SOCI660 **$ (0)**
Thesis Continuation
Student may register for this title while clearing deferred grade (DG) and/or incomplete (I) courses with advisor approvals only. Registration for this title indicates full-time status.

SOCI665 **$ (0)**
Preparation for Comprehensive Exams
Advisor approval required. Registration for this title indicates full-time status.

SOCI670 **(0)**
Comprehensive Exam

SOCI677 **(0)**
Colloquium
The course provides a forum for development and peer review of research projects by CIDP graduate students. The course is to be taken each semester the student is enrolled in the Community & International Development program. Repeatable. S/U grade.

SOCI680 **(1–2)**
Field Practicum
Students integrate course content and theory into practice during a 300-hour field practicum coordinated with each student's research project and/or concentration that is the concluding requirement for the concentration. 260 hours may be done with the student's primary employer, but all students must complete one week (40 hours) in an external organization. Students must submit a practicum proposal indicating approval from a sponsoring organization and learning objectives. Upon completion, the student submits a practicum portfolio. Prerequisite: 2 courses in concentration.

SOCI689 **(1–3)**
Seminar

SOCI690 **(1–3)**
Independent Study

SOCI698 **(2–3)**
Research Project
A research project is carried out by a master's degree candidate in which the student's mastery of the research process is demonstrated. A typical end product might be a community assessment study, a program evaluation study, a best practice benchmarking study, or a problem-solving study. Registration for this title indicates full-time status.

SOCI699 **(4)**
Master's Thesis

BIOLOGY

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Faculty
David A. Steen, *Chair*
Gordon J. Atkins
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James L. Hayward
David N. Mbungu
Marlene N. Murray-Nseula
Robert E. Zdor

Emeriti
John F. Stout
Dennis W. Woodland

Academic Programs	Credits
BS: Biology	
Emphasis Areas	
Behavior/Mathematics	67
Biomedical	38–39
Botany	43
Molecular Biology	37–38
Neurobiology	39
Neuroscience	67–69
Secondary Education	42
Special	43
Zoology	43
Minor in Biology	22
Minor in Environmental Sciences	28
MS: Biology	30
MAT: Biology	

Mission

The Department of Biology provides transformational education in the biological sciences for a diverse student population, set in the context of a Seventh-day Adventist Christian worldview. To achieve this mission we:

- Seek knowledge and develop skills for lifelong learning through rigorous research, teaching and learning in the biological sciences;
- Affirm faith, engender integrity and honor the Creator through personal mentoring, intentional study of life as God's creation, and the ethical practice of science; and
- Change the world by active service, promoting responsible living as stewards of creation, and preparing students for meaningful careers in church and society.

Each degree offered by the Department of Biology includes a common core curriculum and additional courses tailored to students' special needs.

Highly motivated students may compete for the Biology Undergraduate Research Traineeship (BURT) program. For full details, consult your academic advisor.

Undergraduate Programs

BS: Biology

All biology majors must complete the following core and cognate courses:

Biology Core—25

BIOL165, 166, 251, 252, 348, 371, 372, 449, 453

Cognate Core—24 or 26

CHEM131, 132, 231, 232, 241, 242; PHYS141 & 142 or 241/271 & 242/272

General Education Cognates

RELT340, PSYC101 or PSYC180. Students taking the Honors Core do not need RELT340.

Students must complete the biology core, the cognate core, and the requirements for one of the emphases listed below.

Behavior/Mathematics Emphasis—28

See p. 112.

Biomedical Emphasis—13–14

Four of the following: ZOOL315, 464, 465, BIOL475; or PHTH417, 427. Include BCHM421 in the cognate core.

Botany Emphasis—18

A botany course (BOT prefix) drawn from each of the environmental, morphological and functional groups of courses listed below. In addition, include one zoological course (ZOOL prefix).

Molecular Biology Emphasis—12–13

BIOL418, 419, 445, 447, and one of the following four courses: BIOL475; BIOL444, 446; ZOOL315; BOT470 or ZOOL464. Include BCHM421 in the cognate core.

Neurobiology Emphasis—14

A zoology course (ZOOL prefix) drawn from each of the environmental, morphological, and functional groups of courses listed below. In addition, ZOOL475 and either PSYC364 or 449 must be taken. Include BCHM421 and 422 in the cognate core.

Neuroscience Emphasis—26

See p. 112.

Secondary Education Emphasis—17

BIOL208, BOT475, BIOL428, ZOOL454, 484

Available only to those students obtaining secondary teacher certification. For teaching certification requirements, see Teaching, Learning & Curriculum section under School of Education.

Special Emphasis—18

In situations where students are preparing for a specific job opportunity or a graduate or professional program, the special emphasis may be considered if other degree programs are not adequate. The credits must include one biology course each from the functional, morphological, and environmental courses listed below. Additional credits to reach a minimum of 18 are to be selected from courses in biology or other disciplines in consultation with a Department of Biology advisor. Departmental approval must be received before the beginning of the spring semester of the student's junior year.

Zoology Emphasis—18

Include a zoology course (ZOOL prefix) drawn from each of the environmental, morphological, and functional groups of courses listed below. In addition, include one botany course (BOT prefix).

Minor in Biology (22)

BIOL165, 166, 449 and one course each from environmental, morphological, and functional biology electives.

Minor in Environmental Sciences (28)

Suggested electives chosen in consultation with the advisor include: BHSC450, BIOL479, 487, BOT468, 475, CHEM340, GEOG240, PLSC435, ZOOL454, 458, 459, 484

Senior Thesis

A minimum of 3 credits of BIOL495 or HONS497. Biology majors may elect to complete a minimum of 3 credits of original research in a topic of mutual interest with a Department of Biology faculty member and present this original work in the form of a senior thesis. This research experience may be supported by a research scholarship.

Graduate Programs

The Department of Biology offers courses leading to the Master of Science degree and also cooperates with the School of Education in offering courses leading to the Master of Arts in Teaching degree. Students are strongly urged to incorporate into their programs a summer of study at the Rosario Beach Marine Station at Anacortes, Washington. During the 8-week summer session, students may earn 6 to 8 credits.

The Department of Biology collaborates in offering the MS: Mathematics and Science with the departments of Mathematics, Chemistry, and Physics. See the program description under Mathematics and Science, p. 174.

MS: Biology

In addition to the general requirements for admission to and enrollment in graduate degree programs outlined in this bulletin on pp. 44–54, students must meet the following departmental requirements.

Admission Requirements

- A bachelor's degree with major in biology or an approved, related discipline, including courses in cell/molecular biology, organismal physiology, developmental biology, genetics, and ecology.
- A minimum GPA of 3.00 (B) in the undergraduate major for admission to regular student status.
- Cognate sciences, including full-year courses in general chemistry, organic chemistry, and physics. Mathematics through calculus level is encouraged.

Degree Requirements

- The inclusion of BIOL550, 681, 682.
- A written comprehensive examination (BIOL670) completed before the third semester in residence.
- A thesis earning 6 credits (two registrations for BIOL699).
- A final oral examination in defense of the thesis.
- A minimum of 30 credits of approved course work and thesis.

MAT: Biology

Designed to prepare students for teaching biology in secondary schools, this degree is offered through the School of Education. A minor or its equivalent in biology on the undergraduate level is a prerequisite. In consultation with the department chair or the graduate program director, a minimum of 12 (6 credits must be 500-level or above) credits from courses listed below may be applied toward this program.

Required courses are BIOL550 or MSCI526. For further information, see the School of Education section of this bulletin on p. 286.

Courses (Credits)

See inside front cover for symbol code.

General

BIOL100 **$ (4)**
Human Biology
This course is designed to provide students with a basic understanding of the structure and function of the human body. Emphasis is placed on the practical application of principles learned in the areas of nutrition, anatomy and physiology. Meets the life science general education requirement. Weekly: 3 lectures and 1 lab. *Spring*

BIOL221, 222, 223 **$ (4, 3, 1)**
Anatomy and Physiology I, II, III
BIOL221 and 222 include cell biology, functional anatomy and control of each organ system of the human. BIOL221 Weekly: 3 lectures and 1 lab; BIOL222 Weekly: 2 lectures and 1 lab; BIOL223 Weekly: 1 lecture and 1 lab, includes more detailed anatomy. BIOL221 is a prerequisite for BIOL222. BIOL222 or consent of the instructor is the prerequisite for BIOL223. Does not apply to a major or minor. BIOL221: *Fall*; BIOL222: *Spring*; BIOL223. *Spring*.

BIOL208 **$ (4)**
Environmental Science
Study of basic ecological principles as applied to human activities. Discussions deal with contemporary environmental issues. Lab includes field trips, guest speakers, and experiments. Meets the life science general education requirement, applies toward the environmental science minor and certain state educational certification requirements. Weekly: 3 lectures and 1 lab. *Fall, Spring*

BIOL 251 **(1)**
Research Methods I
An introduction to scientific research with a focus on data analysis. Topics include scientific epistemology, hypothesis formation, probability, normal distributions, sampling, descriptive statistics, graphing, statistical inference, t-tests, analysis of variance, correlation, linear regression, and chi-square. Weekly: 1 lecture/discussion. Prerequisites: BIOL165, 166, MATH145 or higher. *Fall*

BIOL252 **(1)**
Research Methods II
Background and experience in understanding and reporting scientific information. Topics include scientific writing, the nature of scientific literature, literature searches, critique of scientific papers, oral and poster presentations, ethics in scientific reporting, preparing manuscripts for journal submission, and writing grant proposals. Weekly: 1 lecture/discussion. Prerequisites: BIOL251, COMM104, ENGL 215. *Spring*

BIOL260 **$ (4)**
General Microbiology
Includes history, morphology, classification, control, growth, transmission, and pathogenicity of selected bacteria, viruses, rickettsia, fungi, and parasites. Covers the nature of host defenses against pathogens, including the acquisition of specific immunity and immune disorders. Weekly: 3 lectures and two 1½ hour labs. Does not apply on major or minor. *Fall*

BIOL330 **$ (4)**
History of Earth and Life
Survey of fundamental concepts of geology and paleontology with application to a study of the history of the earth and of life. Consideration is given to interactions of religious, philosophical, and geological ideas, within a biblical world view. Meets the life science general education requirement. Weekly: 2 lectures and 1 lab. Does not apply to a major or minor. *Spring*

Required Core

BIOL165, 166 **$ (5, 5 or 4, 4)**
Foundations of Biology
Provides a firm foundation for students majoring or minoring in the biological sciences. Weekly: 5 lectures and one 3-hour lab. Ten credits when offered during the academic year; 8 credits when offered at the Marine Biological Station during the summer. BIOL165: *Fall*; BIOL166: *Spring*

BIOL348 **$ (3)**
General Ecology
Ecological principles as applied to individual, population, community, and ecosystem levels of organization. Labs feature the characterization of ecological systems using standard field and lab techniques. Weekly: 2 lectures and 1 lab. Prerequisites: BIOL165, 166 or 208. *Fall*

BIOL371 **$ (3)**
Genetics, Cellular and Molecular Biology I
Mechanisms of heredity are considered in light of classical population and molecular genetics. Labs feature experience in *Drosophila* genetics, chromosome analysis, statistical techniques, and recombinant DNA technology. Weekly: 2 lectures, 1 recitation and 1 lab. Prerequisite: BIOL166, and completion of or simultaneous enrollment in CHEM131. *Fall*

BIOL372 **$ (3)**
Genetics, Cellular and Molecular Biology II
Information from molecular biology, biochemistry, biophysics, physical chemistry, and electron microscopy are integrated to present the cell as a functional unit. Labs provide experience in the collection and analysis of quantitative data about cells. Weekly: 2 lectures and 1 lab. Prerequisite: BIOL166, and completion of or simultaneous enrollment in CHEM132. *Spring*

BIOL449 **$ (3)**
Historical and Philosophical Biology
Examination of biological, paleontological, and geological concepts central to the study of historical events in biological systems. Considers the interactions of data, theories, and extra scientific concepts in historical biology, within the particular context of a biblical world view. Weekly: 2 lectures and 1 lab. Prerequisite: BIOL166. *Spring*

BIOL453 **(1)**
Biology Seminar
This course provides a capstone experience for senior biology majors. Guest speakers and readings focus on ethical dilemmas in science, medicine, dentistry, and science-related public policy issues. The course also serves as a venue for senior biology majors to report results of research projects completed under BIOL495. Weekly: 1 lecture/discussion. Prerequisites: BIOL252, senior status. *Spring*

BIOL478 **♦ $ (0)**
Study Tour:
Travel to destinations relevant to individual programs of study. Classes will be selected from department(s) offerings. Fee may be required.

Electives

(Elective courses offered at the Marine Biological Station may be included under these electives.)

Group A: Environmental Biology

BIOL208 **$ (4)**
Environmental Science
Study of basic ecological principles as applied to human activities. Discussions deal with contemporary environmental issues. Lab includes field trips, guest speakers, and experiments. Meets General Education science requirements for non-science majors and applies toward the environmental science major and certain state educational certification requirements. Weekly: 3 lectures and 1 lab. *Fall, Spring*

BIOL479 **♦ (3.5)**
***Marine Ecology* (offered only at Marine Station)**
A study of interspecific, intraspecific, and community relationships demonstrated by marine organisms. *Summer*

BIOL487 **♦ $ (3)**
Biogeography
The distribution of plants and animals in relation to their environment, including consideration of major biogeographic regions of the world and the role of distribution in adaptive change and diversification of life in the past and present. Weekly: 2 lectures and 1 conference period. *Spring* (odd years)

BOT450 **♦ $ (3)**
Medical Botany
Designed as an interface between botany, medicine, anthropology and pharmacology to define the impact plants have with the remedial, harmful or psychoactive health of humans. Weekly: 3 lectures & 1 lab. Prerequisites: BIOL222. *Spring*

BOT468 **♦ (3.5)**
***Marine Botany* (offered only at Marine Station)**
A systematic study of marine plants found in Puget Sound, with a survey of marine plants from other areas. *Summer*

BOT475 **♦ $ (4)**
Biodiversity of Vascular Plants
A taxonomic and morphological study of vascular plants emphasizing the plants found in the Great Lakes area. Field trips. Weekly: 3 lectures and 1 lab. Open to non-science majors. *Fall*

ZOOL454 **S ♦ $ (3–4)**
Vertebrate Zoology
Covers the various specialties of vertebrate biology, including herpetology, ornithology, and mammalogy. Repeatable in the different specialized areas. Open to non-science majors. Weekly: 2 lectures and 1 or 2 labs. *Vertebrate Zoology: Mammalogy* (*Fall*, even years) and *Vertebrate Zoology: Ornithology* (*Spring*, even years) both qualify as "S" courses for General Education Service Learning.

ZOOL458 **♦ (3.5)**
***Marine Invertebrates* (offered only at Marine Station)**
Biology of invertebrates studied in the marine environment of Puget Sound. A survey of the various phyla is conducted by studying the living animals in the field, and by tide pool observation, dredging, and scuba diving. A project on a specific group or species is required. *Summer*

ZOOL459 **♦ $ (3–4)**
Entomology
Study of the fundamental aspects of insect biology. Weekly: 2 lectures and 1–2 labs. *As scheduled*

Group B: Morphological Biology

BIOL428 **♦ $ (3)**
Paleobiology
Covers various specialities including general and vertebrate paleontology, origins, history, adaptations, diversity and paleoecology of ancient organisms as documented by the fossil record. Repeatable in different areas. Weekly: 2 lectures and 1 lab. Prerequisites: BIOL166. *Fall* (odd years)

BOT430 **♦ $ (3)**
Plant Anatomy
A study of cell and tissue structure and organ development in vascular plants. Weekly: 2 lectures and 1 lab. *As scheduled*

ZOOL315 **$ (3)**
Animal Development
A study of the cellular and tissue-level events that result in the development of integrated organisms. Vertebrate development is emphasized in the lab using frog and chick models. Weekly: 2 lectures and 1 lab. Prerequisite: BIOL166. *Spring*

ZOOL316 **(1)**
Human Embryology
Acquaints students with the process of human development and embryology. Prerequisite: BIOL166. Prior or concurrent registration with ZOOL315 recommended. Weekly: 1 lecture. *Spring*

ZOOL465 **♦ $ (3)**
Histology
Microscopic anatomy, cytology, ultrastructure of tissues and organ systems are correlated with function. Emphasis on normal tissues of vertebrates. Weekly: 2 lectures and 1 lab. *Spring*

Group C: Functional Biology

BIOL418 **♦ (2)**
Immunology
Topics include organs and cells of the immune system, antigens, immunoglobulins, the MHC, antibody diversity, tolerance and memory, complement, cell mediated immunity, regulation, hypersensitivity, autoimmune diseases, transplantation, and

tumor immunology. Weekly: 2 lectures. Prerequisites: BIOL166. *Spring*

BIOL419 **♦ $ (1)**
Immunology Lab
A theoretical and practical study of techniques used in modern immunology. Includes immunoserological methods; isolation and detection of immunoglobulin molecules in immune serum by SDS-PAGE, western blotting, and immunofluorescence antibody (IFA) methods; enzyme-linked immunosorbant assay (ELISA), in vitro phagocytosis. Weekly: 1 lab. Pre- or corequisite: BIOL418. *Spring*

BIOL445 **♦ $ (3)**
Molecular Genetics
An advanced consideration of the structure, function, and manipulation of nucleic acids and application of molecular information in other disciplines. Weekly: 2 lectures and 1 lab. Prerequisites: BIOL371. *Spring*

BOT470 **♦ $ (3)**
Plant Physiology
Study of plant functions including water relations, metabolic pathways, growth regulators, and photomorphogenesis. Weekly: 2 lectures and 1 lab. Prerequisites: BIOL166; CHEM131. *As scheduled*

ZOOL464 **♦ $ (4)**
Systems Physiology
Functional processes used by animals in adjusting to their external environment and controlling their internal environment. Labs involve the firsthand analysis of selected aspects of the major functional systems. Weekly: 3 lectures and 1 lab. Prerequisite: BIOL166, CHEM131. *Fall*

ZOOL468 **$ (3)**
Systems Physiology: Organismal Maintenance
Functional processes that control an animal's internal environment. This course is the same as ZOOL464 but excludes the material on the nervous system. Students who have taken Neurobiology begin the course later in the semester. Weekly: 3 lectures and 1 lab. Prerequisite: ZOOL475. *Fall*

ZOOL475 **♦ $ (3)**
Neurobiology
The neural basis of behavior, with some emphasis on the human nervous system, including cellular and molecular approaches to neuron function, development of neurons and circuits, and neuro-endocrine mechanisms. Labs develop skills in electrophysiology and neuroanatomy. Weekly: 2 lectures and 1 lab. Prerequisite: BIOL166. *Fall*

ZOOL484 **♦ $ (3)**
Animal Behavior
Behavior of animals including considerations of social interactions, learning processes, instinct, motivation, experimental methods, and the analysis of behavior patterns characteristic of various species. Weekly: 2 lectures and 1 lab. Prerequisite: BIOL166. *Spring* (odd years)

Group D: Other Electives

BIOL444 **♦ (1)**
Electron Microscopy in Biological Investigations
The theory, functions, and use of the transmission and scanning electron microscopes. Weekly: 1 lecture. *Spring* (odd years)

BIOL446 **♦ $ (2)**
Electron Microscopy Laboratory
Lab preparation of tissues for transmission and scanning electron microscopy with hands-on experience with the ultramicrotome and both T.E.M. and S.E.M. instruments. Acceptable photographs with interpretations required with lab reports on appropriate research projects. Weekly: 2 labs. Prerequisite: Prior or concurrent registration in BIOL444. *Spring* (odd years)

BIOL447 **♦ $ (3)**
Tissue Culture
Study of theory, application, and techniques useful for propagating tissues in the research laboratory. Topics include sterile techniques, nutrition, media preparation, establishment and maintenance of primary and secondary cultures, enumeration, and analysis. Weekly: 2 lectures and 1 lab. Prerequisite: BIOL166. Pre- or corequisite: CHEM231. *Spring* (even years)

BIOL450 **♦ $ (3)**
Neuropsychopharmacology
A study of the mechanisms of actions of psychotropic agents and how they affect human perception and behavior. Emphasis is placed on the organization and function of the nervous system and the molecular and biochemical basis of drugs used to treat behavioral and clinical disorders. Weekly: 2 lectures and one 3-hour lab. Prerequisites: PSYC101 or 180; BIOL221, 222 or BIOL165, 166. *Spring*

BIOL475 **♦ $ (3)**
Biology of Bacteria
Study of the properties of bacteria that illustrate their function and relationship to other living systems. Topics include structure and function, classification, and interaction with the environment. Weekly: 2 lectures and 1 lab. Prerequisites: BIOL166. Organic Chemistry background recommended. *Fall*

ZOOL425 **♦ $ (3)**
Parasitology
Emphasis on better known parasites of humans and animals. Attention given to ecological factors concerned with host-parasite contact, pathogenicity and pathology, and treatment and effect on parasitized populations. Weekly: 2 lectures and 1 lab. Prerequisites: BIOL166. *Fall*

Research and Specialized Studies

BIOL405 **(1–4)**
Topics in_____
Investigates various specialties of biology. Repeatable in different areas. *Fall, Spring, Summer*

BIOL495 **(1–4)**
Independent Readings/Research
Independent readings or research in biology under the direction of the instructor. Consent of instructor required. *Fall, Spring, Summer*

Graduate

BIOL516 **(4)**
Behavior of Marine Organisms
(offered only at Marine Station)
Study of inter- and intra-specific behavior of marine animals and their behavioral response to the physical environment.

Involves lab experience, field observation, and a research project. Instructor's permission required. *Summer*

BIOL550 **(3)**
Issues in Origins and Speciation
A comparative survey of the assumptions, attitudes, methods, and conclusions of science and religion in the handling of data. Attention is given to current scientific data and their relationship to an understanding of earth history and the present diversity of life. Weekly: 2 lectures. *Spring*

BOT515 **$ (3)**
Plant Cell Biology
Functional activities of plant tissues provide the basis for this study of the ultrastructure of a variety of plant cell types. Attention is given to the cytoskeleton and other organelles involved in plant cell morphogenesis. Weekly: 2 lectures and 1 lab. Prerequisite: BOT470. *As scheduled*

BOT525 **$ (3)**
Molecular Laboratory Techniques
Acquaints students with modern lab techniques of molecular biology. The manipulation and study of nucleic acids and proteins using model systems involving plant-microbe interactions. Weekly: 2 labs. *Fall* (even years)

BOT530 **$ (3)**
Advanced Systematic Botany
Literature and philosophy of plant classification, processes of speciation in higher plants, sources and interpretation of data, biosystematic methods, and plant nomenclature. Weekly: 2 lectures and 1 lab. Prerequisite: BOT475. *As scheduled*

ZOOL500 **$ (3)**
Protozoology
Protozoa, including morphology, physiology, systematics, ecology, reproduction, and host-parasite relationships; emphasis on the parasitic protozoa, but free-living forms also considered; current problems encountered in protozoan research and methods of studying protozoa. Weekly: 2 lectures and 1 lab. Prerequisite: ZOOL425. *As scheduled*

ZOOL520 **(2)**
Molecular and Developmental Neurobiology
A seminar course that deals in depth with current and relevant issues in the areas of molecular and developmental neurobiology. Offered alternate years. Weekly: 2 lectures. *As scheduled*

ZOOL565 **$ (3)**
Environmental Physiology
Study of the physiological responses of animals to their environments. Topics include environmental periodicities and biological clocks, thermal budgets, water balances, and adaptations to extreme environments. Weekly: 2 lectures and 1 lab/problem session. *As scheduled*

BIOL590 **(1–4)**
Topics in _____
Investigates various specialties of biology. Repeatable in different areas. *As scheduled*

BIOL648 **(1–4)**
Workshop

BIOL655 **$ (0)**
Program Continuation
Students may register for this non-credit continuation course to maintain active status. For additional information on active status, please refer to p. 49 in the bulletin. Registration does not indicate full-time status.

BIOL660 **$ (0)**
Thesis Continuation
Student may register for this title while clearing deferred grade (DG) and/or incomplete (I) courses with advisor approval only. Registration for this title indicates full-time status.

BIOL670 **(0)**
Comprehensive Exam

BIOL681, 682 **(1, 1)**
Research Methods and Biology Seminar
An introduction to graduate studies in biology, the nature and methods of science, and principles of research ethics. During second semester reports are made by each student to the group on topics from current literature and on specific problems in biology. Participation once per week for 2 semesters is required. BIOL681: *Fall*; BIOL682: *Spring*

BIOL690 **(1–4)**
Independent Study
Independent study in biology under the direction of the instructor. Consent of instructor required. *Fall, Spring, Summer*

BIOL697 **(1–4)**
Research in Biology
Repeatable to 4 credits. *Arranged*

BIOL699 **(3)**
Master's Thesis
Repeatable to 6 credits. *Arranged*