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

Director: Peter Wish, 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 two undergraduate science teacher preparation programs currently offered at UNCP; one, the B.S. in Science Education Program and, two, the Biology Education program. Students who completed the B.S. in Science Education Program (science education majors) were eligible for the N.C. Secondary Comprehensive Licensure and were licensed to teach any and all of the science courses offered in N.C. Secondary Schools. Students who completed the Biology Education Program (biology education majors) were eligible for the N.C. Secondary Biology Licensure and were limited to teaching only biology. The M.A. in Science Education has been designed to provide an opportunity for science teachers who hold either the comprehensive Science License or the Biology 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 ed. 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 ed. major will 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 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.

The Non-Licensure Concentration in Biology 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. Upon admission to the program, students will be required to sign a waiver of North Carolina A 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 secondary school classrooms to improve student learning.
2. Plan, implement, and evaluate instruction that is philosophically consistent with the Constructivist viewpoint.
3. Incorporate knowledge of the nature of the learner, learning process, variations in learning abilities and learning styles, and strategies for evaluating learning in the secondary school classroom.
4. Plan, implement, and evaluate instruction that is responsive to wide variations in students' learning needs and learning styles.
5. Understand and employ methods of research to examine and improve instructional effectiveness and student achievement, particularly in the Constructivist science classroom.
6. Understand and link subject matter and students' developmental and diverse needs in the context of secondary science classrooms.
7. Plan, implement, and evaluate instruction that reflects intellectual rigor and depth of knowledge in both science content and students' diverse learning needs.
8. Demonstrate self-directed, self-reflective professional behavior and the importance of providing leadership to colleagues and communities through collaboration and participation in state and national science education organizations.

Requirements for a Master of Arts in Science Education: Licensure Concentration — **Sem. Hrs.**

Required Professional Studies Core 9
- EDN 550 Applied Educational Psychology
- EDN 565 Applied Philosophy of Education
- EDN 566 Applied Educational Research

Specialty Area Requirements

Science Education Core 6
- SCE 560 Foundations of Science Education (required)
- Choose either (a) or (b) (depending on one's area of concentration):
  - (a) SCE 561 Improving Classroom Instruction in the Life and Earth Sciences
  - (b) SCE 562 Improving Classroom Instruction in the Physical Sciences
- SCES 5xx Special Topics in Science Education (elective)

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 510 Marine Biology
- BIO 512 Topics in Ecology and Environmental Biology
- BIOS 5xx Special Topics in Biology
- BIO 515 Advanced Microbiology
- BIO 520 Current Trends in Molecular and Cell Biology
- BIO 525 Evolutionary Botany
- BIO 535 Evolutionary Zoology

Chemistry
- CHM 520 Current Trends in Chemistry
- CHM 548 Historical Perspectives on Chemistry
- CHM 550 Spectroscopic Methods of Structure Determination
- CHM 560 Instruments for Chemical Analysis

Earth Science
- GLY 501 Essentials of Earth Science
- GLY 502 Essentials of Earth History
- GLY 504 The Physiography and Ecology of the Atlantic Coastal Plain
- GLY 541 Meteorology and Climatology

Physics
- PHY 501 Classical Mechanics
- PHY 516 Modern Physics
- PHY 520 Current Trends in Physics
- PHY 548 Historical Perspectives of Physics

Additional courses in the three areas outside of the concentration 9

(note: Science Education majors choose no more than 3 s.h. from any one area; Biology Education majors may choose 3-6 s.h. outside the Biology concentration)
- Biology: BIO 512 or 520
- Chemistry: CHM 520 or 548
- Earth Science: GLY 501 or 502
- Physics: PHY 520 or 548

Capstone Experience

Each candidate must select and successfully complete either a Master's Research Project or Comprehensive Portfolio as the final product of the program and successfully complete a Comprehensive Exit Oral Interview.

Total: 36

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

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 560 Foundations of Science Education	
SCE 561 Improving Classroom Instruction in the Life and Earth Sciences	
SCES 5xx Special Topics in Science Education	
Required Science Content Courses	18-21
A minimum of 18 semester hours from the following:	
BIO 510 Marine Biology	
BIO 512 Topics in Ecology and Environmental Biology	
BIO 515 Advanced Microbiology	
BIO 520 Current Trends in Molecular and Cell Biology	
BIO 525 Evolutionary Botany	
BIO 535 Evolutionary Zoology	
BIOS 5xx Special Topics in Biology	
Guided Electives	9-12
The program coordinator must approve the elective selections based upon the student's career goals and objectives.	
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)

BIO 510. Marine Biology

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 512. Topics in Ecology and Environmental Biology

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 515. Advanced Microbiology

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 520. Current Trends in Molecular and Cellular Biology

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 525. Evolutionary Botany
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 535. Evolutionary Zoology
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.

BIOS 5xx. Special Topics in Biology (1-4 hours)
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.

CHEMISTRY AND PHYSICS DEPARTMENT (CHM/GLY/PHY)

CHM 520. Current Trends in Chemistry
A survey of current developments and trends in the various fields of chemistry.

CHM 548. Historical Perspectives of Chemistry
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 550. Spectroscopic Methods of Structure Determination
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 Spectrophotometry (simulated data only), and various introductory and advanced NMR (nuclear magnetic resonance spectroscopy) techniques, including Proton and Carbon-13, COSY, DEPT, and HETCOR.

CHM 560. Instruments for Chemical Analysis
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.

GLY 501. Essentials of Earth Science
Advanced study of topics in geology, meteorology, oceanography, and solar system astronomy.

GLY 502. Essentials of Earth History
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. Prerequisites: GLY 501 or permission of the instructor.

GLY 504. Physiography and Ecology of the Atlantic Coastal Plain
A systematic study of the physical and cultural setting of the Atlantic Coastal Plain. Topics include soils, water, vegetation, landforms (including extensive study of Carolina bays), weather and climate, population, settlement and resource use. The course includes weekend field trips.

GLY 541. Meteorology and Climatology
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.

PHY 520. Current Trends in Physics
A survey of current development and trends in the various fields of physics.

PHY 548. Historical Perspectives of Physics
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 550. Classical Mechanics
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.

PHY 560. Modern Physics
Special theory of relativity; introductory quantum mechanics with applications to microscopic systems; Fermi-Dirac, Bose-Einstein statistics; and electronic bands in solids.

SCIENCE EDUCATION (SCE)

SCE 560. Foundations of Science Education
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 561. Improving Classroom Instruction in the Life and Earth Sciences
This course will focus on the application of major principles of education and psychology for the improvement of science teaching in the secondary school life and earth science classrooms. 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 the life and earth sciences.

SCE 562. Improving Classroom Instruction in the Physical Sciences
This course will focus on the application of major principles of education and psychology for the improvement of science teaching in the secondary school chemistry and physics classrooms. 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 chemistry and physics.

SCES 5xx. Special Topics in Science Education (1-4 hours)
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.