

Section 2: Program Summary

Biology (DA): Secondary Minor and Major

The University Detroit Mercy (UDM), a Catholic institution whose mission flows from the educational traditions of the Sisters of Mercy of the Americas and the Society of Jesus, exists to provide excellent student-centered undergraduate and graduate education in an urban context. A UDM education seeks to integrate the intellectual, spiritual, ethical, and social development of students. It emphasizes the worth of the individual. Further, the University expects its diverse graduates to be distinguished world citizens, community members, and leaders who:

- Reflect on the meaning of their lives.
 - Think and communicate clearly, imaginatively, and effectively.
 - Process the skills and competencies of a college education.
 - Understand diverse cultural heritages.
 - Have a sense of social responsibility and a desire to serve society.
- (2003-2005 Undergraduate Catalog, 89-91)*

UDM's Core Curriculum consists of a set of requirements (48 hours) based on six objectives that express, in further detail, this academic purpose. The list of approved core courses is published in the *Schedule of Classes* issued for each term. Education students taking their majors in the College of Engineering and Science (CES) must complete the same Core Curriculum as all UDM students with specific recommendations from Core options in Objectives 1, 2, 3, 5 and 6; Objective 4 remains the same as the general core outline requirements. The specific CES recommendations are:

- Objective 1 Communication Skills—Take CST 101 Fundamentals of Speech and ENL 131 Academic Writing.
- Objective 2 Mathematical and Computer Skills—Take MTH 140 (or MTH 141/142 depending on the program) and Computer Science (Required course depends on program).
- Objective 3 Scientific Literacy—At least two courses must be in Natural Science. In some programs, all courses may be selected from Natural Science.
- Objective 5 Diverse Human Experience—Two courses from 5A (History and Religious Studies), 5B (Literary Experiences), and 5C (Aesthetic Experiences). Take one course from 5D (Comparative Experiences).
- Objective 6 Social Responsibility—Education students choose one course from any of the Ethics courses.)
Contemporary Socio-Political Problems—(Education students choose one course from the general core outline—depending on the program.) *BIO 499 is included in the list of courses that fulfill this UDM core objective. (Class Schedule on Web site.)*

The Biology Minor and Major for Secondary Teacher Education are offered by the Biology Department in the CES.

The Department of Education, housed in the College of Liberal Arts and Education (CLAE), offers baccalaureate, post-degree, and master's degree teacher education programs with State of Michigan certification in three areas: Elementary Education, Secondary Education, and Special Education. Each program requires the completion of coursework in three areas:

- University core curriculum.
- A teaching major and minor in approved academic areas.
- Professional education, including student teaching.

In addition to these programs, UDM Education Department delivers the same graduate and postgraduate certification programs to cohorts of K-12 Detroit Archdiocese teacher candidates through Experience Plus. All programs may be completed on a full or part-time basis either during the day, late afternoon, evening, or weekend. UDM majors and minors in Elementary, Special Education, and/or secondary education are completed in the following colleges and appropriate departments:

- College of Business Administration
- College of Engineering & Science (Includes Mathematics) and
- College of Health Professions
- College of Liberal Arts

The Department of Education, therefore, works closely with the faculty members throughout the University to ensure that each student is effectively advised and assisted to complete her/his Education program with a quality major and/or minor.

UDM offers teacher certification in Biology (DA) for students who wish to teach in secondary schools. The Biology minor is a program of 24 required hours, which are completed in the College of Engineering and Science. The Biology major is a program of 44 required credit hours. Pre- and co-requisite courses provide teacher certification Biology majors with an additional 28 credits, and teacher certification Biology minors an additional 17 additional credits in relevant science coursework. The *Michigan Curriculum Framework* for Biology specifies the guidelines for integrating basic concepts and scientific inquiry skills into real-world contexts throughout a secondary Biology program. Those concepts include the areas cells and cell theory, organization and life processes of living things, human biology, heredity and evolution, ecology and ethology. UDM students take classes that give them an in depth knowledge of these concepts and the appropriate biology inquiry skills to become a secondary education teacher who also makes positive contributions to society. The Biology teacher education program provides personal instruction by scholars in their field, strong laboratory experiences, and comprehensive study of the various areas of Biology.

A. Philosophy, Rationale, and Objectives

Philosophy: The Biology faculty members, housed in the Chemistry and Biochemistry Department in College of Engineering and Science, and the Education Department faculty work together to prepare teacher education candidates for the Biology teacher certification. The philosophies of these two departments are complementary. The Biology Department's mission is to establish a strong scientific and career foundation, as well as an educational ethic in students that will

continue to serve the student's personal and professional needs upon graduation. The establishment of such an ethic is facilitated by:

1. the personal attention awarded to all students and their academic needs,
2. the model of professionalism typified by faculty through active research endeavors and lecture demeanor,
3. the diversity of course work that develops an extensive scientific background, and
4. instillation of professional and communal responsibility in students of Biology.

Both departments believe that theory and scholarly research need to be placed in the proper historical, social, and political context. They seek to integrate laboratory and field experience into the learning process so that students not only learn about their discipline but also construct knowledge in a real and tangible manner. Students, thus, have the advantage of developing a knowledge and skill base which empowers them to be active, positive contributors to the local, national and global societies. In order to teach students from diverse backgrounds, socio-economic status, and abilities in urban, suburban, and rural settings, UDM Education and Biology faculty believe that a strong pedagogy program must be a full partner with academic knowledge.

Rationale: The role of science in today's complex and highly technological society is considered a critical determinant to our future as a global community. With this in mind, the faculties of the Biology and the Education Departments strive to provide an education which integrates the intellectual, spiritual, moral and social development of their students. This integration requires a solid base of discipline knowledge which demonstrates the interrelationships within the discipline as well as those relationships with other disciplines. It is through this kind of study that students learn and practice the knowledge and skills required to be inquiring, reflective, ethical and value-driven educators. Preparation for the Biology secondary teacher certification enables teacher candidates to use this knowledge and skill base to make knowledgeable, practical and creative applications of theory as well as to identify issues and solve problems which challenge our ability to create a better world.

In today's complex world, Biology teachers need to use the skills of the art and science of teaching to teach their students to learn how science can help them to be productive members of society. Recent developments such as biogenetic engineering, advancing medical technology, biodiversity, and ecological systems in peril require ethical, caring, responsive citizens capable and willing to make knowledgeable decisions. The Biology program of studies is designed to provide the knowledge, skills, and practice that Teacher Education students need in order to be competent educators in this regard.

Objectives: The general objectives for the preparation of all secondary teacher education candidates, including those with secondary Biology Majors and Minors, are delineated in the “Education Department’s Conceptual Framework,” which is published annually along with the “Education Department’s Code of Ethics” in its *Teacher Education Handbook*. This “Framework,” which complements the Michigan Department of Education’s Standards for the Secondary Physical Science programs and the Entry-Level Standards for Michigan Teachers (ELSMT), identifies three dimensions of the role of teacher:

- A *scholar* who uses the research-knowledge base for teaching integrated with the liberal arts and sciences disciplines.
- An *inquirer* who is skilled in decision-making based on ethical, critical, and reflective thinking.
- A *moral agent* who values and acts according to the UDM values and the “Department of Education Professional Code of Ethics.”

These general objectives, in addition to complementing the University mission and the Biology department’s philosophy, reflect the key ideas expressed by the Michigan State Board of Education-January 2002 Content Guidelines/Standards (SBE Standards) and the “*Michigan Curriculum Framework Content Standards for Biology*”. Additionally, they are aligned with the Michigan Test for Teacher Certification (MTTC).

These content categories have been reviewed by the Biology and Education faculty, who believe that the Biology program of studies effectively prepares candidates for certification as teachers of Biology in the secondary classroom as follows:

Sub area	Approximate Percentage Of Questions on Test
Constructing and Reflecting on Scientific Knowledge	22%
Cells and Cell Theory	13%
Organization and Life Processes of Living Things	13%
Human Biology	20%
Heredity and Evolution	16%
Ecology and Ethology	16%

Constructing and Reflecting on Scientific Knowledge

- ▶ Apply procedures for gathering, organizing, interpreting, evaluating and communication data.
- ▶ Identify and apply principles and procedures of research and experimental design.
- ▶ Identify and apply procedures related to the proper use of tools and equipment, and materials (including chemicals and living organisms) commonly used in biology, and practices for maintaining safety during biological investigations.
- ▶ Analyze historical and social aspects of biological study and contributions made to biology by people of diverse backgrounds.

- ▶ Understand the interrelationships of biology, society, technology, and other sciences and disciplines.
- ▶ Analyze the nature of scientific thought and inquiry.
- ▶ Understand processes for decision making related to biological problems and issues.

Cells and Cell Theory

- ▶ Understand cell structure and function and the cell theory.
- ▶ Understand the chemical components of living systems and basic principles of biochemistry.
- ▶ Analyze physiological processes of cells.
- ▶ Analyze cell growth, division, and differentiation.

Organization and Life Processes of Living Things

- ▶ Understand principles of taxonomy and classification in biology.
- ▶ Analyze reproduction, development, and life cycles of living organisms.
- ▶ Analyze the processes used by living organisms to obtain, store, and use energy.
- ▶ Analyze the anatomy and physiology of living organisms.

Human Biology

- ▶ Understand the structures and functions of the human skeletal, muscular, and integumentary systems.
- ▶ Understand the structures and functions of the human circulatory and immune systems.
- ▶ Understand the structures and functions of the human respiratory and excretory systems.
- ▶ Understand the principles of human nutrition and structures and functions of the human digestive system.
- ▶ Understand the structures and functions of the human nervous and endocrine systems.
- ▶ Understand the structures and functions of the human reproductive systems and the processes of embryonic development.

Heredity and Evolution

- ▶ Understand the principles of Mendelian and non-Mendelian genetics.
- ▶ Understand the synthesis of DNA, RNA, and protein.
- ▶ Understand genes, chromosomes, and changes in genetic material.
- ▶ Analyze the process of natural selection.
- ▶ Analyze the theory of evolution.

Ecology and Ethology

- ▶ Understand populations and communities.
- ▶ Understand types and characteristics of ecosystems and biomes and factors affecting their change over time.
- ▶ Analyze the cycling of materials through an ecosystem.
- ▶ Understand human ecology and the physical and societal effects of human activities on the environment.

- ▶ Understand basic concepts of animal behavior.

B. Sequence of Courses and/or Experiences

UDM's College of Liberal Arts and Education offers baccalaureate, post-degree, and master's degree teacher education programs with State of Michigan certification in three areas: Elementary Education, Secondary Education, and Special Education. Each program requires the completion of coursework in these areas:

- University core curriculum.
- A teaching major and a teaching minor in approved academic subject areas.
- Professional education, including field experiences and student teaching.

The UDM 48 Hour Core Curriculum is explained in the *2003-2005 Undergraduate Catalog* (89-91) and is published, with a list of approved courses for each of the six objectives, in the *Class Schedule* for each of the three terms (16-18 Term I 2003-2005). Education students are encouraged to select courses that will complement their certification as well as their major and minor areas of study. For example: Biology students would be encouraged to select courses in the Math, Science, Social Studies, Literature, and the Fine Arts that would complement their Biology major or minor as well as their other area of study. Those objective areas are:

1. Communication Skills (6 hours; 2 courses—Speech and Academic Writing).
2. Mathematical and Computer Skills (6 hours—choices in Mathematics and Computer).
3. Scientific Literacy (9 hours—choices from the Social Sciences and Natural Sciences. All Biology course have natural science components and are geared to expand a knowledge base in biology and not specific subfields that potentially could be specifically skewed to health care.
4. Meaning and Value (9 hours—choices from Philosophy, Religious Studies).
5. Diverse Human Experience (12 hours—choices form Historical, Literary, Aesthetic, Comparative Experiences and Languages).
6. Social Responsibility (6 hours—choices from Ethics and Contemporary Social Problems, ranging from Philosophy, Health Services, Religious Studies across Social and Natural Sciences, Criminal Justice, Communication, Women's Studies.)

The sequence of courses listed in Form XX for the Biology majors and minors provides a systematic study of the fundamental knowledge of the Biological Sciences and their methods of inquiry. A foundation is thereby established for students' future pursuits, including a career in secondary education. The core courses in the Biology sequence develop the students' understanding of the fundamental concepts that comprise the content of Biology and the methods used to create knowledge in this discipline. Course work for a Biology major leading to secondary certification in Biology develops the students' understanding of the fundamental knowledge of the Biological Sciences as well as the interrelationships

among the various fields of Biology and to the other scientific disciplines of Chemistry, Physics, and Earth Science. The courses also engage the students in societal issues related to biology. General Biology I and II (BIO 120 and 122 with accompanying labs) provide a basic framework of biological principles and their application to living systems at the cellular, organismal, and population levels. Form and function are studied in Comparative Anatomy (BIO 260 and its 261 laboratory) or Physiology (BIO 463 and its 464 laboratory) and in Plant Form and Function (BIO 451 and its 452 laboratory). Biological systems are studied by majors in one of the following courses: BIO 420 Evolution or BIO 270 Genetics or BIO 375 Human Genetics, as well as in BIO 421 Microbiology with its laboratory, BIO 422, and BIO 474 Cell and Molecular with its laboratory, BIO 475. Biological systems are studied by both majors and minors in BIO 448 Ecology with its laboratory, BIO 449. Then, BIO 103 Environmental Science provides the Biology minors with the opportunity to examine the effect of science in society and of social attitudes on the practice of science using their knowledge of scientific principles and inquiry. Majors have similar opportunities to understand society and biological relationships in BIO 290 Biometric and BIO 499 Biology and Social Issues.

In addition to being part of the Biology courses, the relationship of Biology to the other scientific and mathematical disciplines is addressed in the UDM Core Curriculum Requirement, particularly Objective 3—Scientific Literacy. In addition, there are science and mathematics courses which are either required of all Biology majors or are prerequisites or co-requisites to Biology courses in the planned program of study.

C. Varied Instructional Approaches

The Biology faculty and the Education faculty prepare students to utilize a variety of instructional approaches by modeling creative, logical, and effective teaching practices in their classes. A review of the Biology course syllabi reveals the range of teaching methods used by that faculty to instill the skills and knowledge of the discipline: lectures, discussion, study guides, textbooks, laboratory experiments and reports, films, quizzes, use and review of web sites, critical analysis of articles from scholarly journals, essays, and examinations.

A review of the Education Syllabi on the UDM WEB reveals a similar range of teaching methods practiced by the Education faculty. Educators also include group/team/collaborative activities, building a community of learners, both non-fiction and fiction analysis, field observations and research, written and oral presentations enhanced with electronic equipment/programs, and other education projects and assessment tools. A review of the Education Courses listed in Form XXX, the “Course Descriptions,” and the course syllabi on the WEB link explicates the wide range of instructional methods taught to Secondary and Special Education teacher candidates. EDU 400 Introduction to Education provides a semester long initial field experience with the “Field Research/Case Study” where students observe and work with a teacher in their major and/or minor areas. This project allows them to observe a variety of instructional strategies and to reflect upon their effectiveness

and appropriateness for their developing teaching style. In EDU 469 Curriculum and Methods of Teaching in Secondary Schools I, students are introduced to secondary level curriculum and instructional methods. Topics include methods of instruction, classroom leadership/management, lesson designs, assessment, evaluation, and reporting of student progress. In EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science, they are asked to consider Biology as they concentrate on learning the theory behind instructional methods uniquely effective for teaching and learning science. They also have opportunities to observe and reflect about learning in grade 6-12 classrooms as well as to practice methods within the college classroom and in grade 6-12 classrooms. EDU 478/578 Reading in the Content Areas provides instruction in a variety of methods for teaching reading to secondary students across the curriculum. In addition to a variety of technology methods used and demonstrated in all the Education courses, EDU 459 Instructional Technology and EDU 600 Computer Use in Education teach a variety of instructional approaches for using many kinds of technology to assess various learning styles of students and to accommodate those learning styles. These courses also develop the candidates' knowledge, skills, and attitudes for applying technology in education settings. As the candidates develop their assignments, the science candidates focus on their majors and minors. These courses were developed to address the Seventh Standard of the Entry Level Standards for Michigan teachers. Student teaching, EDU 490, for secondary (6-12 grades), as well as SED 474 and SED 489 (Special Education candidates), provides students with a full semester of grade 6-12 real teaching experiences with both grade 6-12 cooperating teachers and UDM college supervisors. Observations early in those courses and eight seminars complement their experiences and encourage self reflection and feedback about their instructional methods in collaboration with grade 6-12 Co-operating Teachers and UDM College Supervisors. Candidates with Biology majors are assigned to secondary teachers who teach Biology. If at all possible, the Co-operating Teacher to whom the majors are assigned also teaches a class in the candidate's minor area. The same effort is made to assign Biology minors to a Co-operating Teacher for their major area who also teaches Biology.

D. Elementary and Secondary Level Preparation Differences

The Biology major is only offered for secondary level.

E. Gender Equity, Multi-cultural, and Global Perspectives

Biology majors and minors learn to incorporate issues of gender equity, multicultural and global perspectives which are addressed within their University Core Curriculum courses. Objective IV- Meaning and Value (9 hours), Objective V- Diverse Human Experience (9 hours) and Objective VI-Social Responsibility (5-6 hours) require all students to select classes from Philosophy, Religious Studies, History, English, Human Services, and/or the Fine Arts. Instructors in the courses of the Chemical Science programs take care to provide a comfortable learning environment for those whose voices have traditionally been stifled in the physical sciences and mathematics. The College's success is documented by the National Science Foundation's recognition that the College of Engineering and Science has a

highly favorable rate for admission and graduation of women. The College was sought out for recipients of Clare Boothe Luce Scholarships in Physical Sciences and Engineering; it will have two Luce Scholars in programs beginning in fall 2005. The Education Courses continue the infusion of equity issues throughout the program.

E. Multiple Methods of Student Assessment

Biology minors learn a variety of assessment tools from personal experience in every Biology course; they are then adaptable to their own teaching. All Biology courses rely on regular quizzes and examinations to assess the students' knowledge. For example, quizzes and exams in BIO 121 and BIO 122 include objective type questions and problems that are evaluated using rubrics that connect the students' theoretical knowledge to practical, real life situations involving principles of Biology. In the complementary laboratories (BIO 464, BIO 452, BIO 449, BIO 422), students write lab reports that are assessed regularly. They are taught how to assess their work in laboratories and how to write standard laboratory reports according to specific guidelines. These guidelines acquaint students with professional publishing formats, and serve as a check list to ensure proficiency in scientific methodology, statistical usage and data interpretation, practical use of technology, and application of biological concepts. Class room exams, exercises, problem sets, and/or short papers are also included as a percentage of the students' grade in courses such as: BIO 103, 108, 270, 290, 448, 463, 474 and 499. Courses listed serve as examples utilizing multiple disciplines (math, chemistry, etiology...) in course exercises and problem sets. Heavy emphasis in mathematical and statistic interpretation occur in BIO 270, 290, 375, 463, and 474.

External assessment is accomplished with the ACAT (Area Concentration Achievement Test), Curriculum C in Biology. The curriculum C format includes: bacteriology, cellular physiology, ecology, genetics, embryology, human anatomy and physiology, and botany. These disciplines areas provide assessment of course listed in form XX. Graduating seniors are required to take the ACAT prior to graduation, and student's ACAT scores are contrasted with the student's own GPA and national scores of participating universities and colleges.

The Education courses continue to model and to teach a variety of assessment processes, including authentic models and/or other alternative assessments procedures. In methods EDU 469, portfolio assignments must include assessments appropriate to the lesson's or unit's objectives and the specific content being taught. Students become familiar with a variety of assessment tools and practices. They are also taught how to construct student-led conferences and demonstrate their ability to the peers in the class. EDU 475 (Science Methods) teaches students a variety of evaluative strategies for use in dealing with specific problems in science instruction; students demonstrate their acquisition of assessment skills through written and oral presentations. They also develop a "science and management kit" that is composed of a series of folders, one of which must include articles about a variety of assessment processes and their plans for assessing their future students. The

evaluation forms used by the grade 6-12 Co-operating Teachers and the University Supervisors in Student Teaching (490 General Education) and 474 and 478 (Special Education) include evaluation of the assessment practices use by the student teachers to evaluate the performances of their grade 6-12 students.