Purpose Statement:
To enhance student preparation for professional studies in the health sciences.

Program Description
The Department of Biology is committed to helping students maximize their God-given potential. The graduate certificate program in Pre-professional Biology focuses on those students who have already completed the prerequisite coursework for admission into a professional program but require a stronger background in Biology in preparation for taking or improving their admissions exam and/or who may need to boost their science GPA to be competitive for admission to any of a variety of professional programs. Many professional programs are extremely competitive with many applicants being turned away each year. It is critical that a student's application stand out from their peers. The graduate certificate program in pre-professional biology is positioned to assist students in this way. The curriculum has been designed to allow students to demonstrate their ability to be successful in graduate-level coursework as well as to provide them with valuable advising and mentoring as they continue to pursue their goal of attending a professional school. The program is very affordable compared to similar programs around the country and students who leave Union and go on to professional programs are extremely well prepared to be successful at the professional level.

Admission Information

Admission Requirements
• Bachelor's degree from accredited college or university;
  Official transcript(s) showing all course work, completion of baccalaureate degree(s), and all graduate credit previously attempted. Even if withdrawal occurred prior to earning credits and even if those credits do not apply to the current degree being sought, official transcripts must be sent from each institution.
• Minimum undergraduate GPA of 2.5
• Minimum of 12 undergraduate hours in biology applicable to a biology major or minor
• Letter of intent
• Three letters of recommendation
• Scores from professional exam preferred

Retention Criteria
• Must maintain minimum 3.0 GPA
• If not achieved after Fall term, student will be on probation, and will be able to raise the GPA with the Winter term course
• If GPA of 3.0 is not achieved after Winter term, student will be dismissed from the program

Alternate List
Students who otherwise meet the eligibility requirements for the Graduate Certificate program but who apply after the entering class has been filled will be placed on an alternate list and will be notified if they are selected for inclusion in the program for the upcoming academic year. Students who are placed on the alternate list and who are not admitted will receive a refund of half of their Application Fee ($25).

Completion Requirements
Students will take three courses in the Fall (along with one 1-hour required course), one course in the Winter (with lab), and three courses in the Spring. Students are required to take one Fall and one Spring graduate level course that includes the laboratory component of the course, and may take additional laboratory sections if space permits. Minimum hours for completion of the certificate: 25.

A. BIO 508
B. Fall Semester: Three courses from BIO 505 OR 521; 510, 514, 517, 525, or 540 (one of the selected courses must have a lab component)
C. Winter Term: One course from BIO 539, 541, or 542
D. Spring Semester: Three courses from BIO 507 OR 522; 512, 515, 516, 523 (one of the selected courses must have a lab component)
E. Special Topics in Cell or Molecular Biology may be considered if applicable (BIO 597)

Students will be assigned a mentor, and the student and mentor will select a schedule, with the objective being to not duplicate courses that the student has already taken, if possible.

Financial Information
• Application Fee: $50
• Laboratory Fees: A fee of $30 will be assessed to each lab course, except for BIO 510 which requires a $110 fee.
• Tuition/semester hour: $500
• Deposit: $500 (will be applied to your first semester’s tuition following matriculation); due May 1 or within two weeks of acceptance of your application. The deposit is 100% refundable within 20 business days of the acceptance of your application, 50% refundable between 21 and 35 days after acceptance of your application, non-refundable after 35 days of acceptance of your application). No refunds of deposits will be given after July 1.
• General Student Fee: $20/hour
• All financial information is subject to change without notice.
Graduate Certificate students are not eligible for Federal Student Loans, but may be eligible for Private Alternative Loans (uu.edu/financialaid/loans/AlternativeLenderList.cfm). Additional external scholarship information may be obtained through www.fastweb.com

**Course Descriptions: Biology (BIO)**

**505. Applied Anatomy & Physiology I (3) F**
Prerequisites: BIO 221 and 222 or permission of instructor. An intensive examination of the human body that addresses the normal complex physiological processes of the cell, fluids and electrolytes, acid-base balance, temperature regulation, vascular hemodynamics, mobilization of fluids through the body and lymphatic system, musculoskeletal systems and function of the myocardium. The acquired information will provide the student with a body of knowledge to critically evaluate co-existing conditions of the surgical patient.

**507. Applied Anatomy & Physiology II (3) S**
Prerequisites: BIO 221 and 222 or permission of instructor. A continuation of 505 focusing on the normal complex physiological processes of blood components and coagulation and the respiratory, renal, endocrine, digestive and nervous system.

**508. Preparation for Pre-professional Biologists (1) F**
This course is designed to develop critical professional skills in students interested in a career in the biological sciences, with special emphasis on gaining acceptance into professional programs such as medicine, dentistry, and pharmacy. The course will focus on guiding students through the application process, including improving essay writing and interviewing. In addition, it will stress the significance of networking and shadowing in professional and social development, help the students find the best fit for their professional education or career goals, and educate them on alternative career paths in the biological sciences.

**510. Advanced Human Gross Anatomy (3) F**
Prerequisites: BIO 221 & 222 or BIO 505 & 507 or permission of instructor. This course will incorporate the dissection of cadavers and viewing of anatomical models in understanding the nervous, endocrine, cardiovascular, respiratory, digestive, and urinary systems of the human body. Additional emphasis is placed on the needs of professional health care personnel.

**512/512L Comparative Vertebrate Anatomy (3) and Comparative Vertebrate Anatomy Lab (1) S**
Study of the similarities of anatomy and early development of vertebrates, complemented by dissection of representative adults. Three hours lecture and optional 3 hours laboratory/week.

**514. Immune Response to Infectious Disease (3) F**
This course reviews the organisms associated with infections in humans with application directed towards those most commonly encountered in the United States. This will be integrated with a study of the immune system, how the body responds to various types of infections, and relevant clinical treatment methods.

**515/515L. Genetics (3) and Genetics Lab (1) S**
A study of the principles of heredity including both classical and molecular genetics. Three hours lecture and optional 3 hours laboratory/week.

**516/516L. Physiology (3) and Physiology Lab (1) S**
A study of the principles of physiology, emphasizing metabolic processes common to many organisms. Three hours lecture and option 3 hours laboratory/week.

**517/517L. Developmental Biology (3) and Developmental Biology Lab (1) F**
A study of development in organisms, including both classical, descriptive embryology and contemporary investigations of processes involved in morphogenesis and differentiation. Three hours lecture and optional 3 hours laboratory/week.

**521/521L. Advanced Human Anatomy & Physiology I (3) and Advanced Human Anatomy & Physiology I Lab (1) F**
The 1st of a 2-semester sequence designed to establish a knowledge base of human anatomy and physiology. Body systems studied include the integumentary, skeletal, muscular, and nervous systems. Three hours lecture and optional 3 hours laboratory/week.

**522/522L. Advanced Human Anatomy and Physiology II (3) and Advanced Human Anatomy & Physiology II Lab (1) S**
Prerequisite: BIO 521. A continuation of BIO 521 studying body systems: endocrine, cardiovascular, respiratory, urinary, digestive, and lymphatic. Three hours lecture and optional 3 hours laboratory/week.

**523/523L. Cell Biology (3) and Cell Biology Lab (1) S**
A study of biological systems at the cellular and subcellular levels emphasizing functional aspects such as protein procession and sorting, membrane systems, energy generation in mitochondria and chloroplasts, and cell signaling. Three hours lecture and optional 3 hours laboratory/week.

**525/525L. Molecular Biology (3) and Molecular Biology Lab (1) F**
Basic principles of molecular biology focusing on recombinant DNA methods as applied to a variety of biological questions. Students will learn basic research laboratory skills through a wide range of methods from gel electrophoresis to subcloning. Three hours lecture and optional 3 hours laboratory/week.
539. Ecotoxicology (4) W
A comprehensive overview of the ecological consequences of environmental pollution, the effects of toxic substances on the ecosystem as a whole and on individuals with that ecosystem, and the methodology of assessing pollutant damage. Three hours lecture and 3 hours laboratory/week.

540. Experimental Design and Biostatistics (4) F
Statistical analysis of data in a biological context. Students will be given the opportunity to identify a variety of biological problems, develop specific questions, design and conduct experiments to address these questions, formulate and test hypotheses, choose and run the appropriate statistical test, and interpret the outcomes of such test. Three hours lecture and 3 hours laboratory/week.

541. Histology (4) W
The branch of anatomy that deals with structure, composition, design and function of body tissues as it relates to the principles of physiology, biochemistry, molecular biology and medicine. Three hours lecture and 3 hours laboratory/week.

542. Medical Parasitology (4) W
Parasitology is a course that will apply information learned in a variety of Biology courses to the study of parasites and parasitic diseases. Specifically, this course will address the ecology, epidemiology and biochemistry of parasites and diseases caused by parasites. The laboratory will focus on the identification of important parasite groups and methods for host examination and diagnosis. Three hours of lecture and 3 hours laboratory/week.

570. Graduate Project I (2) F, S
Students enrolling in this course will work with a faculty mentor on a year-long project, culminating in a research paper, which will be defended in a public forum before a committee of three faculty members (including the mentor). The mentor will work with the student to select courses to support the general overview of the project.

571. Graduate Project II (2) F, S
Continuation of BIO 570.

597. Special Topics in Cell and Molecular Biology  F, S
Variable content course designed to address cutting-edge topics in cell and molecular biology.