GENE - GENETICS

GENE 603 Genetics

Credits 3. 3 Lecture Hours. Development of fundamental concepts related to the structure, function, organization, transmission and distribution of genetic material. **Prerequisite:** GENE 301.

GENE 606 Quantitative Phylogenetics

Credits 4. 3 Lecture Hours. 4 Lab Hours. Designed to provide the theory and tools required for inference of phylogenetic (evolutionary) relationships among biological taxa using various types of comparative data including morphological characters, biochemical and molecular characters, and DNA sequences; hands-on analysis of data using contemporary tools. **Prerequisite:** ENTO 601 or approval of instructor. **Cross Listing:** ENTO 606 and ECCB 606.

GENE 608 Critical Analysis of Genetic Literature

Credits 2. 2 Lecture Hours. Introduction to Major Genetic Model Systems (MSs).

GENE 613 Quantitative Genetics I

Credits 3. 3 Lecture Hours. Quantitative genetics concepts particularly dealing with partitioning of phenotypic variance into genetic and environmental components, selection response, effects of systems of mating, genetic covariance and threshold effects. **Prerequisites:** STAT 651.

GENE 616/BICH 616 Mechanisms of Cell Division

Credit 1. 1 Lecture Hour. Mitotic cell cycle; progression of biochemical and morphological phases and events; duplication of cellular constituents and segregation into daughter cells. **Prerequisites:** Graduate classification in biochemistry, biochemistry and molecular biophysics, genetics, genetics and genomics, or approval of instructor. **Cross Listing:** BICH 616/GENE 616.

GENE 620 Cytogenetics

Credits 3. 3 Lecture Hours. Examination and analysis of variation in chromosome structure, behavior and number; developmental and evolutionary effects of this variation. **Prerequisite:** GENE 603.

GENE 629 Applied Animal Genomics

Credits 3. 3 Lecture Hours. Theory and application of genomics by livestock industries; consideration of genetic markers, gene mapping methods, genome analysis and emerging technologies such as microarrays, transgenesis, cloning and marker assisted selection; exposure to bioinformatic tools for genomics. **Prerequisite:** GENE 603 or approval of instructor. **Cross Listing:** ANSC 629 and POSC 630.

GENE 630/VIBS 630 Comparative Genomics

Credits 3. 3 Lecture Hours. Analysis of comparative genome architecture, function and evolution; modern genome assembly, annotation, alignment and comparative analysis; functional coherence of chromosomes; evolution of genomes at population and macroevolutionary levels. **Prerequisite:** GENE 603 or VTPB 613 or equivalent. **Cross Listing:** VIBS 630/GENE 630.

GENE 631/BICH 631 Biochemical Genetics

Credits 3. 3 Lecture Hours. Genetic control of cellular metabolism. Mechanism of gene action; gene-enzyme relationships; regulation of gene expression; structure and organization of genomes; biochemical manipulation and characterization of genetic molecules. **Prerequisite:** GENE 431/BICH 431 or BICH 431/GENE 431; BICH 603. **Cross Listing:** BICH 631/GENE 631.

GENE 633/ECCB 634 Conservation Genetics

Credits 3. 3 Lecture Hours. Genetic concepts and techniques relevant to management and conservation of biological diversity; research and conservation strategies within a conservation genetics framework. **Prerequisites:** Introductory courses in genetics and ecology or biological conservation. **Cross Listing:** ECCB 634/GENE 633.

GENE 638/ANSC 638 Predictions of Genetic Merit

Credits 3. 3 Lecture Hours. Mixed linear models and best linear unbiased prediction for genetic evaluation. **Prerequisite:** GENE 613. **Cross Listing:** ANSC 638/GENE 638.

GENE 639/ANSC 639 Bacterial Genomics

Credits 3. 3 Lecture Hours. Analysis of bacteria on the whole genome level including effects on microbiology, ecology, epidemiology, diagnostics and bacterial pathogenesis; exploration of the variability of bacterial genomes within and across bacterial species; discovery of how these variations affect bacterial cell function, virulence and epidemiology. **Prerequisites:** Graduate classification or approval of instructor. **Cross Listing:** ANSC 639/GENE 639.

GENE 642/ANSC 642 Advanced Quantitative Genetics

Credits 3. 3 Lecture Hours. Introduction to Bayesian methods of genetic analysis; understanding of distributions associated with genetic analyses; describe basic methodology and procedures for random sampling; set up and conduct basic linear regression analysis and mixed model prediction of genetic merit using Bayesian methodology. **Prerequisites:** GENE 613 and STAT 651, graduate classification or approval of instructor. **Cross Listing:** ANSC 642/GENE 642.

GENE 643/SCSC 643 Molecular Quantitative Genetics and Plant Breeding

Credits 3. 3 Lecture Hours. Classical, applied and molecular aspects of quantitative genetics in plant breeding; genetic relationships; genetic diversity; genetic phenomena (linkage, heterosis and epistasis); genotype by environment interaction; mapping quantitative trait loci (QTL); genomic and marker-assisted selection; application of statistical software. **Prerequisites:** STAT 651, SCSC 642 or GENE 613; or approval of instructor. **Cross Listing:** SCSC 643/GENE 643.

GENE 645 Ecological Genomics

Credits 3. 3 Lecture Hours. Ecological genomics toolkit including genetic maps, genotyping, RAD-sequencing, whole-genome assembly and resequencing, RNA-sequencing analyses; genomics of adaptation; speciation genomics; speciation genomics; conservation genomics; genomics and life history traits; phylogenomics; climate change and genomics. **Prerequisites:** GENE 301, GENE 302, GENE 310 or GENE 412, or approval of instructor. **Cross Listing:** ECCB 645 and EEBL 645.

GENE 648/ECCB 602 Molecular Evolution

Credits 3. 2 Lecture Hours. 2 Lab Hours. Theory and tools used in the analysis of molecular evolutionary patterns of DNA and protein sequences; format combines lecture presentations by instructor, discussion of relevant scientific literature, computer exercises, preparation of research proposal or independent research project, and practice in peer review process. **Prerequisites:** Basic courses in general Genetics and Evolution. **Cross Listing:** ECCB 602/GENE 648.

GENE 654 Analysis of Complex Genomes

Credits 3. 3 Lecture Hours. History and current status of genetic and molecular analysis of higher eukaryotic genomes; coverage of techniques for dissection of genomes into manageable parts; investigations in genetics, breeding and evolution; emphasis on quantitative inheritance, genetic mapping, physical mapping, map-based cloning, with examples drawn from a wide range of organisms. **Prerequisite:** GENE 603 or GENE 431/BICH 431. **Cross Listing:** SCSC 654 and MEPS 654.

GENE 655 Analysis of Complex Genomes —Lab

Credits 3. 7 Lab Hours. Analysis of Complex Genomes--Lab. Laboratory methods in molecular genetic techniques for genetic mapping, physical mapping, and map-based cloning of both qualitative and quantitative phenotypes. **Prerequisite:** GENE 603 or equivalent or approval of instructor. **Cross Listing:** SCSC 655 and MEPS 655.

GENE 656 Bioinformatics - Metagenomics Data Analysis

Credit 1. 1 Lecture Hour. Data analysis for bacterial metagenomic analysis; step-by-step instruction for analysis of metagenomics data, starting with raw sequencing data and continuing through publication quality figures. **Prerequisites:** GENE 603 or equivalent.

GENE 657 Command Line Skills

Credits 3. 3 Lecture Hours. Bioinformatics for genomic and biomedical sciences; foundation in bioinformatics computing that included command line interfaces, reformatting data, automating analyses and database access, and using scripts in biological programming languages such as Perl and Python. **Prerequisites:** GENE 603 or equivalent.

GENE 658 Differential Gene Expression

Credit 1. 1 Lecture Hour. Analysis of Illumina RNA-sequencing such as RNA-seq or shot gun sequencing; data for differential expression analysis using the newest available tools starting with raw sequencing data and continuing through publication quality figures.

GENE 659 Genome Assembly

Credit 1. 1 Lecture Hour. A practical introduction to de novo genome assembly on a high-performance computing cluster using a variety of command-line tools; includes assembly of bacterial, eukaryotic and metagenomic data sets; demonstration of statistics and tools for assessing genome assembly completeness.

GENE 673/BICH 673 Gene Expression

Credit 1. 1 Lecture Hour. Oral presentations and discussions related to the biochemistry and molecular biology of gene expression in animal, plant, and microbial systems. Course may be repeated for credit up to 12 times. **Prerequisite:** Graduate classification in biochemistry or genetics or approval of instructor. **Cross Listing:** BICH 673/GENE 673.

GENE 676 Speciation Genetics

Credits 3. 3 Lecture Hours. Introduction to the ability to speciate into biologically diverse forms via microevolutionary processes; literature on the origin of species beginning with Darwin and continuing through contemporary work; overview of several major topics in speciation with special emphasis on the genetics of speciation in this genomic era. **Prerequisites:** GENE 603 and BIOL 610 or BIOL 466, or equivalent. **Cross Listing:** VIBS 676 and EEBL 676.

GENE 677/MCMD 677 Genes and Diseases

Credits 3. 3 Lecture Hours. Molecular and genetic basis for human disease; structure, function and evolution of chromosomes; epigenetics; gene mapping; complex genetic traits; cancer genetics; neurodegenerative disorders; animal models (yeast, mouse, worms, fruit flies); ethics. **Prerequisite:** GENE 603, GENE 631/BICH 631, or MSCI 601 or approval of instructor. **Cross Listing:** MCMD 677/GENE 677.

GENE 681 Seminar

Credit 1. 1 Lecture Hour. Reports and discussions of topics of current importance in genetics; reports to be prepared and presented by graduate students enrolled in course.

GENE 682 Seminar Presentation

Credit 1. 1 Lecture Hour. Presentation of research progress and results; perform peer assessment.

GENE 685 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Individual problems or research not pertaining to thesis or dissertation. **Prerequisite:** Approval of instructor.

GENE 689 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of genetics. May be repeated for credit. **Prerequisite:** Approval of instructor.

GENE 691 Research

Credits 1 to 23. 1 to 23 Other Hours. Prerequisite: GENE 603.

GENE 697 Teaching Genetics Labs

Credit 1. 1 Lecture Hour. Theory and practical aspects of teaching genetics labs, with emphasis on content, grading, instructional methods and practical aspects of genetics labs. May be repeated for credit. **Prerequisites:** Graduate classification in genetics; appointment as a TA for genetics labs.