## INTRODUCTORY COURSES

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>Course Description and Prerequisites</th>
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<tbody>
<tr>
<td>BIO 311C: Introductory Biology I</td>
<td>Introduction to biological energy transformation, cell structure and physiology, and gene expression. Prerequisites: Credit or registration for CH 301 or 301H.</td>
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<tr>
<td>BIO 311D: Introductory Biology II</td>
<td>Introduction to mechanisms of inheritance, evolution, physiology, and species interactions. Basic principles of Mendelism, molecular genetics, structure and function of genes and chromosomes, populations and evolution. Prerequisites: BIO 311C with a grade of at least C-.</td>
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<tr>
<td>BIO 325: Genetics</td>
<td>Basic principles of Mendelism, molecular genetics, structure and function of genes and chromosomes, populations and evolution. Prerequisites: BIO 311C and 311D with a grade of at least C- in each.</td>
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<tr>
<td>CH 301: Principles of Chemistry I</td>
<td>Three lecture hours a week for one semester. Some sections also require one enrichment/discussion hour a week; these are identified in the Course. Prerequisite: Credit with a grade of at least C- or registration for one of the following: Mathematics 305G, 408C, 408D, 408K, 408L, 408M, 408N, 408S, Statistics and Scientific Computation 302; and an appropriate score on the ALEKS chemistry placement examination.</td>
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<tr>
<td>CH 302: Principles of Chemistry II</td>
<td>Development and application of concepts, theories, and laws underlying chemistry. Prerequisites: Credit with a grade of at least C- in Chem 301 or 301H; and credit with a grade of at least C- or registration for one of the following: M408C, 408D, 408K, 408L, 408M, 408N, 408S, SSC 302.</td>
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<tr>
<td>CH 204: Introduction to Chemical Practices</td>
<td>Introduction to the techniques of modern experimental chemistry. Designed to provide basic laboratory and analytical skills. May include organic, analytical, and physical chemistry, as well as materials science. Prerequisites: Credit or registration for CH 302.</td>
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## CALCULUS COURSE – CHOOSE ONE OF THE FOLLOWING SEQUENCES

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<thead>
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<tr>
<td>M408C: Differential and Integral Calculus</td>
<td>Introduction to the theory and applications of differential and integral calculus of functions of one variable; topics include limits, continuity, differentiation, the mean value theorem and its applications, integration, the fundamental theorem of calculus, and transcendental functions. Prerequisites: A score of at least 80 on the ALEKS placement examination.</td>
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<td>AND</td>
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<tr>
<td>M408 D: Sequences, Series, and Multivariable Calculus</td>
<td>Introduction to the theory and applications of sequences and infinite series, including those involving functions of one variable, and to the theory and applications of differential and integral calculus of functions of several variables; topics include parametric equations, sequences, infinite series, power series, vectors, vector calculus, functions of several variables, partial derivatives, gradients, and multiple integrals. Prerequisites: M 408C, 408L, or 408S with a grade of at least C-.</td>
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<tr>
<td>OR</td>
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<tr>
<td>M 408N: Differential Calculus for Science</td>
<td>Introduction to the theory of differential calculus of functions of one variable, and its application to the natural sciences. Subjects may include limits and</td>
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PHY 317K and 117M, and 317L and 112N: General Physics I and II

**Prerequisites:** Introductory courses designed and recommended primarily for premedical students and others in the biomedical sciences whose professional or preprofessional training includes an introductory course in calculus. Mechanics, heat, and sound, with biomedical applications. Electricity and magnetism, light, atomic and molecular physics, nuclear physics, and their biomedical applications.

**Prerequisites:** M 408C, or 408K and coenrollment in M 408S and credit or registration for PHY 117M, and PHY 317K and 117M and credit or registration for PHY 117N.

**AND**

M 408S: Integral Calculus for Science

Restricted to students in the College of Natural Sciences. Introduction to the theory of integral calculus of functions of one variable, and its applications to the natural sciences. Subjects may include integration and its application to area and volume, and transcendental functions, sequences, and series and their application to numerical methods.

**Prerequisites:** M 408C, 408K, or 408N with a grade of at least C-.

**ORGANIC CHEMISTRY – CHOOSE ONE OF THE SEQUENCES**

CH 320M: Organic Chemistry I

The development of organic chemical structure, nomenclature, and reactivity.

**Prerequisites:** CH 302 with a grade of at least C-, and credit or registration for CH 204 or 317.

CH 320N: Organic Chemistry II

The development of organic chemical reactivity, with a focus on carbohydrates, proteins, and nucleic acids.

**Prerequisites:** CH 204 or 317 and CH 310M with a grade of at least C- in each, and credit or registration for CH 210C.

CH 220C: Organic Chemistry Laboratory

**Prerequisites:** CH 204 or 317 and CH 310M with a grade of at least C- in each, and credit or registration for CH 310N

**ADDITIONAL CHEMISTRY COURSEWORK**

CH 339K: Biochemistry I

Structure and function of amino acids, proteins, carbohydrates, lipids, and nucleic acids.

**Prerequisites:** Eight semester hours of coursework in organic chemistry.

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CH 339L: Biochemistry II

A second-semester biochemistry course designed for chemistry, premedical, predental, and life sciences majors. Biosynthesis of nucleic acids and proteins.

**Prerequisites:** Chemistry 339K with a grade of at least C-.

**OR**

CH 369: Fundamentals of Biochemistry (Required)

A survey course covering the basics of protein structure and function, carbon and nitrogen metabolism, and molecular biology of macromolecules.

**Prerequisites:** CH 320M or 318M with a grade of at least C-

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CH 353M: Physical Chemistry I for Life Sciences

Thermochemistry and kinetics of reactions in cells, enzyme catalysis, electrical and transport properties of membranes.

**Prerequisites:** M 408C and 408D, or two of the following: M 408K, 408L, 408M 408N, 408S; CH 302 or 302H with a grade of at least C--; and PHY 316 and 116L, 303L and 103N, or 317L and 117N.

**PHYSICS SEQUENCE (CALCULUS BASED) – CHOOSE ONE 8 HOUR SEQUENCE**

**Prerequisites:** A score of at least 70 on the ALEKS placement examination.

**Prerequisites:** M 408C, 408K, or 408N with a grade of at least C-.
PHY 301 & 101L; and 316 & 112L: Mechanics; Electricity and Magnetism

Prerequisites: M 408C, or 408K and coenrollment in 408L or M408N and coenrollment in M408S and credit or registration for PHY 101L; PHY 301 and 101L, M 408D, or 408L and coenrollment in 408M and credit or registration for PHY 116L.

PHY 303K and 103M; and 303L & 103N: Engineering Physics I and II


Prerequisites: M 408C, or 408K and coenrollment in 408L or M408N and coenrollment in M408S and credit or registration for PHY 101M; PHY 303K and 103M, M 408D, or 408L and coenrollment in 408M and credit or registration in PHY 103N.

REQUIRED UPPER-DIVISION BIOLOGY COURSES

- **BIO 320: Cell Biology**
  Principles of eukaryotic cell structure and function; macromolecules, energetics, membranes, organelles, cytoskeleton, gene expression, signaling, division, differentiation, motility, and experimental methodologies.
  **Prerequisites:** BIO 325 or 325H with a grade of at least C-.

- **BIO 344: Molecular Biology**
  Molecular basis of cellular processes: gene structure and function; DNA replication; RNA and protein synthesis; viruses; molecular aspects of immunology and cancer, and recombinant DNA.
  **Prerequisites:** BIO 325 or 325H with a grade of at least C-.

- **BIO 326R: General Microbiology**
  Overview of the major areas of micro-biological study, including cell structure and function, genetics, host-microbe interactions, physiology, ecology, diversity, and virology.
  **Prerequisites:** BIO 325 or 325H with a grade of at least C-, and CH 302 or 302H with a grade of at least C-.

- **BIO 226L: General Microbiology Laboratory**
  Introduction to microbiology laboratory techniques and experimental demonstration of principles of microbiology.
  **Prerequisites:** Credit with a grade of at least C- or registration for BIO 326M or 326R.

- **BIO 349: Developmental Biology**
  Principles of animal development, with emphasis on developmental mechanisms.
  **Prerequisites:** BIO 325 or 325H with a grade of at least C-.

- **BIO 370: Evolution**
  Introduction to modern evolutionary biology, focusing on the evolution of molecular, developmental, morphological, and behavioral traits. Genetic and ecological bases of evolutionary changes within populations and of evolutionary divergence in animals and plants.
  **Prerequisites:** BIO 325 or 325H with a grade of at least C-.

ADDITIONAL REQUIRED UPPER DIVISION BIOLOGY COURSEWORK – CHOOSE AT LEAST 3 HOURS

- **BIO 328: Introductory Plant Physiology**
  General principles of the mineral nutrition, water relations, metabolic activities, growth and development of green plants.
  **Prerequisites:** BIO 325 or 325H with a grade of at least C-, and CH 302 or 302H.

- **BIO 365R: Vertebrate Physiology**
  Introduction to the nervous system and other excitable tissues. Subjects may include membrane potentials, ion channels, synaptic transmission, learning and memory, skeletal and cardiac muscle, and how systems of neurons lead
BIO 365S: Vertebrate Systems Physiology
Overview of body fluids, the cardiovascular system, respiration, digestion, metabolism, and endocrinology.
**Prerequisites:** BIO 311C; BIO 325 or 325H with a grade of at least C-; CH 301 with a grade of at least C-; and one of the following with a grade of at least C-: M 408C, 408K, 408N, 408R, SSC 302.

**ADDITIONAL REQUIRED UPPER DIVISION BIOLOGY COURSEWORK (LABS) – CHOOSE AT LEAST 3 HOURS**

**BIO 320L: Cell Biology Laboratory**
Explores the complex structures and functions of cells through direct observation and experimentation. Subjects may include regulation of gene transcription and translation, protein sorting, organelles and membrane trafficking, cytoskeletal dynamics, and cell division. Students use a combination of modern molecular biology, biochemistry, and microscopy techniques, with a strong emphasis placed on hypothesis-driven approaches, proper experimental design, and clear scientific writing and presentation.
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and credit with a grade of at least C- or registration for BIO 320.

**BIO 331L – Laboratory Studies in Molecular Biology**
The methods and principles of molecular biology in a research laboratory context. Students conduct a research project directed by a faculty member.
**Prerequisites:** BIO 205L, 206L, 208L, or 226L; and BIO 325 or 325H with a grade of at least C-.

**BIO 349L: Experiments in Animal Developmental Biology**
Methods and principles of developmental biology in a laboratory context, with emphasis on animal embryology using molecular techniques and microscopy.
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and credit with a grade of at least C- or registration for BIO 349.

**ADDITIONAL BIOLOGY COURSEWORK – CHOOSE AT LEAST 6 HOURS WITH A MINIMUM OF TWO LABS**

**BIO 323L – W: Laboratory Studies in Cell Biology**
Research exercises involving light/electron microscopy, image processing, auto-radiography, chromatography, fractionation, flow cytometry, spectroscopy, diffraction, antibody labeling, cell growth, and kinetics.
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and credit or registration for BIO 320.

**BIO 325L-W: Laboratory Experience in Genetics**
Experimentation and direct observation in fundamental aspects of transmission genetics.
**Prerequisites:** BIO 325 or 325H with a grade of at least C-.

**BIO 330: Animal Virology**
Mechanisms by which viruses replicate and kill or transform cells.
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and BIO 326R with grades of at least C- in each.

**Bio 230L: Virology Laboratory**
Basic experimental techniques applied to selected bacteriophages and animal viruses.
**Prerequisites:** BIO 325 or 326R, and 226L with a grade of at least C- in each, and credit with a grade of at least C- or registration for BIO 330 or 333.

**BIO 332: Yeast Cell Biology**
Yeast is used as a model to teach some of the more actively researched areas of cell biology, such as chromosome structure, mating type, cell-cell interaction, DNA replication, mitosis, cytoskeletal motors, cell polarity, signal interaction, DNA replication, mitosis, cytoskeletal motors, cell polarity, signal interactions.
transduction, cell cycle, checkpoints, secretion, protein modification, yeast genetics, and yeast technology.  
**Prerequisites:** Biology 325 or 325H with a grade of at least C-, and Biology 226L and 326R with a grade of at least C- in each.

**BIO 335: Introduction to Biochemical Engineering**  
Microorganisms in chemical and biochemical synthesis; genetic manipulation of cells by classical and recombinant DNA techniques. Enzyme technology; design of bioreactors and microbial fermentations; separations of biological products.  
**Prerequisites:** BIO 311C with a grade of at least C-, and either CH 339K and 339L, or 369.

**BIO 336: Tumor Biology**  
Natural history and causal mechanisms of cancer; viral and chemical carcinogens.  
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and BIO 330 or 360K with a grade of at least C- in each.

**BIO 337J: Computational Biology**  
Overview of computational biology, with emphasis on nucleic acid sequence analysis and databases. Class projects and self-learning exercises.  
**Prerequisites:** BIO 325 or 325H, with a grade of at least C- in each.

**BIO 339: Metabolism and Biochemistry of Microorganisms**  
A study of the metabolic processes of microorganisms, using a biochemical approach.  
**Prerequisites:** BIO 326R with a grade of at least C-, and CH 320M and 320N.

**BIO 339M: Bacterial Behavior and Signaling Mechanisms**  
Advanced studies in how bacteria perceive their environment and communicate with each other. Subjects may include chemotaxis and motility, morphogenesis and development, and secretion and virulence. Taught entirely through reading and discussion of original articles.  
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and BIO 326R with a grade of at least C-.

**BIO 343:**

**BIO 345: Cell Physiology**  
An integrated approach to basic processes in physiology: metabolism, transport, energetics, molecular and cellular control mechanisms.  
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and CH 320M.

**BIO 345E: Endocrinology**  
Vertebrate endocrinology (primarily mammalian), with a focus on human pathophysiology.  
**Prerequisites:** BIO 325 or 325H with a grade of at least C-.

**BIO 347: Biology and Genetics of Immune Disorders**  
Immune disorders in mammals, including humans, used as models for examining basic immunological and immunogenetic principles; emphasis on immune disorders of vertebrates.  
**Prerequisites:** BIO 325 or 325H with a grade of at least C-.

**BIO 349L: Experiments in Animal Developmental Biology**  
Methods and principles of developmental biology in a laboratory context, with emphasis on animal embryology using molecular techniques and microscopy.  
**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and credit with a grade of at least C- or registration for BIO 349.

**BIO 350M: Plant Molecular Biology**  
Fundamentals of plant molecular biology, including structure and expression of the chloroplast and mitochondrial genomes.
BIO 360K: Immunology

The basic concepts of humoral and cell-associated immune phenomena.

**Prerequisites:** BIO 325 or 325H with a grade of at least C-.

BIO 360M: Molecular Immunology

Current techniques in experimental cellular and humoral immunology.

**Prerequisites:** Credit with a grade of at least C- or registration for BIO 360K.

BIO 360R: Molecular Genetics

Molecular genetics.

**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and BIO 326R a grade of at least C-.

BIO 361L: Immunology Laboratory

Current techniques in experimental cellular and humoral immunology.

**Prerequisites:** Credit with a grade of at least C- or registration for BIO 360K.

BIO 365D: Principles of Drug Action

Introduction to the basic principles of pharmacology, including how drugs get into the body, exert their actions, and are metabolized and excreted.

**Prerequisites:** BIO 325 or 325H with a grade of at least C-.

BIO 365L: Neurobiology Laboratory

An introduction to physiological, morphological, and molecular techniques used for analysis of the nervous system. Experiments and computer simulations illustrate basics of information processing by the nervous system.

**Prerequisites:** BIO 205L, 206L, or 226L with a grade of at least C-; BIO 325 or 325H with a grade of at least C-; and BIO 365R or 371M with a grade of at least C-.

BIO 365R: Molecular Genetics

Molecular genetics.

**Prerequisites:** BIO 325 or 325H with a grade of at least C-, and BIO 326R a grade of at least C-.

BIO 365T: Neurobiology of Disease

Study of the neurobiology of neurotransmitters, and the influence of alcohol and drugs of abuse on neurotransmitters.

**Prerequisites:** BIO 365R or 371M with a grade of at least C-.

BIO 365W: Neurobiology of Addiction

Study of the neurobiology of neurotransmitters, and the influence of alcohol and drugs of abuse on neurotransmitters.

**Prerequisites:** BIO 365R or 371M with a grade of at least C-.

BIO 366: Microbial Genetics

Molecular biology of nucleic acids; biosynthesis of macromolecules, transfer of genetic material from cell to cell, recombination, mutagenesis, and regulatory mechanisms.

**Prerequisites:** Biology 325 or 325H with a grade of at least C-, and BIO 326R with a grade of at least C-.

BIO 366R: Molecular Genetics

Techniques used for studying molecular biology and transgenic organisms. Includes advanced genetics and the molecular genetics used in clinical
applications.

**Prerequisites:** BIO 325 or 325H with a grade of at least C-.

**SSC 328M: Biostatistics**

Introduction to methods of statistical analysis of biological data. Includes data analysis, basics of experimental design, statistical inference, interval estimation, and hypothesis testing.

**Prerequisites:** M 408D, 408L, or 408S with a grade of at least C-, and four semester hours of coursework in biology.