

MASTER OF ARTS IN SCIENCE EDUCATION (M.A.)

Director: Rita Hagevik, Biology

Program Description

The Master of Arts (M.A.) in Science Education program has two concentrations. The Licensure Concentration is designed to prepare currently licensed North Carolina Secondary School Science Teachers for the N.C. Master's/Advanced Competencies License. The program requires 36 s.h. and is a logical extension of any undergraduate science teacher preparation program including those currently offered at UNCP.

The M.A. in Science Education has been designed to provide an opportunity for science teachers who hold a comprehensive Science License, a Biology License, or a Science Content Area License to enter the program and qualify for the N.C. Master's/Advanced License.

While in the M.A. Program, the former undergraduate science education major will be required to concentrate in one of four areas of science (12 s.h. in Biology, Chemistry, Physics, or Earth Science) and take nine additional s.h. in the three areas outside of the concentration (no more than 3 s.h. from any one area). The former undergraduate biology education major or science education major can concentrate in biology (15-18 s.h.) and take an additional 3 s.h. to 6 s.h. in an area or areas outside of biology. Both groups will also take a required core of professional education courses (9 s.h.) and six additional s.h. in science education.

The M.A. in science education will build upon the instructional expertise and leadership qualities and skills of an experienced licensed science teacher by requiring the following qualifications prior to full admission into the program:

1. the applicant must hold either the N.C. Secondary Science Comprehensive License or the Secondary Biology, Chemistry, Earth Science, or Physics License. Any out-of-state applicants will have to hold licenses deemed equivalent to the N.C. licenses.
2. the applicant must meet all of the graduate school general admission requirements.

Another degree program, the Non-Licensure Concentration in Biology, enables individuals to combine their science expertise with advanced understanding of teaching and learning to prepare individuals to teach science in the community such as in a community college or as an instructor in a university or to work as a scientist or perhaps to pursue an advanced degree in the sciences. Students in this program work with a faculty advisor to develop and implement a research project culminating in a thesis. This program includes an internship customized to individualized career goals. In addition, courses are offered in a wide variety of exciting locations including study in Bermuda, Costa Rica, Ossabaw Island, the Grand Canyon, and Nova Scotia. A video and additional program information can be found at http://www.uncp.edu/biology/grad_programs/. The non-licensure program is designed for applicants who meet all of the graduate school general admission requirements for the program with the exception of the teaching licensure requirement and do not desire to pursue a teaching license. Students in this Master's program are prepared to teach in community college settings, non-formal science education settings such as zoos, museums, and aquaria or other professional science settings. Upon admission to the program, students will be required to sign a waiver of North Carolina Standard Professional I and M level licensure.

Program Goals

The major goals of the program are designed to prepare a student to be able to:

1. Apply the theoretical, philosophical, and research bases for educational practice in a variety of science educational settings to improve student learning.
2. Plan, implement, and evaluate instruction that is philosophically consistent with the current National Science Education Standards.
3. Incorporate knowledge of the nature of the learner, learning process, variations in learning abilities, assessments, and strategies for evaluating learning in the secondary school classroom.
4. Plan, implement, and evaluate instruction that is culturally and pedagogically responsive to diverse students.

5. Understand and employ methods of research to examine and improve instructional effectiveness, student achievement, and program evaluation in the science classroom and other non-formal science settings.
6. Understand and link subject matter to students' developmental and diverse needs.
7. Plan, implement, and evaluate instruction that reflects intellectual rigor and depth of knowledge in both science content and pedagogy.
8. Demonstrate self-directed, self-reflective, and research-based practice that provides leadership to colleagues and communities through collaboration, participation, and presentation in international, national, and state science education, science, and/or other educational organizations.

Requirements for a Master of Arts in Science Education

Sem. Hrs.

Core: Required courses

15

EDN 5440 Survey of Educational Research
 EDN 5660 Applied Educational Research
 SCE 5600 Foundations of Science Education
 SCE 5700 Improving 9-12 Science Classroom Instruction
 SCE 5800 Contemporary Issues in Science Education

Content: Choose 21 credit hours from the following:

A concentration in one of these areas (12 hours)

12

(note: Biology Education majors may choose 15-18 hours in Biology)

Biology (required for undergraduate Biology Education majors)

BIO 5100 Marine Biology
 BIO 5120 Topics in Ecology and Environmental Biology
 BIO 5140 Biogeography
 BIO 5150 Advanced Microbiology
 BIO 5200 Current Trends in Molecular and Cell Biology
 BIO 5250 Evolutionary Botany
 BIO 5280 Teaching Practicum in Biology
 BIO 5350 Evolutionary Zoology
 BIO 5400 Natural History of Costa Rica
 BIO 5550 Independent Biology Research
 BIO 5770 Science in the Natural Environment
 BTEC 5300 Principles of Medical Biotechnology
 BIOS 5xxx Special Topics in Biology

Chemistry

CHM 5200 Current Trends in Chemistry
 CHM 5420 Environmental Chemistry
 CHM 5480 Historical Perspectives on Chemistry
 CHM 5500 Spectroscopic Methods of Structure Determination
 CHM 5600 Instruments for Chemical Analysis
 CHMS 5xxx Special Topics in Chemistry

Earth Science

GLY 5010 Essentials of Earth Science
 GLY 5020 Essentials of Earth History
 GLY 5030 Geology of North Carolina
 GLY 5410 Meteorology and Climatology
 GLYS 5xxx Special Topics in Geology
 GGYS 5xxx Special Topics in Geography

Physics

- PHS 5000 The Art and Science of Chemistry and Physics
- PHY 5200 Current Trends in Physics
- PHY 5480 Historical Perspectives of Physics
- PHY 5500 Classical Mechanics
- PHY 5600 Modern Physics
- PHYS 5xxx Special Topics in Physics

Additional courses in the three areas outside of the concentration 9

Students must complete at least 3 semester hours in each of the three areas outside of their area of concentration.

Capstone Experience

Each candidate must select and successfully complete a Comprehensive Portfolio as the final product of the program and successfully complete a Comprehensive Exit Oral Interview.

NOTE: For EDN course descriptions, see listings in the M.A.Ed. program.

Total: 36**Requirements for a Master of Arts in Science Education:** **Sem. Hrs.****Non-Licensure Concentration in Biology****Required Science Education Courses** 6

Choose two of the following:

- SCE 5600 Foundations of Science Education
- SCE 5700 Improving 9-12 Science Classroom Instruction
- SCES 5xxx Special Topics in Science Education

Required Science Content Courses 18-21

A minimum of 18 semester hours from the following:

- BIO 5100 Marine Biology
- BIO 5120 Topics in Ecology and Environmental Biology
- BIO 5140 Biogeography
- BIO 5150 Advanced Microbiology
- BIO 5200 Current Trends in Molecular and Cell Biology
- BIO 5250 Evolutionary Botany
- BIO 5280 Teaching Practicum in Biology
- BIO 5350 Evolutionary Zoology
- BIO 5400 Natural History of Costa Rica
- BIO 5550 Independent Biology Research
- BIO 5770 Science in the Natural Environment
- BTEC 5300 Principles of Medical Biotechnology
- BIOS 5xxx Special Topics in Biology

Guided Electives 9-12

The program director must approve the elective selections based upon the student's career goals and objectives. Students are required to take the following two courses or six credit hours as part of the guided electives section: BIO 5280 and BIO 5550. It is recommended that students take at least one course in research.

Capstone Experience

Each candidate must select and successfully complete a Master's Research Project as the final product of the program and successfully complete a Comprehensive Exit Oral Interview. The Research Project must be approved by the candidate's graduate committee.

Total: 36

COURSES**BIOLOGY DEPARTMENT (BIO/BTEC)****BIO 5100. Marine Biology (3 credits)**

A survey of the common organisms associated with tropical marine habitats. Emphasis will be on fish, invertebrates, algae, and birds. Coverage will include discussions of the coral reef and mangrove communities, ocean currents, and physical and geological factors. The course includes a one-week on-campus study followed by a one-week field, lab work at the Bermuda Biological Station for Research. There are additional costs involved in the trip.

BIO 5120. Topics in Ecology and Environmental Biology (3 credits)

Students will become cognizant of the principles of ecology and environmental biology through analysis of the interactions of organisms with each other and their interactions with the physical environment. The impact of humans and human systems on the natural world will be examined. The interaction of ecological, geological and human processes is examined at regional, national, and global scales. Human management of fragmented landscapes will be discussed. Certain topics may be emphasized according to the expertise of the instructor.

BIO 5140. Biogeography (3 credits)

Students will become cognizant of the principles of biogeography through an analysis of the interactions of organisms with each other and with the physical environment through time. Biogeographic processes are examined at individual, community, and ecosystem levels. The effects of evolution and a changing earth on species distribution and extinction will be assessed. Causes of modern and historical distributions of taxa will be examined.

BIO 5150. Advanced Microbiology (3 credits)

A survey of modern developments emphasizing the application of the knowledge of fundamental microbiology to address problems which exist in today's environment. Topics will be discussed using case studies and problem-based learning and will include comparative genomics, emerging infectious diseases, antibiotic resistance, bioterrorism, microbial biotechnology and archaeal, viral, and prion biology.

BIO 5200. Current Trends in Molecular and Cellular Biology (3 credits)

This course is designed to provide the student with an awareness and appreciation of the rapidly changing trends in molecular and cellular biology. Discussion will include the medical potential and ethical issues raised by developments in these areas. Topics of discussion will include cloning, gene therapy, etc.

BIO 5250. Evolutionary Botany (3 credits)

A survey of all photosynthetic organisms with emphasis on phylogenetic relationships. Topics covered will include early evolution of life and the part photosynthesis played, three billion years of evolution restricted to the aquatic habitat, and evolution of terrestrial plants over the last half billion years.

BIO 5280. Teaching Practicum in Biology (3 credits)

Experience in some aspects of the teaching of biology with formal evaluation, supervision, and direction determined by the supervisory professor and student. PREREQ: Permission of coordinating professor and graduate director of science education. Application must be approved in the semester preceding the one in which the practicum is to be undertaken.

BIO 5350. Evolutionary Zoology (3 credits)

A review of the basic workings of science, evolutionary concepts, and the animal kingdom. Topics will also include animal fossils, morphological & behavioral phylogeny, and human evolution.

BIO 5400. Natural History of Costa Rica (3 credits)

An introduction to different ecosystems within Costa Rica. Students participate in field trips and excursions to study first-hand the biological complexities of the tropics. Students will experience cultural aspects of Costa Rica, discuss Costa Rica's conservation ethic and the impact of humans on the environment. Offered in the summer of odd-numbered years; students spend two full weeks in Costa Rica.

BIO 5550. Independent Biology Research (3 credits)

Advanced students carry out independent research activity relating to a significant problem in a major field of study in biology based on their interests. Supervised by a faculty member. Formal report and preparation required. PREREQ: Permission of the supervising professor and the graduate director of science education. Application must be approved in the semester preceding the one in which the independent research is to take place.

BIO 5770. Science in the Natural Environment (3 credits)

An overview of the study of the natural environment and environmental education methods for science professionals and science educators, including design of and participation in experiential learning programs that emphasize environmental and nature studies. The use of Geographic Information Systems (GIS) for the biological and environmental sciences is emphasized as students create maps, analyze spatial data, and create their own data from field observations. An emphasis is placed on wetland-related topics.

BIO 5xxx. Special Topics in Biology (1-4 credits)

The course content will vary from offering to offering. It will meet the special needs of individuals within the master's program at UNCP and of students who seek credit by enrolling in special departmental offerings such as short courses, seminars, and special, intense summer experiences which focus on concepts within the discipline of biology. Offerings will be on an announced basis.

BTEC 5300. Principles of Medical Biotechnology (3 credits)

The purpose of this course is to provide a broad overview of the methods and strategies of biotechnology for medicinal applications including drug discovery. Major emphasis will be placed on describing therapeutic concepts and how they are developed from the discovery of a molecular target for drugs to the use of disease models to test new pharmaceutical agents. The course covers many aspects of biotechnology, including aspects of molecular pharmacology, gene therapy, and drug safety evaluation. This course also introduces analytical methods as applied to experimental design and quantitative analysis of data encountered in biotechnology and biomedical sciences. Graduate students will also take part in assembling specific components of a manuscript in the drug discovery field. PREREQ: BIO 1000, CHM 1300, and graduate status.

CHEMISTRY AND PHYSICS DEPARTMENT (CHM/PHS/PHY)**CHM 5200. Current Trends in Chemistry (3 credits)**

A survey of current developments and trends in the various fields of chemistry. PREREQ: At least 24 credit hours of undergraduate coursework in chemistry or consent of the instructor and the department chair.

CHM 5420. Environmental Chemistry: Water Chemistry (3 credits)

A study of water in our environment and our daily lives focusing on human interactions with water. Field trips allow first-hand experience with some of the issues covered. PREREQ: General Chemistry (CHM 1300 or equivalent); one semester of Organic Chemistry and General Biology recommended.

CHM 5480. Historical Perspectives of Chemistry (3 credits)

This course emphasizes the development of physical concepts in the discipline of chemistry from the earliest records through Aristotle, the alchemist and beyond, to the present. Topics include contributions of such scientists as Boyle, Lavoisier, Dalton, Mendeleev, Rutherford, and others. Discussions concerning their methods, motives, and the mental and social climate of their time are also included.

CHM 5500. Spectroscopic Methods of Structure Determination (3 credits)

The student will be introduced to the process by which the modern organic chemist determines the atom-to-atom structure of organic molecules. A review of empirical and molecular formulas, and what can be learned from them, is included. However, the major focus of the course will be teaching the student about the use of a number of instrumental techniques that is used in the elucidation of individual molecular structures. The specific techniques, and how they relate to molecular structure determination, include: UV-VIS (ultra violet-visible spectroscopy), IR (infrared spectroscopy), mass

spectrometry (simulated data only), and various introductory and advanced NMR (nuclear magnetic resonance spectroscopy) techniques, including Proton and Carbon-13, COSY, DEPT, and HETCOR. PREREQ: At least 24 credit hours of undergraduate coursework in chemistry or consent of the instructor and the department chair.

CHM 5600. Instruments for Chemical Analysis (3 credits)

A course examining the theory and operation of instrumentation used for quantitative and qualitative analyses of matter. A combination of lecture and laboratory activities will develop both student knowledge of and skills in a variety of modern spectroscopic, electrochemical and chromatographic techniques. PREREQ: At least 24 credit hours of undergraduate coursework in chemistry or consent of the instructor and the department chair.

CHMS 5xxx. Special Topics in Chemistry (3 credits)

Course content will focus on topics in chemistry and will vary from offering to offering, with prerequisites appropriate to content. It will meet the special needs of individuals within the master's program at UNCP and of students who seek credit by enrolling in special departmental offerings such as short courses, seminars, and special, intense summer experiences which focus on concepts within the discipline of chemistry.

PHS 5000. The Art and Science of Chemistry and Physics (3 credits)

Essential concepts of chemistry and physics will be explored in the context of current topics in science and technology. Varied course assignments will actively engage students in the review of popular and scientific literature; the collection, analysis, interpretation, and presentation of scientific data; and the correlation of scientific knowledge to societal issues. PREREQ: Enrollment in an MA or MS degree program.

PHY 5200. Current Trends in Physics (3 credits)

A survey of current development and trends in the various fields of physics. PREREQ: At least 24 credit hours of undergraduate coursework in physics or consent of the instructor and the department chair.

PHY 5480. Historical Perspectives of Physics (3 credits)

This course emphasizes the development of physical concepts in the discipline of physics from the earliest records through Aristotle, Einstein and beyond, to the present. Topics include contributions of such scientists as Copernicus, Galileo, Newton, Boyle, Rutherford, Millikan, Bohr, DeBroglie, Schroedinger, and others. Discussions concerning their methods, motives and the mental and social climate of their time are also included.

PHY 5500. Classical Mechanics (3 credits)

Newtonian mechanics, linear oscillations, non-linear oscillations, introduction to calculus of variation. Hamilton's principle and La Grange's equations, central force motion, non-inertial frames, rigid body dynamics, vibrating systems. PREREQ: At least 24 credit hours of undergraduate coursework in physics or consent of the instructor and the department chair.

PHY 5600. Modern Physics (3 credits)

Special theory of relativity; introductory quantum mechanics with applications to microscopic systems; Fermi-Dirac, Bose-Einstein statistics; and electronic bands in solids. PREREQ: At least 24 credit hours of undergraduate coursework in physics or consent of the instructor and the department chair.

PHYS 5xxx. Special Topics in Physics (3 credits)

Course content will focus on topics in physics and will vary from offering to offering, with prerequisites appropriate to content. It will meet the special needs of individuals within the master's program at UNCP and of students who seek credit by enrolling in special departmental offerings such as short courses, seminars, and special, intense summer experiences which focus on concepts within the discipline of physics.

GEOLOGY AND GEOGRAPHY DEPARTMENT (GLY, GGY)**GLY 5010. Essentials of Earth Science (3 credits)**

Advanced study of topics in geology, meteorology, oceanography, and solar system astronomy.

GLY 5020. Essentials of Earth History (3 credits)

An Advanced study of earth history as recorded in the rock record. Topics include geologic time; evolution of the continents, oceans and atmosphere; fossils and the development of life through time; and the historical development of geologic concepts. PREREQ: GLY 5010 or permission of the instructor.

GLY 5030. Geology of North Carolina (3 credits)

Study of the geology of North Carolina. Areas include the Blue Ridge, Piedmont, Newark-type Basins, and Coastal Plain. Topics include rocks, structures, environmental geology, economic geology, and plate tectonic implications of these regions. May include field trips.

GLY 5410. Meteorology and Climatology (3 credits)

Analysis and presentation of weather and climate information. Emphasis on explanatory methods in basic meteorology. Graphical representation and modeling of weather elements, atmospheric processes and climate regions.

GLYS 5xxx. Special Topics in Geology (1-4 credits)

Course content will change from offering to offering. It will meet the special needs of individuals within the master's program at UNCP and of students who seek credit by enrolling in special departmental offerings such as short courses, seminars, and special intense summer experiences that focus on concepts within the discipline of geology. Offerings will be on an announced basis.

GGYS 5xxx: Special Topics in Geography (1-4 credits)

Course content will change from offering to offering. It will meet the special needs of individuals within the master's program at UNCP and of students who seek credit by enrolling in special departmental offerings such as short courses, seminars, and special intense summer experiences that focus on concepts within the discipline of geography. Offerings will be on an announced basis.

SCIENCE EDUCATION (SCE)**SCE 5000. Teaching Science in Grades 6-12 (3 credits)**

Purposes, methods, materials, and evaluation procedures in the life and physical sciences; preparation of teaching plans and materials appropriate for teaching science in the 6-12 classroom. Limited to MAT students only. PREREQ: Formal admission to the MAT program; EDN 5500.

SCE 5600. Foundations of Science Education (3 credits)

Historical, philosophical, sociological, political, and economic factors affecting science education in the schools of the United States will be analyzed. The goals of science education in the United States from the early nineteenth century to the present along with the implications of various learning theories and models for curriculum development will be examined. Current trends, issues, and problems in science education will also be evaluated.

SCE 5700. Improving 9-12 Science Classroom Instruction (3 credits)

This course will focus on the application of major principles of education and psychology for the improvement of science teaching in the secondary school science classroom. This will include clarification of goals and objectives of science teaching, instructional strategies, assessment, elements of a desirable classroom climate, and a critical analysis of research relevant to the teaching of all science disciplines.

SCE 5800. Contemporary Issues in Science Education (3 credits)

Students will continue in-depth studies into problems and emerging issues related to standards-based science education instruction and programs building upon the knowledge, skills, and dispositions addressed in both SCE 5600—Foundations of Science Education and SCE 5700—Improving 9-12 Science Classroom Instruction. In this culminating course, students will finalize their field-based

experiences and/or leadership project and present the results at a professional meeting. Prerequisites: SCE 5600 and SCE 5700.

SCE 5810. Internship in 9-12 Science Education (3 credits)

Ten week, full-time internship experiences in an off-campus public school setting appropriate for 9-12 Science licensure. PREREQ: Approval of the Science Education Program Director.

SCES 5xxx. Special Topics in Science Education (1-4 credits)

The course content will vary from offering to offering, but it will be designed to encompass a variety of concepts and pedagogy within the area of science education. It will meet the special needs of individuals within the master's program at UNCP, as well as students seeking credit in special offerings such as short courses, seminars, and special, intense summer experiences.