

BIOLOGY

BIOL 103 Introduction to Biology I – Ecology and Biodiversity (3 sem. hrs.)

An introduction to basic concepts and connections in the study of life, with emphasis on ecology and adaptation of representative life forms. The major plant and animal groups are surveyed with emphasis on unifying elements and diversities. This course is designed for non-Science majors and, without BIOL 104 and 105, does not serve as a prerequisite for upper level Biology courses.

Prerequisite(s): None. (3-3; 0-0)

BIOL 104 Introduction to Biology II – The Design of Life (3 sem. hrs.)

An introduction to the basic relationships governing the existence of all living organisms. The anatomy and physiology at all levels from DNA to organ-systems are studied, looking at energy requirements, inheritance, reproduction, development, and adaptation of representative life forms. This course is designed for non-Science majors and, without BIOL 105, does not serve as a prerequisite for upper level Biology courses.

Prerequisite(s): None. (0-0; 3-3)

BIOL 105 Advanced Introduction to Biology (3 sem. hrs.)

This lecture course covers certain topics in biology that are foundational to modern biology. The course examines the chemistry of life, DNA, phylogeny, ecosystems, physiology, and biotechnology. This course is designed for students who have taken BIOL 103, 104 and intend to take upper level Biology courses.

NB: Summer sessions only.

Prerequisite(s): BIOL 103, 104

BIOL 113 Principles of Biology I (3 sem. hrs.)

An introduction to the basic relationships governing the existence of all living organisms, with emphasis on ecology and adaptation of representative life forms. Consideration is given to classification and surveys of the major plant and animal groups with emphasis on unifying elements and diversities.

Prerequisite(s): Biology 11 or 12 or equivalent. (3-3; 0-0)

BIOL 114 Principles of Biology II (3 sem. hrs.)

An introduction to the basic relationships governing the existence of all living organisms. Consideration is given to the anatomy and physiology at all levels as these relate to the energy requirements, inheritance, reproduction, development, and adaptation of representative life forms.

Prerequisite(s): Biology 11 or 12 equivalent. (0-0; 3-3)

BIOL 212 Biology of Vascular Plants (3 sem. hrs.)

An exploration of the role of plants as the basis for most ecosystems, and as valuable resources for agriculture, horticulture, forestry, biotechnology, and other areas of human concern. The study of vascular plants includes classification, development, physiology, ecology, and economic uses. Comparison of form, function, and significance involves local field trips and laboratory studies.

NB: Students may take only one of BIOL 212 and BIOL 312 for credit. Not offered every year. See Department chair.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114. (0-0; 3-3)

BIOL 214 Biology of Non-vascular Plants (3 sem. hrs.)

An exploration of non-vascular plants and the important niches they occupy, particularly in aquatic or moist environments. The course covers algae, fungi, lichens, and bryophytes including classification, development, physiology, and ecology. Applied aspects include productivity of freshwater and marine systems, commercial uses, mushroom culture, plant pathology, and environmental health. Firsthand experience of the organisms includes local field trips and laboratory studies.

NB: Students may take only one of BIOL 214 and BIOL 314 for credit. Not offered every year. See Department chair.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114. (0-0; 3-3)

BIOL 216 Plant Environments (3 sem. hrs.)

An inventory of plant life across major habitats, particularly in the local area of British Columbia, provides insights into the ecology of these environments. Local field trips highlight natural habitats, agricultural and horticultural crops, and managed forests. Critical assessment of planetary stewardship forms a common theme.

NB: Summer sessions only. Includes field work in the Gulf Islands. Not offered every year. See Department chair.

Prerequisite(s): None.

BIOL 223 Cell Biology (3 sem. hrs.)

A study of the molecules and processes that determine cell structure and function, including how this information is derived from the wide range of visual and analytical tools available today. The course describes the chemical nature of cells and the structure and behaviour of cells in the context of tissues

NB: Students taking BIOL 223 are urged to take CHEM 221 (Organic Chemistry) concurrently in order to be prepared to take BIOL 384 or 386.

Prerequisite(s): A minimum grade of C in BIOL 103, 104, and 105; or BIOL 113, 114; and CHEM 103, 104; CHEM 103, 112 or CHEM 111, 112. (3-3; 0-0)

BIOL 241, 242 Human Anatomy and Physiology (3, 3 sem. hrs.)

An introductory course in human anatomy and physiology open to students in Human Kinetics, Nursing, and other non-Biology majors. The first semester (BIOL 241) covers primarily the skeletal, muscle, and cardiovascular systems. The second semester (BIOL 242) is devoted to the anatomy and physiology of the systems: nervous, digestive, renal, endocrine, and reproductive, with special emphases on homeostasis, physical fitness, and clinical applications.

Prerequisite(s): No prerequisite for BIOL 241. BIOL 241 is prerequisite for BIOL 242. (3-1-3; 3-1-3)

BIOL 262 Marine Biology (3 sem. hrs.)

A study of the life history and distribution of marine organisms in several major habitat types, including soft sediment and rocky substrate communities. Emphasis on field and laboratory work in a survey of common local marine plants and animals and their relationships. Includes field work in the B.C. Lower Mainland, Gulf Islands, and/or Vancouver Island.

NB: Summer sessions only. Not offered every year.

See Department chair.

Prerequisite(s): Instructor's consent.

BIOL 308 Vertebrate Zoology (3 sem. hrs.)

A comparative study of the vertebrate classes with special emphasis on the anatomy and physiology of representative forms. The significance of advances in the complexity of chordates is considered, as well as the impact of human activities on vertebrate population dynamics.

NB: Not offered every year. See Department chair.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114. (3-3; 0-0)

BIOL 312 Advanced Biology of Vascular Plants (3 sem. hrs.)

An exploration of the role of plants as the basis for most ecosystems, and as valuable resources for agriculture, horticulture, forestry, biotechnology, and other areas of human concern. The study of vascular plants includes classification, development, physiology, ecology, and economic uses. Comparison of form, function, and significance involves local field trips and laboratory studies. Recent discoveries in plant biology are highlighted through the completion of a literature review.

NB: Students may take only one of BIOL 212 and BIOL 312

for credit. Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114.
(0-0; 3-3)

BIOL 314 Advanced Biology of Non-Vascular Plants (3 sem. hrs.)

An exploration of non-vascular plants and the important niches they occupy, particularly in aquatic or moist environments. The course covers algae, fungi, lichens, and bryophytes including classification, development, physiology, and ecology. Applied aspects include productivity of freshwater and marine systems, commercial uses, mushroom culture, plant pathology and environmental health. Firsthand experience of the organisms includes local field trips and laboratory studies. Recent discoveries in plant biology are highlighted through the completion of a literature review.

NB: Students may take only one of BIOL 214 and BIOL 314 for credit. Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114.
(0-0; 3-3)

BIOL 315 Plant Physiology (3 sem. hrs.)

An inventory of basic plant mechanisms and plant development. Mechanisms include assimilation, transport, and utilization of water and mineral nutrients and the utilization and distribution of photoassimilates. Plant development includes cell division, tissue culture, meristems, and the role of hormones in plant morphogenesis. Experimental approaches and biotechnology applications of plant molecular biology are stressed.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; BIOL 223 recommended. (3-3; 0-0)

BIOL 316 Plant Ecology (3 sem. hrs.)

The crucial role of plant ecology in shaping major habitats, including those in the local area of British Columbia, is examined. Local field trips highlight the population dynamics and inter-relationships of plant communities in natural habitats, agricultural and horticultural crops, and managed forests. Critical assessment of planetary stewardship forms a common theme across various issues in plant ecology.

NB: Summer sessions only. Includes field work in the Gulf Islands. Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114.

BIOL 318 Tropical Botany (3 sem. hrs.)

As an exploration of the botanical riches of the tropics, focusing on the plant life of Hawaii, the course traces fundamentals of plant taxonomy, physiology, and ecology in relation to complexities of existence on the most isolated island chain in the world. Issues related to indigenous vegetation, including effects of introduced animals and plants, agriculture, and ethnobotany, are discussed. The course involves one week of lectures at Trinity Western and two weeks of lectures and field work in Maui, Hawaii.

NB: Summer sessions only. Not offered every year.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114.

BIOL 333 Introduction to Medical Microbiology (3 sem. hrs.)

A study of pathogenic microorganisms and the control of infectious diseases. Topics include (i) the biology of bacteria, viruses, fungi, protozoa, and helminths; (ii) infectious diseases of temperate and tropical climates; (iii) immunity, immunology, and immunization; (iv) sterilization, disinfection, chemotherapeutic agents; and (v) epidemiology and public health microbiology.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; or BIOL 241, 242 (3-3; 0-0)

BIOL 334 Basic and Applied Microbiology (3 sem. hrs.)

An advanced study of topics in basic and applied microbiology including (i) the structure, ultrastructure, and biochemical structure of prokaryotes, eukaryotes,

and viruses; (ii) microbial biochemistry and physiology; (iii) microbial taxonomy and phylogeny; (iv) microbial ecology and agricultural microbiology; and (v) industrial microbiology and biotechnology.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114.
(0-0; 3-3)

BIOL 336 Immunology (3 sem. hrs.)

A lecture course covering current topics in immunology including the cellular basis of immunity, the molecular genetics of antibody diversity, the major histocompatibility complex, antigen recognition, lymphocyte development, the complement system, hypersensitivity reactions, and immunodeficiency diseases. The course provides an integrated view of the immune system and the immunologic response to disease.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 223; BIOL 333 recommended.
(0-0; 3-0)

BIOL 340 Development Biology (3 sem. hrs.)

Animal development and its underlying causal principles including introductory reproductive biology, embryology, and developmental genetics.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; 223. (3-3; 0-0)

BIOL 343 Human Histology (3 sem. hrs.)

A study of the normal microscopic anatomy of the various tissues and organs of the body with an emphasis on the relationship between structure and function. Special attention is given to the field of human histology with some discussion of the similarities and differences in animals. The laboratory component of the course involves the observation and discussion of representative tissue sections and provides a basic understanding of normal versus abnormal morphology.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; BIOL 223 recommended. (3-3; 0-0)

BIOL 344 Environmental Physiology (3 sem. hrs.)

A survey of physiological adaptations of animals to different environments including environmental stress. These adaptations are examined at several levels of organization, from the molecular and biochemical to the function of organ systems and behaviour. Includes in-depth examination of both vertebrate and invertebrate examples.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114.
(0-0; 3-3)

BIOL 345 Vertebrate Physiology (3 sem. hrs.)

A course on the physiology of the various organ systems of humans and higher vertebrates. The course provides an integrated view of the organization and functioning of the different organ systems of the body and their role in maintaining homeostasis.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; BIOL 223 recommended. (3-3; 0-0)

BIOL 346 Advanced Human Physiology (3 sem. hrs.)

This course builds on the foundation established in BIOL 243, 244; or BIOL 345. In addition to providing a deeper insight into mechanisms underlying a broad range of physiological phenomena, this course emphasizes the integration of the homeostatic mechanisms involving the various organ systems.

NB: Not offered every year. See Department chair.
Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; 345; or instructor's consent. (0-0; 3-3)

BIOL 350 Brain and Behaviour (3 sem. hrs.)

An overview of the relationship between the nervous system and behaviour. Human behaviour and clinical problems.

Biological bases of emotion, learning, memory, sexual behaviour, and homeostatic motivations. Biochemical theories of schizophrenia, autism, and mood disorders.

Cross-listed: PSYC 350.

Prerequisite(s): PSYC 105, 106; 201; or BIOL 113, 114. (3-0 or 3-0)

BIOL 360 Invertebrate Zoology (3 sem. hrs.)

A survey of the invertebrate phyla with particular reference to their phylogenetic relationships. Laboratories and field trips provide hands-on experience studying both terrestrial and marine invertebrates of the Pacific coastal region.

NB: Not offered every year. See Department chair.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114. (3-3; 0-0)

BIOL 364 Coral Reef Ecology (3 sem. hrs.)

A field course focusing on the systematics and ecology of tropical coral reef organisms. Plants, animals, and physical factors of a fringing coral reef are examined through snorkeling excursions and laboratory studies. One species is chosen for a detailed research project. Includes field course work in Maui, Hawaii.

NB: Summer sessions only. Not offered every year.

See Department chair.

Prerequisite(s): Advanced standing in Biology and instructor's consent.

BIOL 371 Introduction to Genetics (3 sem. hrs.)

An introduction to the study of heredity. Emphasizes classic genetics of populations and individuals in viruses, bacteria, plants, and animals.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114. (3-4; 0-0)

BIOL 372 Molecular Genetics (3 sem. hrs.)

This class considers modern developments and techniques in genetics, especially the basic and applied aspects of recombinant DNA technology.

Prerequisite(s): BIOL 103, 104, and 105 or BIOL 113, 114; a minimum grade of C in BIOL 223; and CHEM 103, 104; or 103, 112; or 111, 112. CHEM 221, 222 recommended. (0-0; 3-3)

BIOL 381 General Ecology (3 sem. hrs.)

A study of the structure and dynamics of ecosystems. Consideration of plant and animal populations in relation to physical, chemical, and biological factors affecting their interaction and productivity. Considerable laboratory time is devoted to the study of local ecosystems, field sampling techniques, and field trips to ecological research stations.

Prerequisite(s): BIOL 103, 104, and 105; or BIOL 113, 114; or equivalent. (3-3; 0-0)

BIOL 382 Marine Ecology (3 sem. hrs.)

A study of the ecological relationships of marine life in several major habitat types. Emphasis is on productivity, food webs, nutrient cycling, and community ecology. Ecosystem parameters are investigated through field and laboratory studies. Part of course work takes place in the B.C. Lower Mainland, Gulf Islands, and/or Vancouver Island.

NB: Summer sessions only. Not offered every year. See Department chair.

Prerequisite(s): Advanced standing in Biology and instructor's consent.

BIOL 384 Principles of Biochemistry (3 sem. hrs.)

The chemical structure, function, and metabolism of carbohydrates, lipids, proteins, and nucleic acids. This class is continued as BIOL 386.

Cross-listed: CHEM 384.

Co-requisite: CHEM 221, 222.

Prerequisite(s): CHEM 111, 112. Recommended: BIOL 103, 104, and 105; or BIOL 113, 114; 223. (3-1-3 or 3-1-3)

BIOL 386 Biosynthesis (3 sem. hrs.)

The modern understanding of the biochemical transfer of genetic information: DNA structure and synthesis,

transcription and translation. This course also examines the regulatory mechanisms of gene control in prokaryotes and eukaryotes, as well as protein structure and function. The central theme of the course is to illustrate the significance of nucleic acid and protein biochemistry in modern biology.

NB: Not offered every year. See Department chair.

Cross-listed: CHEM 386.

Co-requisites: CHEM 221, 222.

Prerequisite(s): CHEM 111, 112. Recommended: BIOL 103, 104 and 105; or BIOL 113, 114; 223. (3-0 or 3-0)

BIOL 390 Biology and Christian Theology (3 sem. hrs.)

This course is designed to untangle some of the actual or perceived dissonance between issues of biological science and Christian theology. Six major topics are addressed:

(1) models, analogies, and metaphors in science and Christian theology; (2) scientific and religious investigations of the biosphere; (3) defining human nature; (4) defining non-human nature; (5) caring for the earth; and (6) the biomedical revolution. The common threads among these topics are the tension between Christian faith and the findings of basic and applied biology (biotechnology), and the call to action required in a faith-based view of creation. As well as speaking from their own disciplines and background, the course instructors take part in panel discussions to foster discussion and dialogue. Student participation is encouraged by group projects that develop and present a paper on an area that engenders dissonance between scientific and religious worldview perspectives. Prerequisite(s): BIOL 103, 104, and 105 or BIOL 113, 114; third year standing. (3-0 or 3-0)

BIOL 400 Directed Studies in Biology (3 sem. hrs.)

Students are required to produce an outline of the topic to be studied in consultation with the instructor. A course of reading and/or experimentation is pursued according to the approved outline. Assessment may be via examination and/or a final written report.

NB: This course, with the appropriate choice of topics, can be used as a preparation for the senior thesis (BIOL 410).

Prerequisite(s): Advanced standing in Biology or instructor's consent.

BIOL 409 Thesis Preparation (1 sem. hr.)

Students are required to choose a topic for their senior thesis (BIOL 410) in consultation with an instructor. Selected readings and references pertinent to the topic are assigned. A final written report is presented consisting of a detailed thesis proposal and a review of the literature. Students choosing environmental studies or ecology should start in their third year to allow observations over a full calendar year.

Prerequisite(s): Advanced standing in Biology or instructor's consent. (1-1; 0-0)

BIOL 410 Senior Thesis (2 sem. hrs.)

Research in a chosen area of biology with a final written report. Students present research findings in a seminar.

Prerequisite(s): BIOL 409, a related directed study in preparation, or instructor's consent. (0-0; 1-2)

BIOL 411 Senior Thesis (3 sem. hrs.)

Research in a chosen area of Biology with a final written report. Students present research findings in a seminar. Allows students with larger projects to gain extra credit.

Prerequisite(s): BIOL 409, a related directed study in preparation, or instructor's consent. (0-0; 1-3)

BIOL 423 Advanced Cell and Molecular Biology (3 sem. hrs.)

A laboratory course emphasizing advanced techniques in cell biology, molecular biology, and developmental genetics. Topics include functional genomics, mobile genetic elements, somatic clonal analysis, molecular cloning, and epifluorescence/confocal microscopy. This course is designed for students who are interested in a career in the life sciences and who wish to familiarize themselves with a number of applied laboratory techniques.

NB: BIOL 423 is an appropriate addition to or substitution for BIOL 409, 410.

Prerequisite(s): CHEM 221, 222; a minimum grade of C in BIOL 223, and at least one of BIOL 384 or 372. BIO 371 is highly recommended. (0-4; 0-0)

BIOL 438 Virology (3 sem. hrs.)

The course provides a basic understanding of some of the current topics in modern virology including the structure, classification, and replication of viruses, virus-cell interactions, diagnostic and research applications in virology, and the molecular biology of several important viruses causing disease in humans and animals. Special emphasis is given to viral pathogenesis making this course suitable for those pursuing careers in medicine or related fields.

NB: Not offered every semester. See Department chair.

Prerequisite(s): BIOL 223; 333; and BIOL 372 or 386. (0-0; 3-0)

BIOL 450 Neuroscience (3 sem. hrs.)

An advanced course in neuroscience which examines current research on the cellular organization of the brain as well as the role of physiological processes in human thought, emotions, and behaviour. Interactions between physiological and psychological processes are emphasized. Laboratory experiments focus on the basics of recording bioelectric potentials in invertebrates and humans.

Prerequisite(s): BIOL 350 or PSYC 350. (0-0; 3-3)

BIOL 470 Genomics, Proteomics, Bioinformatics (3 sem. hrs.)

An overview of the interdisciplinary science of genomics, proteomics, and bioinformatics which applies the tools of information technology (computer hardware and software) to analyze biological data such as gene or protein sequences. This course examines the theory of bioinformatics as well as its practical application to biological problems using approaches such as BLAST searches, phylogenetics, and protein structure function analysis.

Prerequisite(s): BIOL 223; BIOL/CHEM 372, and either 3 sem. hrs. of Computing Science or MATH 102. (0-0; 3-3-0)

BIOL 474 Genetics and Cell Biology of Neoplasia (3 sem. hrs.)

A lecture course reviewing a wide range of topics related to cancer including the biology and immunology of tumor cells, chemical and viral carcinogenesis, oncogenes, genetic predisposition to cancer, and treatment strategies.

NB: Not offered every year. See Department chair.

Prerequisite(s): BIOL 223, and one of BIOL 340, 372, or 386. (0-0; 3-0)

BIOL 482 Applied Ecology (3 sem. hrs.)

An exploration of various practical applications of biology in environmental management, monitoring, and remediation. Topics include many important areas of concern such as wildlife management, fisheries, forestry, agriculture, water and air pollution, and protection of endangered ecosystems. Various biological approaches to these are considered, such as population modelling, ecophysiology, microbiology techniques, biomonitoring, ecosystem health, and biodiversity inventories. The implications of environmental ethics and the role of Christian environmental stewardship are discussed.

NB: Not offered every year. See Department chair.

Prerequisite(s): BIOL 381 (may be taken concurrently). (0-0; 3-3)

For further course listings, see Au Sable Institute of Environmental Studies listings (under Environmental Studies).

BIOTECHNOLOGY

BIOT 100 Biotechnology Practicum I (1 sem. hr.)

This hands-on course is an intern program in the Biology Department at TWU providing instruction in general laboratory procedures and laboratory safety beyond that provided during regular undergraduate laboratories. The tasks include general care of laboratory animals and plants, microbial culture, preparation of microbial culture media, and preparation of chemical and biochemical reagents.

Prerequisite(s): BIOL 103 or BIOL 113. (0-0, 0-1)

BIOT 200/300/400 Biotechnology Practica II, III, IV (2 or 3 sem. hrs.)

Biotechnology Practica II–IV provide general and advanced intern experiences in industrial settings. BIOT 200 (2 sem. hrs.) is a requirement for entry to co-op placements and graduation. BIOT 300 and 400 (3 sem. hrs. each) are additional intern experiences providing exposure to advanced techniques and applications in biotechnology. The skills taught in each practicum vary depending on the industrial setting but should include some of the following techniques: mammalian tissue culture; monoclonal antibody production including cell fusion; hybridoma screening by ELISA and immunoblotting; fermentation microbiology and the operation of large-scale fermentation systems; insect cell culture and use of Baculovirus expression vectors to produce recombinant proteins; downstream processing and the recovery and purification of proteins, carbohydrates, lipids; freezing, freeze-drying and preservation of microorganisms, animal viruses, cell lines and hybridomas; high throughput screening strategies, diagnostic testing; methods in bioinformatics; and quality control procedures.

Prerequisite(s): BIOT 100.

BIOT 290 Introduction to Biotechnology (3 sem. hrs.)

This course reviews the role of modern biotechnology in plant, animal, and marine biology, microbiology, agriculture, the pharmaceutical industry and medicine. The course focuses on underlying technologies in biotechnology, how these technologies are implemented, together with public concerns and government guidelines and legislation.

Prerequisite(s): BIOL 103, 104, and 105 or BIOL 113, 114. (3-0 or 3-0)

BIOT 390 Biotechnology and Christian Theology (3 sem. hrs.)

This course is designed to untangle some of the actual or perceived dissonance between issues of biological science and Christian theology. Six major topics are addressed: (1) models, analogies and metaphors in science and Christian theology; (2) Scientific and religious investigations of the biosphere; (3) defining human nature; (4) defining non-human nature; (5) caring for the earth; and (6) the biomedical revolution. The common threads among these topics are the tension between Christian faith and the findings of basic and applied biology (biotechnology), and the call to action required in a faith-based view of creation. As well as speaking from their own disciplines and background, the course instructors will take part in panel discussions at the end of each of the six units to foster discussion and dialogue on the issues. Student participation will be further encouraged by group projects in which the group must develop and present a position paper on an area that engenders dissonance between scientific and religious worldview perspectives.

Cross-listed: BIOL 390.

Prerequisite(s): BIOL 103, 104, and 105 or BIOL 113, 114; third year standing. (3-0 or 3-0)

BIOT 409 Thesis Preparation (1 sem. hr.)

Students choose a research topic for their senior thesis in consultation with biotechnology faculty. Selected readings and pertinent references to the topic are assigned. A final