# GENETICS, DEVELOPMENT AND CELL BIOLOGY (GDCB)

***Any experimental courses offered by GDCB can be found at:***
registrar.iastate.edu/faculty-staff/courses/explistings/ **(**http://www.registrar.iastate.edu/faculty-staff/courses/explistings/**)**

**Courses primarily for graduate students, open to qualified undergraduates:**

**GDCB 510: Transmission Genetics**
(3-0) Cr. 3. F.
*Prereq: GEN 410 or graduate standing*
In-depth investigations of modern research practices of transmission genetics. Designed for students interested in genetic research. Topics include: Mendelian genetic analysis, analysis of genetic pathways, mutational analysis of gene function, chromosomal mechanics, genetic mapping, epigenetic inheritance, human genetic analysis.

**GDCB 511: Advanced Molecular Genetics**
(Cross-listed with MCDB). (3-0) Cr. 3. S.
*Prereq: BIOL 313 and BBMB 405*
Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data.

**GDCB 513: Plant Metabolism**
(Cross-listed with PLBIO). (2-0) Cr. 2. Alt. F., offered even-numbered years.
*Prereq: BIOL 330, PHYS 131, CHEM 331; one semester of biochemistry recommended*
Photosynthesis, respiration, and other aspects of plant metabolism.

**GDCB 528: Advances in Molecular Cell Biology**
(Cross-listed with MCDB). (3-0) Cr. 3. Alt. F., offered even-numbered years.
*Prereq: Courses in general cell biology and biochemistry*
Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility.

**GDCB 533: Advances in Developmental Biology**
(Cross-listed with MCDB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
*Prereq: BIOL 314 or Biol 423*
Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature.

**GDCB 536: Statistical Genetics**
(Cross-listed with STAT). (3-0) Cr. 3.
*Prereq: STAT 401 or STAT 587; STAT 447 or STAT 588; GEN 320 or BIOL 313*
Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

**GDCB 542: Introduction to Molecular Biology Techniques**
(Cross-listed with B M S, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

**GDCB 542A: Introduction to Molecular Biology Techniques: DNA Techniques**
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

**GDCB 542B: Introduction to Molecular Biology Techniques: Protein**
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

**GDCB 542C: Introduction to Molecular Biology Techniques: Cell Techniques**
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

**GDCB 542D: Introduction to Molecular Biology Techniques: Plant Transformation**
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

**GDCB 542E: Introduction to Molecular Biology Techniques: Proteomics**

(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

**GDCB 542F: Introduction to Molecular Biology Techniques: Metabolomics**

(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

**GDCB 542G: Introduction to Molecular Biology Techniques: Genomic**

(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.

Offered on a satisfactory-fail basis only.

**GDCB 544: Fundamentals of Bioinformatics**

(Cross-listed with BCB, COM S, CPR E). (4-0) Cr. 4. Alt. F., offered odd-numbered years.

*Prereq: MATH 165 or STAT 401 or equivalent*

A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

**GDCB 545: Plant Molecular, Cell and Developmental Biology**

(Cross-listed with MCDB, PLBIO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405*

Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

**GDCB 556: Cellular, Molecular and Developmental Neuroscience**

(Cross-listed with B M S, NEURO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: BIOL 335 or BIOL 436; physics recommended*

Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, and regulatory systems.

**GDCB 557: Rotations in Neuroscience**

(Cross-listed with NEURO). (2-0) Cr. 2. F.S.

Rotation experiences in various neuroscience research methods and techniques related to our current faculty specialties.

**GDCB 568: Statistical Bioinformatics**

(Cross-listed with BCB, COM S, STAT). (3-0) Cr. 3. S.

*Prereq: BCB 567 or (BIOL 315 and one of STAT 430 or STAT 483 or STAT 583), credit or enrollment in GEN 409*

Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

**GDCB 569: Structural Bioinformatics**

(Cross-listed with BBMB, BCB, COM S, CPR E). (3-0) Cr. 3. F.

*Prereq: BCB 567, BBMB 316, GEN 409, STAT 430*

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

**GDCB 570: Systems Biology**

(Cross-listed with BCB, COM S, CPR E, STAT). (3-0) Cr. 3. S.

*Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430 or STAT 483 or STAT 583*

Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

**GDCB 585: Fundamentals of Predictive Plant Phenomics**

(Cross-listed with BCB, M E). Cr. 4. F.

Principles of engineering, data analysis, and plant sciences and their interplay applied to predictive plant phenomics. Transport phenomena, sensor design, image analysis, graph models, network data analysis, fundamentals of genomics and phenomics. Multidisciplinary laboratory exercises.

**GDCB 590: Special Topics**

Cr. arr. Repeatable.

*Prereq: Permission of instructor*

**Courses for graduate students:**

**GDCB 661: Advanced Topics in Neuroscience**
(Cross-listed with BBMB, KIN, NEURO). (3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
*Prereq: NEURO 556 (or comparable course) or permission of instructor*
Students will present three journal articles and two overview lectures on topics in neuroscience that are related but outside of their own research interest.

**GDCB 690: Seminar in GDCB**
Cr. 1. Repeatable.
Research seminars by faculty, invited speakers, and graduate students. Offered on a satisfactory-fail basis only.

**GDCB 696: Research Seminar**
(Cross-listed with AGRON, BBMB, FOR, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

**GDCB 698: Seminar in Molecular, Cellular, and Developmental Biology**
(Cross-listed with BBMB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. S.
Student and faculty presentations.

**GDCB 699: Research**
Cr. arr. Repeatable.
Research for thesis or dissertation. Offered on a satisfactory-fail basis only.