

MEDICAL GENETICS (MD GENET)

MD GENET/GENETICS 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

MD GENET/BIOCHEM/GENETICS 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

MD GENET/GENETICS/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

MD GENET/GENETICS 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

MD GENET/GENETICS 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&S Credit - Counts as Liberal Arts and Science credit in L&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 & Undergrad

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

Audience: Graduate

MD GENET 699 – INDEPENDENT READING

1-3 credits.

Directed study projects as arranged with instructor.

Requisites: Consent of instructor

Course Designation: Level - Advanced

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

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Fall 2015

Learning Outcomes: 1. Apply concepts learned in coursework to real life situations

Audience: Undergraduate

2. Develop critical, analytical, and independent thinking skills

Audience: Undergraduate

MD GENET/GENETICS 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

MD GENET/GENETICS 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

MD GENET 911 – MODERN CLINICAL GENETICS: HOW TO APPROACH A RAPIDLY CHANGING FIELD

2 credits.

Genetics and genomics are rapidly evolving fields. In modern clinical care settings, clinicians will be exposed to genetic and genomic data, including that brought by patients, and knowing how to read genetic and genomic data is increasingly necessary in clinical practice. Genetics and genomics in a clinical setting spans a wide range of topics including diagnosis and treatment of genetic diseases. Familiarity with clinical genetic analysis, and the genetic approaches used in basic science, helps medical students better understand genetic disease background. Learn how to bridge basic concepts of human genetics and clinical genetics (actual diseases). Emphases will include research into human genetic diseases, including designing genetic testing, using model organisms and/or cell culture systems, and the development of genetic testing technologies.

Requisites: MED SC-M 810, 811, 812, and 813

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

Repeatable for Credit: No

Last Taught: Spring 2023

Learning Outcomes: 1. Demonstrate understanding of basic concepts of human genetics

Audience: Graduate

2. Describe various genetic approaches and models for studying human genetic diseases

Audience: Graduate

3. Apply basic concepts of genetics to answering questions in human genetic diseases

Audience: Graduate

4. Explain fundamentals of clinical genetics, including genetic testing

Audience: Graduate

5. Model logical thinking process to organize scientific discussion and presentation

Audience: Graduate

MD GENET 999 – INDEPENDENT WORK

1-3 credits.

Directed study projects as arranged with instructor.

Requisites: Consent of instructor

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

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Fall 2010

Learning Outcomes: 1. Exhibit a broad understanding of general Genetics and Genomics principles.

Audience: Graduate

2. Conduct advanced independent research using a variety of approaches.

Audience: Graduate