# GENETICS

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**Assistant Professors** X. Bi, Y. Chen (*Immunobiology*), M. Chioccioli, S. Garg (*Laboratory Medicine*), T. Jerves Serrano, E. Koch, N. Lake, S.M. Lanno, D. Ma, D. Massilani, R. Munoz Xicola, S. Reilly, Z. Smith (*Adjunct*), T. Sorrells, B. Sozen, K. Sumigray, L. Sweeney (*Obstetrics, Gynecology, and Reproductive Sciences*), J. Wen, C. Zhao

**Instructor** A. Jha

**Senior Research Scientists** A.L. Horwich, A. Hudson

**Research Scientists** J. Choi, W. Fenton, C. Hendry, J. Knight, W. Lee, J. Lopez-Giraldez, X. Lu, T. Xin

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**GENE 6250a / MB&B 6250a / MCDB 6250a, Basic Concepts of Genetic Analysis** Jun Lu

The universal principles of genetic analysis in eukaryotes are taught in lectures. The course covers both the concepts and methodologies in genetic studies, ranging from genetics in model organisms, genomics and gene regulation, to human genetics. In discussion sessions, students read primary papers illustrating the very best of genetic analysis and dissect them in detail, as well as designing experiments to solve research questions. Overall, the course aims to build a solid foundation for students in the concepts of both traditional and modern genetics. Through this process, students learn

how to evaluate experimental results, think critically, and design experiments to address questions.

**GENE 6500a / CB&B 6500a, Quantitative Foundations for Human Genetics** Hoon Cho and Steven Reilly
This course provides an in-depth, comprehensive foundation in the genetic concepts and statistical methods required to analyze human genetic data. Quantitative frameworks including statistical modeling, inference, and machine learning approaches are taught in the context of human genetics and genomics, with applications spanning population and evolutionary genetics, complex trait modeling, genomic architecture and linkage, genome-wide association studies, and disease risk prediction. Through interactive discussions, primary literature review, and hands-on workshops, students learn to analyze and interpret quantitative, genetic data and to apply computational approaches for statistical analyses. This course is intended for graduate students who plan to use quantitative and statistical methods in their thesis research or who seek deeper knowledge in these areas. Prior experience with basic probability and Python coding is recommended; additional training will be provided to students who have limited background. Permission of the instructor is required. Interested students must contact the instructor to discuss their prior experience and expectations for the course.

**GENE 6550a / CB&B 6550a, Stem Cells: Biology and Application** In-Hyun Park
This course is designed for first-year or second-year students to learn the fundamentals of stem cell biology and to gain familiarity with current research in the field. The course is presented in a lecture and discussion format based on primary literature. Topics include stem cell concepts, methodologies for stem cell research, embryonic stem cells, adult stem cells, cloning and stem cell reprogramming, and clinical applications of stem cell research. Prerequisites: undergraduate-level cell biology, molecular biology, and genetics.

**GENE 6750a and GENE 6760b, Graduate Student Seminar: Critical Analysis and Presentation of Scientific Literature** Staff
Students gain experience in preparing and delivering seminars and in discussing presentations by other students. A variety of topics in molecular, cellular, developmental, and population genetics are covered. Required of all second-year students in Genetics. Graded Satisfactory/Unsatisfactory.

**GENE 7340b / MB&B 7340b / MBIO 7340b, Molecular Biology of Animal Viruses** Walther Mothes
Lecture course with emphasis on mechanisms of viral replication, oncogenic transformation, and virus-host cell interactions.

**GENE 7430b / MB&B 7430b / MCDB 7430b, Advanced Eukaryotic Molecular Biology** Mark Hochstrasser, Wendy Gilbert, Matthew Simon, and Franziska Bleichert
Selected topics in transcriptional control, regulation of chromatin structure, mRNA processing including spliceosomal splicing, mRNA turnover, RNA interference, translational regulation, protein modification, and protein degradation. Emphasis is placed on how these processes are regulated and the experiments that led to their discovery and understanding. Prerequisite: biochemistry or permission of the instructor.

**GENE 7600a, Genomic Methods for Genetic Analysis** Bluma Lesch and Diyendo Massilani

Introduction to the analysis and interpretation of genomic datasets. The focus is on next-generation sequencing (NGS) applications including RNA-seq, ChIP-seq, exome and whole genome, and single-cell sequencing. By the end of this time-intensive, practical problem-set based course, each student will be able to process and analyze large-scale NGS datasets and interpret the results. This course is intended only for graduate students who are interested in applying genomic approaches in their thesis research. A basic familiarity with working in a UNIX/Linux computing environment or prior experience with a programming language is not required but can be useful. Extra resources will be made available prior to the course starting for students without any programming experience. Prerequisite: permission of the instructor. Interested students must contact the instructor to discuss their prior experience and expectations for the course. Enrollment limited to approximately twenty-five students.

**GENE 7770b / MCDB 6770b, Mechanisms of Development** Salil Garg and Berna Sozen

An advanced graduate seminar on animal development focusing on conserved mechanisms that govern germline development, embryogenesis, and somatic differentiation in molecular detail. The course runs parallel to the spring session of the Department of Genetics Seminar Series and is divided into two components: six Yale faculty-led lectures on core concepts in development and six combined journal club/student-led discussions with outside developmental biology speakers on their cutting-edge research. Over the course of the semester, small student groups are responsible for presenting one journal club-formatted discussion on two papers selected from the outside speaker's lab, as well as emceeing a dedicated question and answer session between the class and the speaker. This course provides a rare opportunity for Yale students to actively engage with world leaders on their work in developmental genetics, epigenetics, and cell biology, as well as learn essential skills in experimental thinking and scientific communication. The course grade is based on 40 percent take-home problems, 40 percent class participation and 20 percent student-led journal club/distinguished speaker question-and-answer session. There are no official prerequisites. However, some familiarity with concepts and techniques of modern biology is necessary to get the most out of the course.

**GENE 9000a / CBIO 9000a / MCDB 9000a, Research Skills and Ethics I** Stefania Nicoli

This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the first and second laboratory rotations.

**GENE 9010b / CBIO 9010b / MCDB 9010b, Research Skills and Ethics II** Chenxiang Lin

This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the third laboratory rotation.

**GENE 9110a / CBIO 9110a / MCDB 9110a, First Laboratory Rotation** Andrew Xiao

First laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

**GENE 9120a / CBIO 9120a / MCDB 9120a, Second Laboratory Rotation** Josh Gendron

Second laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

**GENE 9130b / CBIO 9130b / MCDB 9130b / MCDB 913b and MCDB 9130b, Third Laboratory Rotation** Andrew Xiao

Third laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.