

Baker University



Biology Department Programs

The mission of the Department of Biology at Baker University is to provide a foundation in biological science that is consistent with the University tradition of liberal arts. Our curriculum emphasizes the relationship between the structure and the function of living systems from the biochemical to the ecological levels. The faculty promote the use of the scientific method to help students majoring within the department acquire the knowledge and skills necessary to become proficient and productive graduates.

Fall 2010

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Departmental Objectives

In light of the departmental mission, the following fourteen objectives were articulated in the spring of 2003 and reconfirmed in the summer of 2005. Nine of these objectives relate to the content of the curriculum (C1-C9) and five relate to the methodology of science (M1-M5). In setting these objectives the departmental faculty members have concentrated on the central themes in the study of biology as established by the National Academy of Science (documented in the National Science Education Standards, copyright 1995), the regulations and standards for Kansas Educators (documented in the Teacher Education and Licensure materials - updated July 29, 2004) and the mission and goals of Baker University.

Students graduating with a degree from the Biology Department at Baker University should be able to:

- C1. **describe** the broad scope of biology. They should recognize that life is studied from the molecular level to the ecosystem level of organization.
- C2. **summarize** how the Theory of Evolution by Natural Selection provides the foundation for the study of biology.
- C3. **explain** the importance of energy to living things, from its capture and storage in photosynthesis, to its extraction in catabolic respiration and its use in metabolic function.
- C4. **use** similarities and differences among life forms to construct a classification of selected taxa using the tools of classical and/or modern systematics.
- C5. **develop** models to illustrate both the eucaryotic cell cycle and the processes of cellular reproduction including fission, mitosis and meiosis.
- C6. **discuss** the processes of heredity including the flow of genetic information from DNA replication to RNA transcription to protein synthesis.
- C7. **illustrate** the relationship between structure and function in the cell, the subcellular compartments and the major biomolecules.
- C8. **explain** the principles of homeostasis in biological systems and examine how they apply to relationships between structure and function at the cellular and organismal levels of biology.
- C9. **summarize** how higher-level ecological processes function, including those of populations, communities and ecosystems. Evaluate the negative impact man's activities have on many of these processes.
- M1. **design** a simple, controlled experiment based on an original hypothesis to address a question using the scientific method.
- M2. **analyze** the results of an experiment, evaluating the data in order to formulate appropriate conclusions.
- M3. **communicate** clearly the methodology and interpret the results of an experiment both orally (as a poster presentation or an oral presentation with visual aids) and in writing as a scientific (journal style) paper.
- M4. **select** a collection of articles on a given biological topic from the primary literature and the review literature using the resources of a research library and the Internet.
- M5. **use** the tools of a research biologist both in the field and in the laboratory.

Calvin L. Cink, Ph.D. - Professor and Chairman

Education

Doctoral Study (1972-77) The University of Kansas

Mentor: Dr. Richard F. Johnston, Ph.D.

Dissertation Title: "Winter Ecology and Behavior of North American House Sparrow Populations"

Master's Study (1969-72) The University of Nebraska-Lincoln

Mentor: Dr. Paul A. Johnsgard, Ph.D.

Thesis Title: "Comparative Behavior and Vocalizations of Three *Colinus* Species (Aves: Galliformes) and their Hybrids"

Undergraduate Education (1965-1969) North Dakota State University

Major: Zoology and Botany

Minor: Chemistry

Faculty Positions

Forrest E. Jones Chair in Biology, Baker University, Baldwin City, Kansas

2005-Present

Professor of Biology with Tenure, Baker University, Baldwin City, Kansas

1985-Present

Associate Professor of Biology with Tenure, Baker University, Baldwin City, Kansas

1982-1985

Assistant Professor of Biology, Baker University, Baldwin City, Kansas

1976-1982

Courses Currently Taught at Baker University

Ecology and Organismal Biology, General Zoology, General Ecology, Animal Behavior, Ornithology

Research Interests

Area 1: Comparative Behavior and Ecology of Nightjars

Area 2: Population Ecology of grassland and wetland birds, reptiles and amphibians, small mammals and invertebrates

Area 3: Community Ecology of Forest Vertebrates

Area 4: Ecology of Coral Reefs and Intertidal Invertebrates

Current Project:

My current summer project is a comparison of reproductive biology and feeding habits of watersnakes in the Baker Wetlands and how they are influenced by late summer drought conditions. During the fall and spring seasons I am monitoring the differential migration of juvenile and adult rails through the wetlands. In winter I am studying how food conditions influence the timing of molt in Song Sparrows at the wetlands.

Charmaine B. S. Henry, Ph.D. - Associate Professor

Education

Post-Doctoral Study (1996-2000) at University of Virginia

Topic: Molecular interactions of the endothelial glycocalyx

Mentor: Dr. Brian Duling, Ph.D.

Doctoral Study (1990-96) at University of Medicine and Dentistry of New Jersey

Topic: Development of capillaries and the endothelial glycocalyx

Mentor: Dr. David DeFouw, Ph.D.

Dissertation Title: "Ontogeny of the endothelial glycocalyx in permselectivity during normal angiogenesis in the chick chorioallantoic membrane"

Undergraduate Education (1985-89) at University of the Virgin Islands

Major: Biology - Senior Project: "Myasthenia Gravis"

Faculty Positions

Associate Professor of Biology with Tenure, Baker University, Baldwin City, Kansas, 2006- Current

Assistant Professor of Biology, Baker University, Baldwin City, Kansas. 2000-2006

Courses Taught at Baker University

Human Anatomy and Physiology, Comparative Vertebrate Anatomy, Comparative Physiology, Developmental Biology, Immunology.

Research Interests

Developmental anomalies in the cardiovascular system of the early chick embryo.

Effect of toxins on embryonic development.

Grant Received at Baker

National Science Foundation Course, Curriculum and Laboratory Improvement (2001-2002)

Project Title: Improvement of an undergraduate physiology program by using computer-based data acquisition and student-designed investigation.

Erin R. Morris, Ph.D. - Assistant Professor

Education

Doctoral Study (1999-2004) University of Missouri- Columbia

Topic of Study: Molecular Plant Genetics and Development

Mentor: Dr. John C. Walker

Dissertation Title: "FHA Domain Genes of *Arabidopsis*"

Undergraduate Education (1995-1999) Drury University, Springfield, Missouri

Major: Biology

Minor: Chemistry, Global Studies

Faculty Positions

Assistant Professor of Biology, Baker University, Baldwin City, Kansas

2007-present

Visiting Professor of Biology, Monmouth College, Monmouth, Illinois

2005-2007

Visiting Assistant Professor, St. Lawrence University, Canton, New York

2004-2005

Courses Taught at Baker University

Introduction to Molecular and Cellular Biology, Cell Biology, Genetics, Molecular Biology, Developmental Biology

Research Interests

Area 1: Protein interactions in cell signaling pathways that control plant development.

Area 2: Genomic studies of genes controlling plant development.

Current Project:

My research currently focuses on understanding signal transduction pathways that control *Arabidopsis* development. Signals are relayed by protein interactions, which are often mediated by phosphorylation patterns. The FHA domain recognizes and binds to phosphorylated proteins in signaling pathways. Plants lacking one FHA domain gene, *DAWDLE*, have pleiotropic development defects: decreased fertility, inhibited root growth and reduced cell division. We are using modern molecular and biochemistry techniques to search for proteins *DAWDLE* interacts with in order to determine the cause of the developmental defects.

Darcy L. Russell, Ph.D. - Professor

Education

Post-doctoral Study (1986-1989) North Carolina State University/The University of North Carolina at Chapel Hill

Topic of Study: The Molecular Biology of Sindbis Virus
Mentor: Dr. Robert E. Johnston, Ph.D.

Doctoral Study (1980-1986) Kansas State University

Topic of Study: The Biochemistry of Baculoviruses
Mentor: Dr. Richard A. Consigli, Ph.D.

Dissertation Title: "An Investigation of the Structural Proteins of the Granulosis Virus infecting *Plodia interpunctella*"

Undergraduate Education (1976-1980) Baker University

Major: Biology
Minor: Chemistry

Faculty Positions

Professor of Biology with Tenure, Baker University, Baldwin City, Kansas
2001-Present

Associate Professor of Biology, Baker University, Baldwin City, Kansas
1998 - 2001

Associate Professor of Biology with Tenure, Washington and Lee University,
Lexington, Virginia. 1996-1998

Assistant Professor of Biology, Washington and Lee University, Lexington, Virginia.
1989-1996

Courses Taught at Baker University

Introduction to Molecular and Cellular Biology, Cell Biology, Genetics, Molecular Biology, Microbiology and Virology

Research Interests

Area 1: The early interactions between viruses and host cells.

Area 2: The mechanisms of antiviral and antibiotic resistance by microorganisms.

Current Project:

My students and I are investigating the prevalence of strains of *E. coli* that are resistant to antibiotics in our natural areas (Boyd Woods, Boyd Prairie, and Baker Wetlands). We have found several antibiotic resistant strains and we are working to identify the genes that confer this resistance.

Roger L. Boyd, Ph.D. - Emeritus Professor

Education

Doctoral Study (1972-76) Colorado State University

Mentor: Dr. Paul H. Baldwin, Ph.D.

Dissertation Title: "Behavioral Biology and Energy Expenditure in a Horned Lark Population"

Master's Study (1969-72) Emporia State University

Mentor: Dr. David F. Parmelee, Ph.D.

Dissertation Title: "Breeding Biology of the Snowy Plover at Cheyenne Bottoms Waterfowl Management Area, Barton County, Kansas"

Undergraduate Education (1965-1969) Baker University

Major: Biology - Senior Project "Prairie Seed Germination Techniques"

Minor: Chemistry

Faculty Positions

Senior Professor of Biology, Baker University, Baldwin City, Kansas 2005-present

Adjunct Curator of Ornithology, Kansas University, Lawrence, Kansas 2000-present

Professor of Biology with Tenure, Baker University, Baldwin City, Kansas
1985-2005

Associate Professor of Biology with Tenure, Baker University, Baldwin City, Kansas
1982-1985

Assistant Professor of Biology, Baker University, Baldwin City, Kansas 1976-1982

Courses Taught at Baker University

Human Ecology, General Biology, Botany, Comparative Vertebrate Anatomy, Embryology, Dendrology, Vertebrate Natural History, Wetlands and Prairie Ecology, Wildlife Management

Research Interests

Area 1: Wetland and Prairie restoration and management

Area 2: Management of Endangered Species: Least Tern, Piping Plover, Snowy Plover

Current Project:

My students and I are investigating the success of wetlands restoration at the Baker Wetlands and application of these findings to developing the proposed mitigation for the South Lawrence Trafficway. Grants I have received from US Fish & Wildlife Service and US Army Corps of Engineers continue to provide hands-on experience with several endangered species.

William R. Miller, Ph.D. - Director of Student Research

Education

Doctoral Study (1988-96) University of New England, Armidale, NSW, Australia

Advisor: Harold Heatwole, Ph.D.

Dissertation Title: "The Tardigrades of the Australian Antarctic"

Masters Study (1970-72) University of Montana, Missoula, Montana

Mentor: R. B. Brunson, Ph.D.

Thesis Title: "The Phylum Tardigrada in Montana west of the Continental Divide"

Undergraduate Education (1964-67) at University of Montana, Missoula, Montana

(1962-64) at Baker University, Baldwin City, Kansas

Major: Zoology

Faculty Positions

Assistant Professor of Biology, Baker University, Baldwin City, Kansas 2005-2006

Assistant Professor of Biology, Chestnut Hill College, Philadelphia, PA. 1999-2005

Courses Taught at Baker University

Botany, General Biology, Evolution, Geographical Information Systems, Ecology and Organismal Biology, Wildlife Management

Research Interests

Taxonomy, systematics, phylogeny, distribution, and ecology of the phylum Tardigrada
Wetlands ecology, especially invertebrates and fish and the use of Geographical Information Systems and remote sensing for data logging, low altitude imagery, and video.

Grants Received

National Science Foundation Research at Undergraduate Institutions (2004-2008)

Project Title: *RUI: a Survey of the Moss Dwelling Tardigrades of China*.

(Collaborators: Missouri Botanical Garden, McMurry Univ, and Academy of Natural Sciences).

National Science Foundation Research at Undergraduate Institutions (2007-20011)

Project Title: *RUI: Tardigrades of the LTER Sites: a Framework for Distribution and Phylogeny of North American Tardigrada*. (Collaborators: Fresno City College,

Brigham Young University, and the Academy of Natural Sciences, Philadelphia)

Current Projects:

Taxonomy and distribution of tardigrades in Kansas, North America, and China. I am working with colleagues to establish both the DNA and morphological phylogenetic relationships of tardigrades that delimit species. Also, I am working on a wind distribution model for Antarctic and sub Antarctic tardigrades. Finally, I am developing a remotely operated vehicle (ROV) for the purpose of collecting environmental data.

The Biology Major

All students wishing to major in biology should begin with the following sequence of core courses designed to cover all areas of biology.

Core Courses with Laboratories:		Term:
BI132	Intro to Cell and Molecular Biology	Fall - Freshman
BI278	Intro to Genetics	Spring - Freshman
BI133	Intro to Ecology and Organismal Biology	Fall - Sophomore
BI298*	Intro to Research in Biology (1 credit)	Fall - Sophomore
BI252	General Zoology	Spring - Sophomore
BI298*	Intro to Research in Biology (2 credits)	Spring - Sophomore

*During the fall term in BI298 students will attend a seminar by each member of the faculty focused on the research project that faculty member is pursuing. Students will then select a research mentor and design a small project with that mentor. During the spring term the student will carry out the project designed and report on the results in both written and oral presentations.

All students that complete the core courses listed above with a "C" or better are eligible to declare a major in biology. Students will then select a particular track (see the following pages) for study in the junior and senior years. Students must earn a "C" or better in a course to apply it to the major.

The four tracks available are:

- Molecular Bioscience
- Ecology and Evolution
- Vertebrate Structure and Function
- Biology for Secondary Education

Molecular Bioscience Track

Required Courses		Term	Lecture	Lab
BI383	Advanced Cell Biology	Fall	Yes	No
BI385	Advanced Molecular Biology	Spring	Yes	No
BI386	Methods in Molecular Bioscience	Fall	No	Yes
BI3XX	Upper Level Elective with Lab		Yes	Yes
BI3XX	Upper Level Elective (Lab optional)		Yes	
BI410	Senior Seminar	Fall	Yes	
CH137	General Chemistry I	Fall	Yes	Yes
CH138	General Chemistry II	Spring	Yes	No
CH140	Quantitative Analysis	Spring	Yes	Yes
CH251	Organic Chemistry I	Fall	Yes	Yes
CH252	Organic Chemistry II	Spring	Yes	Yes
CH370	Biochemistry	Spring	Yes	No

MA171 Calculus I or MA321 (for the BS degree)

Note: Students pursuing medicine, dentistry or veterinary medicine would also need to take PC125 and PC126 to meet the requirements for admission.

Ecology and Evolution Track

Required Courses		Term	Lecture	Lab
BI242	Botany	Spring	Yes	Yes
BI375	Evolution	Spring	Yes	No
BI377	General Ecology	Fall	Yes	Yes
BI3XX	Upper Level Elective with Lab		Yes	Yes
BI3XX	Upper Level Elective (Lab optional)		Yes	
BI410	Senior Seminar		Yes	
CH137	General Chemistry I	Fall	Yes	Yes
GE210	General Geology	Summer	Online	
MA321	Statistics II		Yes	

Note: Students must select a minor in the area of their choice.

Vertebrate Structure and Function Track

Required Courses	Term	Lecture	Lab
BI360 Comparative Vertebrate Anatomy	Fall	Yes	Yes
BI361 Developmental Biology	Fall	Yes	Yes
BI382 Comparative Physiology	Spring	Yes	Yes
BI3XX Upper Level Elective (Lab optional)		Yes	Yes
BI3XX Upper Level Elective (Lab optional)		Yes	
BI410 Senior Seminar		Yes	
CH137 General Chemistry I	Fall	Yes	Yes
CH138 General Chemistry II	Spring	Yes	No

One Math Course - Either

MA321 Statistics II		Yes	
MA171 Calculus I		Yes	Yes

Note: Students must select a minor in the area of their choice.

Biology for Secondary Teaching Track

Required Courses	Term	Lecture	Lab
BI242 Botany	Spring	Yes	Yes
BI360 Comparative Vertebrate Anatomy	Fall	Yes	Yes
BI377 General Ecology	Fall	Yes	Yes
BI382 Comparative Physiology	Spring	Yes	Yes
BI3XX Upper Level Elective (Lab optional)		Yes	
BI410 Senior Seminar		Yes	
CH137 General Chemistry I	Fall	Yes	Yes
GE210 General Geology	Summer	Online	
PC125 Intro to Physics I	Fall	Yes	Yes

One Math Course - Either

MA321 Statistics II		Yes	
MA171 Calculus I		Yes	Yes

Note: Students must also major in Secondary Education.

Common Requirements

❖ Writing Manual

All students majoring in one of the programs within the biology department are required to purchase a writing manual to use in all courses offered within the department.

Ambrose, H.W., D. J. Emlen, K. P. Ambrose, and K. L. Bright. (2007) *A Handbook of Biological Investigation*. 7th edition. Hunter Textbooks Inc. Winston Salem, NC

ISBN: 0-88725-331-8

❖ Senior Seminar in Biology

This course is taught every fall semester. Students are required to complete the following activities:

- Take the Major Field Test in Biology (10 points)
 - Points are credited as High Pass(10), Pass(5), and No Pass(0)
- Complete a Review of the Current Literature (50 points)
 - The topic is selected by the student with advise from a faculty mentor
 - The review is written in a style similar to that of a grant proposal review
- Generate a Hypothesis and Design an Experiment (25 points)
 - Based on what the students learn from their literature review they will propose a hypothesis and design an experiment as they would in a grant proposal.
- Defend the Proposal Orally to Peers and Professors (15 points)

Study Tips for Science Courses

- Read before you come to class.
 - Write down your impressions, questions, and ideas as you read.
 - List the major concepts.
- Come to class and listen.
 - During lectures take selective notes, but don't try to write every word or you will miss the big ideas.
- Go back and read the material again.
 - As you read, expand your class notes for use when you begin to prepare for the tests.
- Form a study group and get together with class mates to talk about the material.
 - Use the questions at the end of each chapter to guide your discussion sessions.
 - Develop mnemonic devices that will help you to learn the material.
 - Before the test, see if you could teach the major concepts to another person - think about how you would explain what you are learning to your parents.
- Study for short periods of time every day (e.g. an hour to an hour and one half each day). Biologists who study brain chemistry have found that the receptors involved in learning and memory must be regenerated about every 30 minutes. A marathon study session is not a good idea - it is physiologically impossible to learn all the information you will need to know using this method. Daily repetition is a good idea - it is the best way to approach any scientific discipline.
- Begin to prepare for the tests several days in advance.
 - Do some preparation with others - but also be sure that you personally can address the major concepts.
 - Ask yourself the hardest questions you can think of and practice writing out an answer.
 - Design your own multiple choice questions one day and then take your own test several days later. (Or do this with a friend and switch tests!)

Pre-Professional Studies

At Baker University the advising of students seeking eventual admission to graduate work in the health professions (medicine, dentistry and veterinary medicine) is conducted by several of the professors in the biology and chemistry departments. These individuals are:

Dr. Michael Barbush, Professor of Chemistry; Dr. Calvin Cink, Professor and Chair of the Biology Department; Dr. Gary Giachino, Professor and Chair of Chemistry; and Dr. Darcy L. Russell, Professor of Biology and Coordinator of the Health Professions Programs. Dr. Cink has special expertise in working with Pre-Veterinary Medicine students as his daughter recently graduated from Kansas State University with her DVM.

To obtain information on pre-professional study, please contact Dr. Russell or the departmental administrative assistant, Mrs. Kathy Wright.

Darcy L. Russell, Ph.D.
 Department of Biology, Baker University
 P.O. Box 65
 Baldwin City, Kansas
 (785)-594-8418 (direct line)
 (785)-594-8419 (Mrs. Wright)
 darcy.russell@bakeru.edu

Basic Admissions Requirements

The basic requirements for admission into any medical, dental or veterinary college are:

Two semesters of biology with labs	8 credit hours
Two semesters of general chemistry with labs	8 credit hours
Two semesters of organic chemistry with labs	8 credit hours
Two semesters of physics with labs	8 credit hours

Beyond these basics many of the schools require additional courses. To determine the exact requirements for the schools of your interest, you need to consult with a health-professions advisor.

Because students may choose a variety of majors any of which will meet the entrance requirements of the professional schools, there is not a single schedule of courses to suggest. Several plans to meet both the general education requirements and the basic science courses are presented on the additional pages of this document.

This document was updated in June 2010

Plan #1 for Pre-Professional Health Studies at Baker University

Developed by Darcy L. Russell, Program Coordinator

This plan is for students with strong high-school math and science backgrounds who plan to major in biology with the molecular bioscience track.

Freshman Year

Fall Semester (16 hrs)

Intro. to Cell/Molec. Biol. (w Lab)
Calculus I (w lab and workshop)
LS111
First Year Experience
General Chemistry I (w. Lab)

Spring Semester (16 hrs)

Intro. to Genetics (w Lab)
Calculus II (w lab and workshop)
LS112
General Chemistry II
Quantitative Analysis (w Lab)

Freshmen are required to enroll in an interterm course.

Sophomore Year

Fall Semester (15 hrs)

Intro to Ecol/Org. Biol. (w. Lab)
Intro to Research in Biology
Organic Chemistry (w Lab.)
General Education
General Education

Spring Semester (16 hrs)

General Zoology (w Lab)
Intro to Research in Biology
Organic Chemistry II (w Lab)
General Education
General Education

An internship interterm is suggested in January.

Junior Year

Fall Semester (16 hrs)

Advanced Cell Biology
Intro Physics I (w. Lab)
General Education
General Education
General Education

Spring Semester (13 hours)

Advanced Molecular Biology
Intro Physics II (w. Lab)
Biochemistry
General Education

Take a preparation course for the admissions exam (MCAT, DAT, VCAT, GRE) in the spring term.

Senior Year

Students complete their major (including Methods in Molecular Bioscience, two electives, and senior seminar). Students also complete general education requirements as needed. A second internship is the suggested January course.

Plan #2 for Pre-Professional Health Studies at Baker University

Developed by Darcy L. Russell, Program Coordinator

This plan is for students with strong high-school math and science backgrounds who plan to major in biology with the vertebrate structure and function track.

Freshman Year

Fall Semester (16 hrs)

Intro. to Cell/Molec. Biol. (w Lab)
Calculus I (w lab and workshop)
LS111
First Year Experience
General Chemistry I (w. Lab)

Spring Semester (16 hrs)

Intro. to Genetics (w Lab)
Calculus II (w lab and workshop)
LS112
General Chemistry II
Quantitative Analysis (w Lab)

Freshmen are required to enroll in an interterm course.

Sophomore Year

Fall Semester (15 hrs)

Intro to Ecol/Org. Biol. (w. Lab)
Intro to Research in Biology
Organic Chemistry (w Lab.)
General Education
General Education

Spring Semester (16 hrs)

General Zoology (w Lab)
Intro to Research in Biology
Organic Chemistry II (w Lab)
General Education
General Education

An internship interterm is suggested in January.

Junior Year

Fall Semester (16 hrs)

Comparative Vertebrate Anatomy
Intro Physics I (w. Lab)
General Education
General Education
General Education

Spring Semester (13 hours)

Comparative Physiology
Intro Physics II (w. Lab)
Biochemistry
General Education

Take a preparation course for the admissions exam (MCAT, DAT, VCAT, GRE) in the spring term.

Senior Year

Students complete their major (including Developmental Biology, two electives, and senior seminar). Students also complete general education requirements as needed. A second internship is the suggested January course. Premeds in this track should use Chemistry as their minor.

Graduate School in Biology

At Baker University the advising and mentoring of students seeking admission to graduate schools in biology is conducted by all of the professors in the biology department.

Graduate schools can lead to a Master's or Doctor of Philosophy degree with two to four year's additional study and the concentration in a selected specialty within a discipline. Each graduate institution has its own unique set of requirements and students should work with their advisor or faculty mentor to identify those requirements as soon as possible.

Opportunities at graduate schools are limited and very competitive. To qualify a student must present a minimum GPA of 3.2, good scores the Graduate Record Exam (GRE), and demonstrate both an aptitude and interest in the area of specialization. These later requirements are often achieved by summer internships, working in a related field, or doing independent research that demonstrates the interest.

For example, a student who is interested in the effects of pesticides on frogs might find an internship or summer job with the EPA conducting an amphibian survey of the lower Red River in Texas. Another student interested in bird flu might spend one summer tagging water birds in Canada and another summer in a National Science Foundation: Research Experience for Undergraduates program at an epidemiology laboratory. Still a third student with an interest in the survival of Monarch butterflies may work with the Monarch Watch capture and tag program, and spend a summer in a molecular biology laboratory working with the DNA of insects or at a major botanical garden working with milkweeds.

A Ph.D. is generally required for research positions whether in the laboratory or the environment. Areas of growth and continued demand for graduates include stem cell research, life cycles of infectious diseases, food parasites, ecological and environmental research, pharmaceutical laboratories, hazardous waste management, and remote sensing. The array of science careers include molecular biologist, cell biology, evolution biology, reproductive biology, marine biology, environmental health, Bio Imaging, nano-biology, pharmacology, aquatic ecology, microbiology, and other unique areas of specialization.

Each student's path is unique, based on their interests and their qualifications. The harsh reality is that graduate schools have the pick of the crop, and to be successful a student must be ready to compete. Baker's faculty recognizes that students mature at different rates and as such is dedicated to assisting a student in defining the path that best fits their goals, abilities, and accomplishments. For example, a mentor may suggest a student with high GPA and good GRE scores apply directly to a Ph.D. program. While a student with lower results may be directed to a Master's program at a smaller school to raise the GPA and produce a research result (thesis) as an avenue to a Ph.D.

In this regard, Baker's courses of study and faculty will prepare students for this next step. We are dedicated to helping students define their area of interest and developing their plan to achieve their goals.

Internships and Employment Opportunities Post-Graduation

As you near the completion of requirements for a degree in biology, it is no surprise that you ask the questions, "What kind of job has this training prepared me for?" and "Where do I look for such a position?". Fortunately you have pursued a degree that has taught you to ask questions, make detailed observations, evaluate evidence and solve problems. You have also nurtured your curiosity about life; how living things work, interact with other organisms, and how they evolve. These are all valuable tools and attributes for a host of different professions. Some may require some additional education but many do not. By now you probably know that job growth is expected in the areas of biotechnology and molecular biology, but the number of openings in federal agencies charged with managing natural resources, such as Department of the Interior and Department of Agriculture, Environmental Protection Agency, and NOAA is expected to grow as retirements in these agencies increase.

There are a variety of career paths biologists follow that you may or may not have explored.

- **Research:** You may envision the model of your advisor or other faculty in the sciences who do research but many research jobs are associated with private industry or government agencies.
- **Health Care:** Many of you may already see yourself as a doctor, dentist, or veterinarian but there are many other specialties in the health care professions that you should investigate. Many jobs in government involve public health.
- **Education:** Some of you may already be considering a job teaching in primary or secondary schools, but there are life science educators working in science museums, zoos, aquariums, parks and nature centers.
- **Environmental Management and Conservation:** Park rangers, zoo biologists, and conservation biologists are all involved in careers that help solve environmental problems and help preserve the natural world for future generations.

There are a variety of fields that combine scientific training in biology with your interests in other fields and these are worth exploring as well:

- **Forensic science:** Discovery and processing of evidence used to solve crimes for law enforcement agencies
- **Politics and policy:** Essential science input to lawmakers to create new legislation on such topics as biomedical research and the environment.
- **Economics:** Work with the government and other agencies to study economic impacts of biological issues such as environmental pollution.
- **Art:** Illustrations created by talented artists with a thorough understanding of biology are needed by a variety of publications
- **Science writing and communication:** Informing the public about relevant and emerging biological issues requires writers with a science background

- **Business and industry:** Research and test new products for drug companies and providers of scientific products and services. Sales, marketing and public relations positions are also available to biologists.
- **Biotechnology:** Use scientific principles to develop and enhance products, tools and technologies to advance agriculture, medicine and food science.

It is important to plan ahead. For example, by the summer after your junior year you should take the GRE exam if you are thinking about graduate school. You need those scores when you apply in the fall. If you plan on going into the job market right after graduation, think about an internship position related to the areas of biology of most interest to you. There are programs and centers that suit a particular interest, for example a marine station to study marine biology. Your advisor probably will post some of these on a bulletin board or keep a file. Here are a few resources you might also use:

Internship listings:

Environmental Careers Organization—short- and long-term internships in the environmental field: <http://www.eco.org>

Rochester Institute of Technology—biology and biotechnology internship listings: <http://www.rit.edu/~gtfsbi/Symp/summer.htm>

Kalamazoo College—research opportunities listing: <http://www.kzoo.edu/biology/internopps.html>

University of California-Santa Barbara—biology-related internship listings: <http://career.ucsb.edu/students/majors/biology/biointern.html>

Texas A&M job board website: <http://wfscnet.tamu.edu/jobboard>

When you reach the fall of your senior year you should begin to apply for graduate school or start enquiring about jobs that are available. Visit with your advisor about your specific areas of interest. The American Institute of Biological Sciences has a web site (<http://www.aibs.org/careers/>) that has links to its member societies and organizations, each of which has its own career and professional development opportunities on their sites. Here are a few more general sites you might explore:

General career development and job hunting sites

Science Nextwave JobsNet: <http://nextwave.sciencemag.org/jobsnet.dtl>

Environmental Jobs and Careers: <http://www.ecoemploy.com/>

Environmental Career Opportunities: <http://www.ecojobs.com/>

Minority Environmental Leadership Development Initiative:

<http://www.umich.edu/~meldi/>

National Academy of Sciences career planning guide :

<http://nationalacademies.org/careerguides.html>

National Institutes of Health—Career Exploration:

<http://science.education.nih.gov/home2.nsf/Careers/Career+Exploration>

Virtual Hospital—Careers in Biomedical Research:

<http://www.vh.org/welcome/tour/discovery/>

AccessExcellence—Biotechnology Careers:

<http://www.accessexcellence.org/RC/CC/>

The Scientist Magazine—Science careers: <http://careers.the-scientist.com/>

Sloan Career Cornerstone Center—Science, Technology, Engineering, Mathematics &

Computer Career Planning : <http://www.careercornerstone.org/>

The Wildlife Society: <http://www.wildlife.org/jobs/index.cfm?tname=jobsboard>

The Center for North American Herpetology: www.cnah.org/jobs.asp