse areas of evolutionary biology.

Audience: Undergraduate

2. Comprehend and critically evaluate oral research presentations in the field of evolutionary biology.

Audience: Undergraduate

3. Participate effectively in discussions of scientific research in the field of evolutionary biology.

Audience: Undergraduate

4. Write a clear and concise review of a selected topic in evolutionary biology and a critique of a research seminar in that area.

Audience: Undergraduate

5. Synthesize and apply knowledge from other didactic courses and personal experiences in discussions of scientific research.

Audience: Undergraduate

### **GENETICS 525 – EPIGENETICS**

3 credits.

Introductory course in epigenetics - the layer of chemical information that sits on top of the genome - that switch genes 'on' or 'off'. Will introduce how the epigenome, in collaboration with the genome, controls versatile biological processes and cell fates. Will also cover the latest advances of how humans can control their own epigenetic destiny by lifestyle, diet, and other environmental factors.

**Requisites:** GENETICS 466 or 467

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2021

**Learning Outcomes:** 1. Recognize and summarize the difference between genetics and epigenetics.

Audience: Both Grad & Undergrad

2. Apply the basic knowledge of epigenetic mechanism and illustrate how their misregulations cause abnormal development and diseases.

Audience: Both Grad & Undergrad

3. Critically review and discuss epigenetic literature.

Audience: Both Grad & Undergrad

4. Design epigenetic experiments and interpret the results of those experiments.

Audience: Both Grad & Undergrad

5. Demonstrate the ability to clearly communicate epigenetic research in both oral and written formats

Audience: Graduate

### **GENETICS 527 – DEVELOPMENTAL GENETICS FOR CONSERVATION AND REGENERATION**

3 credits.

Human-induced factors such as changes in land use and global climate are causing rapid worldwide biodiversity loss. Can modern molecular genetics contribute to species preservation? In this course, we will first explore the challenges and potential of molecular genetic methods based on biobanking, gene editing and nuclear transfer for animal biodiversity preservation. Topics covered will include: i) maternal factors and early animal development, ii) interspecies somatic cell nuclear transfer (isSCNT) and oocyte-mediated reprogramming in animal cloning, iii) developmental, phylogenetic and ecological considerations for biobanking, iv) gene editing and synthetic biology as potential tools to recapture biodiversity. Use knowledge in animal population status, developmental genetics and phylogeny to address real-life problems involving the conservation of threatened animal populations.

**Requisites:** GENETICS 466, 467, or BIOCORE 381

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Develop a greater knowledge of global threats to animal populations

Audience: Undergraduate

2. Learn principles of animal development at the egg-to-embryo transition, the use of oocytes for reprogramming, cloning and xenograft production, and the effects of phylogenetic relatedness on these processes

Audience: Undergraduate

3. Learn developmental basis and consequences of inbreeding, breeding in captivity and domestication

Audience: Undergraduate

4. Understand basic concepts in germ cell induction and manipulation

Audience: Undergraduate

5. Learn about assessing and banking genetic diversity towards animal species preservation

Audience: Undergraduate

**GENETICS 528 – BANKING ANIMAL BIODIVERSITY:  
INTERNATIONAL FIELD STUDY IN COSTA RICA**

1 credit.

Study abroad course that provides an on-site educational experience where we use developmental genetics concepts to guide projects of biobanking and oocyte-mediated cloning, as a potential last-defense resort for the preservation of living species under risk of extinction. It will provide hands-on experience in current research and activities in biodiversity areas, including visits to biodiversity-rich ecosystems, on site seminars and demonstrations, biodiversity preservation activities, as well as exposure to local culture and social needs.

**Requisites:** GENETICS 466, 467, BIOCORE 381, or ZOOLOGY 470

**Repeatable for Credit:** No

**Learning Outcomes:** 1. Exposure to biodiversity-rich areas and their challenges due to fragmentation, climate change and invasive species.  
Audience: Undergraduate

2. Assessment of scientific methods applicable to biodiversity preservation including ecosystem preservation, restoration, and species reintroduction.  
Audience: Undergraduate

3. Team-based assessment of regional animal phylogenetic biodiversity as related to bio-banking approaches.  
Audience: Undergraduate

4. Achieve a better understanding of local cultural and socioeconomic needs on their own and in the context of balancing ecosystem preservation activities.  
Audience: Undergraduate

**GENETICS 545 – GENETICS LABORATORY**

2 credits.

Gain practical experience in classical and molecular genetic laboratory techniques using plants, animals, and fungi. Topics include complementation and linkage analysis, gene mapping, library screening, yeast and bacterial transformation, restriction analysis, PCR, sequencing, and Southern blot analysis.

**Requisites:** GENETICS 466 or 467

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Understand central concepts in genetics.  
Audience: Undergraduate

2. Use concepts to solve problems.  
Audience: Undergraduate

3. Interpret data from experiments.  
Audience: Undergraduate

4. Apply genetics knowledge to problems.  
Audience: Undergraduate

5. Communicate effectively both written and orally.  
Audience: Undergraduate

**GENETICS 548 – THE GENOMIC REVOLUTION**

3 credits.

Profound advances are now possible thanks to genomic data and analysis. Introduces the structure, function, and evolution of genomes. It also outlines the realized and prospective benefits of genomic technology for human health, agriculture, and conservation.

**Requisites:** GENETICS 466, 468, or BIOCORE 587

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Use scientific literature to learn about new developments in genomic research.

Audience: Undergraduate

2. Examine methods for generating and analyzing genomic data.

Audience: Undergraduate

3. Investigate basic and applied questions being addressed by genomic research.

Audience: Undergraduate

4. Describe the organization, function, and evolution of genomes.

Audience: Undergraduate

5. Appraise the impact of genomic science on health, agriculture, and conservation.

Audience: Undergraduate

**GENETICS/HORT 550 – MOLECULAR APPROACHES FOR POTENTIAL CROP IMPROVEMENT**

3 credits.

Introduction of basic concepts of plant molecular biology and molecular techniques in current use. Topics include: organization and regulation of plant genes, gene cloning and analysis, transformation systems for plants, and molecular techniques for crop improvement.

**Requisites:** BIOCHEM 501 and (GENETICS 466 or 467); or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Learn how to critically read scientific journal articles.

Audience: Both Grad & Undergrad

2. Gain experience evaluating and discussing scientific results as reported in journal articles.

Audience: Both Grad & Undergrad

3. Gain experience preparing and presenting a formal talk on a scientific topic.

Audience: Both Grad & Undergrad

4. Develop an understanding of how discoveries in basic science lead to practical developments that drive crop improvement.

Audience: Both Grad & Undergrad

5. Develop a deep understanding of the following molecular methods: Genome Sequencing, RNAseq, Gene Expression Chips, plant transformation, Gene Silencing, and CRISPR-based gene editing.

Audience: Both Grad & Undergrad

6. Develop a working knowledge of the following bioinformatics tools: BLAST searching, Genome Browsers, EFP Browser, Genevestigator, SnapGene, and gRNA design tools.

Audience: Both Grad & Undergrad

7. Develop skills in writing a scientific research proposal.

Audience: Graduate



**GENETICS 564 – GENOMICS AND PROTEOMICS**

3 credits.

The basic principles of genomics, proteomics and bioinformatics will be taught through a semester-long project of the students choosing. Creative problem solving in science skills will be learned through a variety of active-learning techniques that include: reading of primary literature, group presentations, peer review, bioinformatic lab exercises, science communication skills (writing visualization), and creating a website. Emphasis will be placed upon how to effectively communicate science (written, oral and written). Topics include: genomic sequencing, phylogeny, domain analysis, transcriptomics, CRISPR screens, chemical genomics, quantitative proteomics and protein networks. Capstone course.

**Requisites:** GENETICS 466, 468, or BIOCORE 587. Not open to graduate students

**Course Designation:** Gen Ed - Communication Part B

Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Gain confidence in modern genomic and proteomic experimental methods used to ask fundamental biological questions and how to become creative problem solvers.

Audience: Undergraduate

2. Learn how to mine bioinformatic databases to obtain information about a gene/protein associated with a human disease assembled on a website built by the student.

Audience: Undergraduate

3. Learn how to apply what you learned, by writing and visualizing three specific aims of a grant with goals to address the gap in knowledge about the disease and gene of your choosing.

Audience: Undergraduate

4. Effectively communicate scientific research by applying unique visual, verbal, and oral techniques facilitated by the instructor called "Slide Evolution".

Audience: Undergraduate

5. To learn how working in diverse teams (social and intellectual) makes you a more innovative problem solver.

Audience: Undergraduate

**GENETICS/MD GENET 565 – HUMAN GENETICS**

3 credits.

Principles, problems, and methods of modern human genetics. Focuses on how researchers discover the genetics of diseases and how those discoveries are used to improve clinical practice. Surveys aspects of (i) the molecular function of the human genome, (ii) the basic principles of human genetics including statistical genetics, quantitative genetics, and genomic variation in human populations, (iii) the genetics of rare disorders and common diseases, and genomic analysis approaches, including genome-wide association studies and sequencing, and (iv) how genetics are used in medicine and discussions covering ethical considerations of human genomic data.

**Requisites:** GENETICS 466, 468, BIOCORE 587, or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Predict and describe how different classes of genetic variants, as defined by (a) mutation mechanism, (b) variant size, (c) population frequency, and (d) location in the genome, could affect molecular and cellular functions and risk for disease

Audience: Both Grad & Undergrad

2. Design experimental approaches to investigate the mechanisms of human genetic disorders

Audience: Both Grad & Undergrad

3. Explain and give examples of genetic inheritance patterns and the contribution of inherited factors to disease risk

Audience: Both Grad & Undergrad

4. Describe the design, strengths, and weaknesses of the various approaches for identifying genes or loci associated with a human disease or trait (e.g. linkage mapping, genetic association, sequencing), and interpret results from these studies

Audience: Both Grad & Undergrad

5. Explain how genetic information is used in the practice of medicine for diagnosis or to guide treatment and the limitations of current clinical diagnostic or treatment tools

Audience: Both Grad & Undergrad

6. Apply human genetics concepts to critically analyze published scientific studies and to describe experimental approaches that can be performed to address shortcomings and/or extend the findings of published work

Audience: Graduate

### **GENETICS 566 – ADVANCED GENETICS**

3 credits.

Principles of classical and modern genetic analysis taught through readings in the scientific literature and group projects. Capstone course.

**Requisites:** Declared in Genetics undergraduate program and GENETICS 466, 468, or BIOCORE 587

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level – Intermediate

L&S Credit – Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Critically evaluate primary literature in the field of genetics and genomics.

Audience: Undergraduate

2. Explore and utilize information resources available to aid in the advancement of future professional careers.

Audience: Undergraduate

3. Formulate research questions about the genetic control of biological processes and design experiments to answer these questions using appropriate genetic and genomic tools.

Audience: Undergraduate

4. Demonstrate teamwork, interpersonal and problem-solving skills to address societal, ethical, professional, and scientific issues related to genetics and genomics.

Audience: Undergraduate

5. Communicate scientific findings effectively to multiple audiences.

Audience: Undergraduate

### **GENETICS 567 – COMPANION RESEARCH SEMINAR**

1 credit.

Student-led discussions on scientific, societal, and professional topics relevant to Senior research and selected original research presentations.

**Requisites:** Consent of instructor

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Interpret primary literature data in genetics and related fields

Audience: Undergraduate

2. Communicate accompanying senior laboratory research

Audience: Undergraduate

3. Develop skills in science communication at multiple levels of detail

Audience: Undergraduate

4. Critically discuss interrelated aspects of science and society

Audience: Undergraduate

5. Explore careers related to genetics and genomics

Audience: Undergraduate

### **GENETICS 568 – THE CENTRAL NERVOUS SYSTEM**

1 credit.

Anatomy, physiology, histology and pathology of the central nervous system and the corresponding cellular manifestations which provide diagnostic information. Cell changes related to specimen preparation. Correlation of the didactic information with the microscopic cellular patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving the central nervous system.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of the central nervous system into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of central nervous system specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 569 – THE BREAST**

1 credit.

Anatomy, histology, physiology and pathology of the breast and the corresponding cellular manifestations which provide diagnostic information. Cell changes related to specimen processing. Correlation of the didactic information with the microscopic cell patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving the breast.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of the breast into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of breast specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 570 – THE FEMALE REPRODUCTIVE SYSTEM**

8 credits.

Anatomy, histology, physiology, and pathology of the female reproductive tract and the corresponding cellular manifestations which provide diagnostic information. Cellular changes due to therapy and specimen collection. Correlation of the didactic information with the microscopic cellular patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Demonstrate a basic knowledge of the anatomy, histology and endocrinology of the female reproductive tract as well as the anus and rectum in both men and women.

Audience: Undergraduate

2. Recognize cellular degenerative, reactive and reparative changes and identify all clinically relevant organisms associated with the female reproductive tract as well as the anus and rectum in both men and women.

Audience: Undergraduate

3. Apply criteria and use the Bethesda reporting system to make the appropriate interpretation of cellular changes seen microscopically.

Audience: Undergraduate

4. Correlate each patient's history and clinical findings with the microscopic findings on their uterine cervical/vaginal specimens and know the proper follow-up recommendation for their diagnosis.

Audience: Undergraduate

5. Recommend appropriate ancillary studies and integrate the results with the cytologic diagnosis.

Audience: Undergraduate

**GENETICS 571 – CLINICAL PRACTICE I**

1 credit.

Clinical practicum to develop diagnostic expertise involving the microscopic examination of routine gynecologic specimens (Pap smears). Observe the signout of abnormal cytologic specimens by cytopathologist staff.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Demonstrate professional and ethical responsibility as part of a patient-centered healthcare team.

Audience: Undergraduate

2. Demonstrate a basic knowledge of the CLIA 88 regulation on GYN cytology.

Audience: Undergraduate

3. Demonstrate a basic troubleshooting skill encountered during clinical practice.

Audience: Undergraduate

4. Apply criteria and use the Bethesda reporting system to make the appropriate interpretation of cellular changes seen microscopically.

Audience: Undergraduate

5. Correlate each patient's history and clinical findings with the microscopic findings on their uterine cervical/vaginal specimens and know the proper follow-up recommendation for their diagnosis.

Audience: Undergraduate

6. Value the impact of cytologic diagnosis of cervical/vaginal and anorectal specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 572 – THE RESPIRATORY SYSTEM**

3 credits.

Anatomy, histology, physiology and pathology of the respiratory tract and the corresponding cellular manifestations which provide diagnostic information. Cell changes related to specimen processing. Correlation of the didactic information with the microscopic cellular patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving the respiratory system.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of the respiratory system into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of respiratory tract specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 573 – THE GENITOURINARY SYSTEM**

2 credits.

Anatomy, physiology, histology and pathology of the urinary tract and male reproductive systems and the corresponding cellular manifestations which provide diagnostic information. Cell changes related to specimen processing. Correlation of didactic information with microscopic cell patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving the genitourinary system.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of the genitourinary system into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of genitourinary system specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 574 – THE GASTROINTESTINAL SYSTEM**

3 credits.

Anatomy, histology, physiology and pathology of the gastrointestinal system and the corresponding cellular manifestations which provide diagnostic information. Cell changes related to specimen processing. Correlation of the didactic information with the microscopic cellular patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology**Repeatable for Credit:** No**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, radiologic, and endoscopic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving the gastrointestinal tract.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of the gastrointestinal tract into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of gastrointestinal specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 575 – MISCELLANEOUS SYSTEMS**

3 credits.

Anatomy, histology, physiology and pathology of skin, thyroid, lymph nodes and other sites and the corresponding cellular manifestations which provide diagnostic information. Emphasis on specimen collection by fine needle aspiration. Correlation of the didactic information with the microscopic cellular patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology**Repeatable for Credit:** No**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving skin, thyroid, lymph nodes, and other sites.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of skin, thyroid, lymph nodes, and other sites into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of specimens from skin, thyroid, lymph nodes, and other sites from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 576 – EFFUSIONS**

2 credits.

Anatomy, physiology, histology and pathology of the body cavities. Cytologic manifestations which provide diagnostic information. Cell changes related to specimen processing. Correlation of the didactic information with the microscopic cellular patterns to provide a diagnosis.

**Requisites:** Declared in Cytotechnology**Repeatable for Credit:** No**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving effusions.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of effusions into existing knowledge of other organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis of effusion specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 577 – APPLIED CYTOLOGY I**

1 credit.

Written and practical application of the comprehensive body of knowledge to all aspects of preparation, evaluation, correlation and diagnosis of cytologic specimens.

**Requisites:** Declared in Cytotechnology**Repeatable for Credit:** No**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving all organ systems.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of all organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis from a patient and public health perspective.

Audience: Undergraduate

### GENETICS 578 – APPLIED CYTOLOGY II

1 credit.

Written and practical application of the advanced comprehensive body of knowledge to all aspects of preparation, evaluation, correlation and diagnosis of cytologic specimens. Practice in nationally offered cytologic examinations.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Summer 2024

**Learning Outcomes:** 1. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

2. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of diseases involving all organ systems.

Audience: Undergraduate

3. Integrate cytomorphologic and clinical knowledge of all organ systems.

Audience: Undergraduate

4. Value the impact of cytologic diagnosis from a patient and public health perspective.

Audience: Undergraduate

### GENETICS 588 – IMMUNOGENETICS

3 credits.

Explores the interaction between genetics and the immune system. Examines the genetic mechanisms that drive the immunological and clinical differences observed between individuals when confronted with the same environment of immunological insults, such as COVID-19, influenza, allergies and cancer. Stresses clinical and research perspectives and their societal implications.

**Requisites:** GENETICS 466, 467 or BIOCORE 383

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Describe the genetic mechanisms underlying interindividual immune response differences to the same immunological challenge

Audience: Undergraduate

2. Critically evaluate major research advances in the primary literature and place them within the historical context of other major immunogenetic discoveries

Audience: Undergraduate

3. Predict the downstream effects of manipulating variables that are involved in molecular pathways or currently being used in immunogenetic based research and clinical practices

Audience: Undergraduate

4. Effectively communicate difficult immunogenetics topics regarding interindividual immune response differences

Audience: Undergraduate

**GENETICS 605 – CLINICAL CASES IN MEDICAL GENETICS**

3 credits.

The use of genetics in medicine has experienced significant growth over the past 50 years, identifying risk genes, and devising diagnostic tests and therapies based on this knowledge for specific clinical disorders such as cystic fibrosis, achondroplasia, and Retts syndrome. MDs and biomedical scientists from UW Hospital and Clinics, the School of Medicine and Public Health, and other UW units will present lectures in this field followed by question-answers sessions. Other class sessions will be devoted to student presentations and open discussion of research literature.

**Requisites:** GENETICS 466, 467 or BIOCORE 383

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Design experiments to discover the genes and defects within genes that cause diseases in humans

Audience: Undergraduate

2. Understand how model organisms are used to investigate the molecular mechanisms for genetic disorders

Audience: Undergraduate

3. Design and interpret diagnostic DNA-based tests for the detection of allelic variants that cause disease

Audience: Undergraduate

4. Know the diverse physiological-developmental mechanisms that underlie a broad spectrum of diseases

Audience: Undergraduate

5. Devise strategies to develop therapies to treat or cure disease and understand the limits therapeutic interventions

Audience: Undergraduate

6. Develop a report on (1) the design of a diagnostic test for a genetic disorder, (2) the molecular biological pathways affected by the genetic disorder, and (3) application of the understanding of the disorder to develop a therapy or management regime

Audience: Graduate

**GENETICS/BIOCHEM/MICROBIO 612 – PROKARYOTIC MOLECULAR BIOLOGY**

3 credits.

Molecular basis of bacterial physiology and genetics with emphasis on molecular mechanisms; topics include nucleic acid-protein interactions, transcription, translation, replication, recombination, regulation of gene expression.

**Requisites:** (BIOCHEM 501 or 507) and (MICROBIO 470, GENETICS 466 or 468) or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Access and evaluate original research literature.

Audience: Undergraduate

2. Demonstrate problem solving practices.

Audience: Undergraduate

3. Identify enzyme mechanisms responsible for transcription, translation, gene regulation, and replication in bacteria.

Audience: Graduate

4. Compare the structural bases for the mechanisms.

Audience: Graduate

5. Evaluate the experiments that led to our understanding of these mechanisms.

Audience: Graduate

6. Deconstruct how these enzymes respond to nutritional and environmental signals in cells.

Audience: Graduate

7. Outline the evolutionary basis and selection pressure for these mechanisms in vivo.

Audience: Graduate

**GENETICS/AGRONOMY/AN SCI/HORT 615 – GENETIC MAPPING**

3 credits.

Computing-intensive course to prepare students for genetic mapping research; linkage analysis and QTL mapping in designed crosses; linkage disequilibrium and association analysis (GWAS). Recommended preparation is undergraduate courses in genetics and statistics and prior experience writing R scripts (such as module 1 of STAT 327).

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Write scripts to curate marker data and analyze population structure

Audience: Graduate

2. Explain the distinction between linkage and association mapping

Audience: Graduate

3. Describe how population and model parameters affect statistical power

Audience: Graduate

4. Construct genetic linkage maps and discover QTL in biparental populations

Audience: Graduate

5. Perform a genome-wide association analysis and interpret the results

Audience: Graduate

**GENETICS/BIOCHEM/MD GENET 620 – EUKARYOTIC MOLECULAR BIOLOGY**

3 credits.

Focuses on the basic molecular mechanisms that regulate DNA, RNA, and protein metabolism in eukaryotic organisms.

**Requisites:** BIOCHEM 501, 508 or graduate/professional standing

**Course Designation:** Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Recall core principles that govern the structure and function of DNA, RNA, and protein.

Audience: Both Grad & Undergrad

2. Describe techniques for quantifying the expression, interaction, and cellular localization of specific molecules and for determining their necessity and sufficiency in molecular processes.

Audience: Both Grad & Undergrad

3. Explain how molecular processes that control the synthesis, decay, interactions, localization, folding, and modification of molecules are silenced, initiated, maintained, and terminated.

Audience: Both Grad & Undergrad

4. Describe how information is transferred between molecules to alter cellular activity in response to developmental and environmental signals.

Audience: Both Grad & Undergrad

5. Critique and weigh the credibility of existing molecular data.

Audience: Both Grad & Undergrad

6. Develop and draw hypotheses that use existing data to account for as yet unexplained molecular processes in eukaryotic organisms.

Audience: Both Grad & Undergrad

7. Design discovery/observation, loss-of-function, and gain-of-function experiments to test molecular hypotheses.

Audience: Both Grad & Undergrad

8. Implement problem solving strategies in thesis research project.

Audience: Graduate



**GENETICS/ENTOM/ZOOLOGY 624 – MOLECULAR ECOLOGY**

3 credits.

Basic principles of molecular ecology. Lecture topics include population genetics, molecular phylogenetics, rates and patterns of evolution, genome evolution, and molecular ecology.

**Requisites:** GENETICS 466, 467, BIOCORE 383, or graduate student standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Identify and describe common molecular genetic techniques.

Audience: Both Grad & Undergrad

2. Demonstrate knowledge about the significance of genetic diversity in species biology.

Audience: Both Grad & Undergrad

3. Differentiate how ecological and evolutionary processes shape genetic variation.

Audience: Both Grad & Undergrad

4. Analyze genetic data and communicate the results.

Audience: Both Grad & Undergrad

5. Evaluate whether genetic data are appropriate for answering scientific questions.

Audience: Both Grad & Undergrad

6. Summarize and critique the primary literature in the field of Molecular Ecology.

Audience: Graduate

**GENETICS/CHEM 626 – GENOMIC SCIENCE**

2 credits.

Brings cutting-edge topics in the genomic sciences into the reach of those in chemistry, biology, engineering, computer science statistics fields. Enables biologically-oriented students to deal with advances in analytical science so that they may incorporate new genomic science concepts into their own scientific repertoires.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**GENETICS 627 – ANIMAL DEVELOPMENTAL GENETICS**

3 credits.

Advanced genetics course focusing on genetic mechanisms of animal embryonic development, with particular emphasis on central molecular circuitries that control development and genetic analytical tools used to reveal them. Address topics including maternal and epigenetic inheritance, the egg-to-embryo transition, pattern formation, organogenesis, coordination of cellular and molecular mechanisms, and animal models of human congenital disorders.

**Requisites:** GENETICS 466, 468, or BIOCORE 587

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Integrate concepts in genetics in the identification and function of genes involved in development and cell differentiation.

Audience: Undergraduate

2. Understand developmental cascades and morphogenetic processes involved in patterning and diversification of the animal tissue plan.

Audience: Undergraduate

3. Apply developmental genetic principles towards the understanding of syndromes in animals, including humans.

Audience: Undergraduate

4. Learn principles underlying the divergence of body types during evolution.

Audience: Undergraduate

**GENETICS/BIOCHEM 631 – PLANT GENETICS AND DEVELOPMENT**

3 credits.

Covers the basic concepts of genetics and genomics as applied to plants and their development, including discussions on breeding systems (modes of reproduction, sex determination, self incompatibility and crossing barriers), linkage analysis, genome structure and function (structure, function and evolution of nuclear and organellar chromosomes; haploidy and polyploidy; expression regulation and epigenetics), along with a description of current methodologies used in the analysis of these processes within the context of plant development. The objective is to instigate a broader knowledge and understanding of the principles and methodologies used in plant genetics and their applications in investigations of the molecular mechanisms that modulate plant development.

**Requisites:** GENETICS 466, 468, BIOCORE 587, or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Describe the plant life cycles and key concepts in plant development

Audience: Both Grad & Undergrad

2. Explore and compare experimental approaches to study breeding systems, recombination, and modes of trait segregation in plants, including quantitative traits

Audience: Both Grad & Undergrad

3. Explain genetic, epigenetic and genomic approaches to study plant growth, development and responses to the environment

Audience: Both Grad & Undergrad

4. Analyze and interpret data in plant genetics and development

Audience: Both Grad & Undergrad

5. Critically evaluate papers from the primary literature

Audience: Both Grad & Undergrad

6. Compare and contrast published experimental data that address specific biological questions in plants, use the corresponding information to develop novel hypotheses, and design experiments that test these hypotheses.

Audience: Graduate

**GENETICS 633 – POPULATION GENETICS**

3 credits.

Population genetics, aimed at preparing students to initiate research in this field. Explore how genetic variation is influenced by mutation and recombination, population size changes and migration, and natural selection for or against new mutations.

**Requisites:** GENETICS 466, 468, BIOCORE 381, or graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Understand methods of measuring and summarizing DNA variation.

Audience: Both Grad & Undergrad

2. Examine fundamental population genetic models and their predictions.

Audience: Both Grad & Undergrad

3. Develop intuition for the impact of evolutionary processes on genetic variation.

Audience: Both Grad & Undergrad

4. Identify and understand modern methods of population genetic data analysis.

Audience: Both Grad & Undergrad

5. Evaluate ongoing controversies and unsolved problems in population genetics.

Audience: Both Grad & Undergrad

6. Assess the relevance and utility of course content to own research.

Audience: Graduate

**GENETICS/MD GENET/POP HLTH 636 – PUBLIC HEALTH GENOMICS**

1 credit.

Provides an introduction to public health genomics through a review of fundamental principles of genetics, the use of genetic information in clinical and research settings, and its implications for disease management and prevention, and health promotion. Explores policies that guide public health and discusses current ethical, legal, and social implications of these policies.

**Requisites:** (Junior standing and ZOOLOGY/BIOLOGY/BOTANY 151) or graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Discuss the impact of genetics on clinical care and public health practice

Audience: Both Grad & Undergrad

2. Critically discuss genetic/genomic policies and the relevant ethical, legal, and social implications (ELSI) of these policies

Audience: Both Grad & Undergrad

3. Read, summarize, critique, and relate current news articles to key concepts in public health genomics

Audience: Graduate

**GENETICS/BOTANY/M M & I/PL PATH 655 – BIOLOGY AND GENETICS OF FUNGI**

3 credits.

Fungal genetics, genomics, and physiology using plant pathogenic fungi and the genetic models *Aspergillus nidulans* and *Neurospora crassa* as model systems to explore the current knowledge of fungal genetics and plant/fungal interactions.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Demonstrate a basic understanding of fungal biology and genetics

Audience: Graduate

2. Analyze current research topics in fungal genetics/biology

Audience: Graduate

3. Identify members of the fungal research community

Audience: Graduate

4. Write and critique research grants

Audience: Graduate

5. Critique and discuss peer reviewed manuscripts

Audience: Graduate

6. Develop and deliver oral presentations (research paper and own research)

Audience: Graduate

7. Improve communication skills (oral and written)

Audience: Graduate

### **GENETICS/MD GENET 662 – CANCER GENETICS**

3 credits.

Focuses on the genetic basis by which cancer manifests. Provides a comprehensive overview of how cancer is generated as a result of abnormalities at the DNA level, paying special attention to oncogenes, tumor suppressors, DNA mutations, DNA repair mechanisms, chromosomal instability, and tumor heterogeneity. Stresses the role of the immune system in combating cancer, the phenomenon of cancer resistance, anti-tumor strategies, and epigenetic influences on tumorigenesis. Highlights connections between course material and clinical relevance.

**Requisites:** GENETICS 466, 467 or BIOCORE 383

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Describe major research advances in cancer genetics

Audience: Undergraduate

2. Discuss the promises and challenges that await the field of cancer genetics.

Audience: Undergraduate

3. Apply your understanding of cancer genetics to generate research questions and improve hypothetical patient care

Audience: Undergraduate

4. Critically evaluate primary literature regarding cancer genetics

Audience: Undergraduate

5. Organize and deliver a scientific presentation to your peers

Audience: Undergraduate

### **GENETICS 670 – SEMINAR IN CLINICAL CYTOGENETICS**

1 credit.

Overview of the basic features of chromosome structure and behavior including karyotyping clinical correlates of numerical and structural chromosome aberrations, sex chromosome abnormalities, breakage syndromes and the chromosomal changes associated with the development of cancer.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Recommend cytogenetic and molecular studies on cytology specimens when appropriate.

Audience: Undergraduate

2. Demonstrate appropriate specimen triage and preparation for cytogenetic specimens.

Audience: Undergraduate

3. Recognize the role of chromosomal and other genetic abnormalities in human disease.

Audience: Undergraduate

4. Interpret cytogenetic nomenclature appropriately.

Audience: Undergraduate

**GENETICS 671 – ADVANCED CLINICAL PRACTICE**

8 credits.

Clinical practicum to develop diagnostic expertise of cytologic specimens. Examine challenging cases with emphasis on diagnostic pitfalls. Observe patient clinics related to cytologic specimen collection. Participate at clinical experiences in fine needle aspiration, histology, and a private cytology laboratory.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Summer 2024

**Learning Outcomes:** 1. Demonstrate professional and ethical responsibility as part of a patient-centered healthcare team.

Audience: Undergraduate

2. Demonstrate basic troubleshooting of common problems encountered during clinical practice.

Audience: Undergraduate

3. Integrate each patient's history, clinical, and radiologic findings with microscopic findings to make an accurate diagnosis using standard diagnostic criteria.

Audience: Undergraduate

4. Recommend and interpret ancillary tests appropriately in the context of the molecular basis of disease.

Audience: Undergraduate

5. Integrate cytomorphologic and clinical knowledge of all organ systems.

Audience: Undergraduate

6. Value the impact of cytologic diagnosis of cytology specimens from a patient and public health perspective.

Audience: Undergraduate

**GENETICS 672 – SEMINAR IN LABORATORY OPERATIONS AND QUALITY CONTROL**

1 credit.

Review the fundamentals of basic administrative functions and regulatory requirements including planning, organizing, supervising and controlling business management, record keeping, data processing and laboratory safety. Quality assurance procedures necessary for obtaining, processing, diagnosing and reporting cytologic specimens.

**Requisites:** Declared in Cytotechnology

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Recognize regulations and accreditations requirements for the cytology laboratory.

Audience: Undergraduate

2. Relate laboratory administrative and workflow functions to the quality of patient care.

Audience: Undergraduate

3. Demonstrate appropriate laboratory safety procedures.

Audience: Undergraduate

4. Compare supervisory and business management practices in different laboratory settings.

Audience: Undergraduate

5. Identify best practices in quality assurance and quality control.

Audience: Undergraduate

**GENETICS 673 – SEMINAR IN CLINICAL CYTOLOGY**

1 credit.

Preparation of a case study or clinical topic of choice by each student to present to a peer professional group of cytology staff and medical faculty. Preparation of a referenced scientific term paper or participation in an approved research or class project pertaining to clinical cytology.

**Requisites:** Declared in Cytotechnology**Repeatable for Credit:** No**Last Taught:** Spring 2024**Learning Outcomes:** 1. Demonstrate significant expertise in a focused area of cytology with clinical and/or public health implications.

Audience: Undergraduate

2. Communicate cytology-relevant knowledge in this focused area with others.

Audience: Undergraduate

3. Identify authoritative sources of cytology information.

Audience: Undergraduate

4. Integrate information from a variety of authoritative sources to support a thesis.

Audience: Undergraduate

5. Produce scientific publication-quality written work.

Audience: Undergraduate

**GENETICS/MD GENET 677 – ADVANCED TOPICS IN GENETICS**

1-3 credits.

Contents vary; consideration of subjects not included in the curriculum.

**Requisites:** Graduate/professional standing, GENETICS 466, 468, or BIOCORE 383**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&amp;S Credit - Counts as Liberal Arts and Science credit in L&amp;S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2025**Learning Outcomes:** 1. Apply, analyze, or evaluate advanced theories, concepts, or methods in genetics and genomics.

Audience: Both Grad &amp; Undergrad

2. Apply knowledge of experimental genetics and genomics to related research projects.

Audience: Graduate

**GENETICS 681 – SENIOR HONORS THESIS**

2-4 credits.

Individual study for majors completing theses for Honors degrees as arranged with a faculty member.

**Requisites:** Consent of instructor**Course Designation:** Honors - Honors Only Courses (H)**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Fall 2024**GENETICS 682 – SENIOR HONORS THESIS**

2-4 credits.

Individual study for majors completing theses for Honors degrees as arranged with a faculty member.

**Requisites:** Consent of instructor**Course Designation:** Honors - Honors Only Courses (H)**Repeatable for Credit:** No**Last Taught:** Spring 2025**GENETICS 695 – ADVANCING TO BIOLOGICAL SCIENCES PHD STUDY**

1 credit.

Explore the biological science PhD student experience, from the initial stages of consideration through applications and interviews, to graduate student life and career opportunities. Reflect on personal goals and the nature of graduate study to confirm that a research-focused PhD is right for you. Consider whether to apply this year or later on, in light of admissions expectations and personal readiness. Identify research areas, PhD programs, and prospective advisors of interest. Improve application materials, strengthen interview skills, and consider individual priorities for selecting a program.

**Requisites:** Senior standing**Repeatable for Credit:** No**Last Taught:** Fall 2024**Learning Outcomes:** 1. Appraise the individual appropriateness and optimal timing of PhD study in light of personal goals and preparedness

Audience: Undergraduate

2. Identify research areas, graduate prospects, and prospective mentors of interest

Audience: Undergraduate

3. Recognize the admissions processes and priorities typically followed by graduate programs

Audience: Undergraduate

4. Develop, evaluate, and refine PhD application materials

Audience: Undergraduate

5. Communicate research interests, motivation, personal strengths, and career goals with faculty and peers

Audience: Undergraduate

**GENETICS 699 – SPECIAL PROBLEMS**

1-3 credits.

Individual advanced work in an area of Genetics under the direct guidance of a faculty member.

**Requisites:** Consent of instructor**Course Designation:** Level - Advanced

L&amp;S Credit - Counts as Liberal Arts and Science credit in L&amp;S

**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2025

**GENETICS 701 – ADVANCED GENETICS**

3 credits.

First semester of professional level training in genetic mechanisms and analysis as applied to genetic transmission, gene expression, forward and reverse genetics, molecular genetics, genomics, developmental genetics, and epigenetics.

**Requisites:** Declared in Genetics doctoral program

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**GENETICS 702 – ADVANCED GENETICS II**

3 credits.

Second of semester of professional level training in genetic mechanisms and analysis as applied to genetic transmission, gene expression, forward and reverse genetics, molecular genetics, genomics, developmental genetics, and epigenetics.

**Requisites:** GENETICS 701

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**GENETICS/MD GENET 707 – GENETICS OF DEVELOPMENT**

3 credits.

A research-level analysis of the current status of the investigation of processes controlling differential gene activity and cellular behavior. The major emphasis is genetic. In successive years, the focus moves from the gene to the cell to the organism.

**Requisites:** Declared in Genetics graduate program

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2023

**Learning Outcomes:** 1. Critically evaluate papers, form meaningful questions based on the material, and engage scientists in conversations about their work.

Audience: Graduate

2. Improve oral presentations and scientific writing (grants, review articles).

Audience: Graduate

3. Expand scientific literacy.

Audience: Graduate

**GENETICS/MD GENET 708 – METHODS AND LOGIC IN GENETIC ANALYSIS**

3 credits.

Contemporary issues in genetic, developmental, cell, and molecular biology are addressed in a discussion format. Invited speakers give research lectures and reading material is taken from the primary literature. The discussion focuses on evaluating genetic approaches to biological problems.

**Requisites:** Declared in Genetics graduate program

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Critically evaluate papers, form meaningful questions based on the material, and engage scientists in conversations about their work.

Audience: Graduate

2. Improve oral presentations and scientific writing (grants, review articles).

Audience: Graduate

3. Expand scientific literacy.

Audience: Graduate

**GENETICS/CRB 710 – DEVELOPMENTAL GENETICS**

3 credits.

Covers a broad range of topics in animal development, with an emphasis on molecular mechanisms. Focuses on common themes, with the goal of understanding and analyzing current research in developmental biology and genetics.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Ability to critically evaluate published scientific work (journal reviews).

Audience: Graduate

2. Ability to communicate critical evaluations professionally and articulately (lecturer and TA feedback at each session).

Audience: Graduate

3. Develop deep knowledge of developmental biology, use of genetic model organisms, stem cell biology and regenerative medicine (didactic portion of course).

Audience: Graduate

4. Improved presentation skills (each student has a scheduled presentation four times during the semester in addition to ad hoc participation).

Audience: Graduate

5. Skills in providing feedback to peers (through student evaluations peer presentations each class period).

Audience: Graduate

**GENETICS 808 – FROM GENES TO GRANTS: WRITING WINNING RESEARCH PROPOSALS IN GENETICS**

2 credits.

Introduction to professional scientific writing in the field of genetics. Develop skills and expertise in scientific writing with a special emphasis on preparing grant and fellowship research proposals in genetics and genomics.

**Requisites:** GENETICS 701 and 702

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Learning Outcomes:** 1. Complete a two-page research proposal in the "3 Aims" format and a three-page personal/professional statement on a forward-thinking project in genetics.

Audience: Graduate

2. Differentiate among common genetics research proposal structures, including the "3 Aims" approach, the NIH F31 style used by the Genetics training program for its preliminary examinations, other standard styles for federal grants and fellowships relevant to genetics (e.g., NIH, NSF, USDA, DOE), and familiarity with alternative or highly specialized proposal styles (e.g., HHMI Gilliam Fellowships).

Audience: Graduate

3. Identify key principles in scientific writing, such as supporting claims with evidence, including appropriate literature citations, balancing clarity with complexity, and when to establish boundaries between evidence ("results") and argument ("discussion").

Audience: Graduate

4. Demonstrate professional skills in peer review, editing, and mentorship, including how to provide critical feedback effectively and without negativity, and how to maintain social and cultural sensitivity during peer review.

Audience: Graduate

5. Recognize how to effectively use both written and visual communication in genetics.

Audience: Graduate

**GENETICS/BOTANY/ENTOM/ZOOLOGY 820 – FOUNDATIONS OF EVOLUTION**

2 credits.

Explore some of the most important themes and debates that have permeated evolutionary biology over the last 50 years. Read key papers related to each controversial topic, debate the pros and cons of competing viewpoints, and reflect on the relevance of the issue to contemporary evolutionary biology.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024



**GENETICS/BIOCHEM/BOTANY 840 – REGULATORY MECHANISMS IN PLANT DEVELOPMENT**

3 credits.

Molecular mechanisms whereby endogenous and environmental regulatory factors control development; emphasis on stimulus perception and primary events in the signal chain leading to modulated gene expression and cellular development.

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2020**GENETICS/AN SCI/POP HLTH 849 – GENETIC EPIDEMIOLOGY**

3 credits.

This course will provide an introduction to genetic epidemiology. Topics will include a general overview of genetics and Mendelian and complex inheritance, as well as various elements of study design, including participant ascertainment; phenotype definition; biologic sample selection; genotyping, sequencing, and quality control; measurement of covariates, and choice of analytic methods. We will briefly discuss some of the original study designs and then focus on current study designs for the remainder of the class. Additional emerging topics will be briefly touched upon. Students will complete short homework assignments to enforce concepts learned during lectures, discuss journal articles, and prepare a very short grant application for the mid-term project. In the final weeks of class, students will work together to analyze data from a real genetic study, prepare tables, interpret the findings, and present their project to their peers.

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2024**Learning Outcomes:** 1. Evaluate and discuss genetic/genomic epidemiological literature.

Audience: Graduate

2. Design simple genetic/genomic epidemiological studies.

Audience: Graduate

3. Identify and apply appropriate tests of association between genetic variants and both qualitative and quantitative outcomes using either unrelated individuals or families.

Audience: Graduate

4. Summarize and interpret the results of genetic/genomic tests of association.

Audience: Graduate

**GENETICS 875 – SPECIAL TOPICS**

1-4 credits.

Special topics of current interest to graduate students.

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2024**GENETICS 885 – ADVANCED GENOMIC AND PROTEOMIC ANALYSIS**

3 credits.

With the availability of genome sequences and high-throughput techniques, organismal physiology can now be examined on a global scale by monitoring the behavior of all genes or proteins in a single experiment. This course will present modern techniques in genomics and proteomics, with particular focus on analyzing the data generated by these techniques. Course material will cover genomic sequencing, comparative sequence analysis, phylogeny construction and phylogenomics, transcription factor motif discovery, DNA microarray analysis, techniques in mass spectrometry, proteomic screening methods, and protein-interaction network analysis. In addition to lecture time, the course includes computer lab where students get hands-on experience analyzing genomic and proteomic datasets. Students should have coursework in general statistics and intermediate or advanced genetics.

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2024**GENETICS/B M E/B M I/BIOCHEM/CBE/COMP SCI 915 – COMPUTATION AND INFORMATICS IN BIOLOGY AND MEDICINE**

1 credit.

Participants and outside speakers will discuss current research in computation and informatics in biology and medicine. This seminar is required of all CIBM program trainees.

**Requisites:** Consent of instructor**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2025**Learning Outcomes:** 1. Discuss how methods from computer science, statistics, information science and engineering are applied to problems in biology, medicine and population health

Audience: Graduate

2. Recognize and be able to define applications in translational bioinformatics, clinical informatics and public health informatics

Audience: Graduate

**GENETICS/AN SCI/DY SCI 951 – SEMINAR IN ANIMAL BREEDING**

0-1 credits.

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2020

**GENETICS/AGRONOMY/HORT 957 – SEMINAR-PLANT BREEDING**

1 credit.

Graduate seminar in Plant Breeding Plant Genetics (PBPG) that requires students to give oral scientific presentations on topics chosen by the instructors and/or the student's thesis research. This seminar is coordinated by PBPG faculty on a rotating basis.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Present current research in plant breeding and genetics clearly and effectively, including appropriate visuals and following the structure of a scientific seminar

Audience: Graduate

2. Deliver constructive feedback on peers' research and presentations, fostering a collaborative and supportive academic environment

Audience: Graduate

3. Discuss current research in plant breeding and genetics, identifying strengths, weaknesses, and areas for further research

Audience: Graduate

**GENETICS 990 – RESEARCH**

1-12 credits.

Independent laboratory research in preparation of a graduate thesis under supervision of a faculty member.

**Requisites:** Consent of instructor

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**GENETICS 993 – SEMINAR IN GENETICS**

0-1 credits.

Various aspects of genetics: Drosophila, maize, immunogenetics, developmental genetics, or other special topics.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Summer 2024