CENTER FOR BIOTECHNOLOGY

Keith A. McGee, Ph.D., Program Director
Math and Science Building, 3rd Floor
1000 ASU Drive #870
Phone: 601-877-6198 FAX: 601-877-2328

Degree Offered
M. S. in Biotechnology

Required Admission Test
GRE General Test

Graduate Faculty

Sandra Barnes, Ph.D., Chairperson Department of Chemistry and Physics and Associate Professor of Chemistry
Keith McGee, Ph.D., Director of Biotechnology and Associate Professor of Biology
Babu Patlolla, Ph.D., Dean School of Arts and Sciences and Professor of Biology
Robert Sizemore, Ph.D., Professor of Biology

MASTER OF SCIENCE IN BIOTECHNOLOGY

Program Description

The primary purpose of the master's degree program in biotechnology is to train students in cellular and molecular biology and genetic engineering. The students will be provided with a firm foundation in the principles of genetics and molecular biology of both prokaryotic and eukaryotic organisms. Each student will then specialize in an area appropriate to his or her interest and career goals. Graduates will be prepared to assume government, university, and industry positions or continue their training towards advanced degrees in graduate or professional schools.

The successful student upon completing a Master of Science in Biotechnology, will in having broadened his other specific knowledge, as related to biotechnology and related fields of study:

1. Be able to state and clearly articulate the research goals, objectives, as well as, experimental design goals, and potential experimental outcomes of a proposed thesis level research project.
2. Organize, interpret and present the results generated by a thesis level research project, in a manner consistent with the guidelines set forth by ASU's Office of Graduate Studies.
3. Be able to prepare and submit an abstract of approved thesis level research work at a national, regional, or state research conference, and be able to make a quality oral or poster presentation at a designated conference.
4. Be able to obtain employment in related biotechnology fields, or admission to a doctoral degree program at a university, or enhance the likelihood of entering a professional program leading to a position at a teaching institution such as secondary schools, junior colleges, or occupational/technical/vocational schools.

Course Requirements

Core Courses (24 hours)		Credits
BT 500	Research Seminar	1 hr.
BT 505	Current Topics in Biotechnology	1 hr.
BT 540	Molecular Genetics	3 hrs.
BT 565	Advanced Cell and Molecular Biology	3 hrs.
BT 570A	Techniques in Biotechnology	3 hrs.
BT 600	Internship in Biotechnology	3 hrs.
BT 650	Thesis Research	5 hrs.
CH 580	Advanced Biochemistry	3 hrs.
PS 595	Experimental Design and Method	3 hrs.

Elective Courses (9 hours)		Credits
BI 503	Mycology	3 hrs.
BI 523	Advanced Biostatistics	3 hrs.
BI 525	Advanced Immunology	3 hrs.
BI 526	Advanced Pharmacology	3 hrs.
BI 581	Advanced Toxicology	3 hrs.
BT 526	Economic Aspects of Biotechnology	3 hrs.
BT 544	Advanced Plant Breeding	3 hrs.
BT 545	Laboratory Methods in Tissue/Cell Culture	3 hrs.
BT 546	Principles of Population Genetics	3 hrs.
BT 551	Genomics	3 hrs.
BT 552	Proteomics	3 hrs.
BT 570B	Techniques in Biotechnology	3 hrs.
BT 590	Bio-informatics	3 hrs.
	TOTAL	**33 hrs.**

Biotechnology Course Descriptions (BT)

BT 500 – RESEARCH SEMINAR
(3 Credits)
This course will focus on effective communication of ideas and research findings in biotechnology. Students will be required to provide both oral and written evaluations of research publications and proposals. **The first part** of the semester will focus on a dissection, evaluation, and discussion of recent biotechnology-related research publications. Students will discuss the aspects of successful oral presentations, including the effective use of visual aids. **The middle of the semester** will be spent developing a research proposal, focusing on the separate components of a proposal. **The end of the semester** will involve student presentations of a research proposal that they have developed.

BT 505 – CURRENT TOPICS IN BIOTECHNOLOGY
(3 Credits)
An introduction to biotechnology: historical perspectives, current applications, and future directions. This course will consist of informal lectures and interactive discussions led by biotechnology faculty and visiting professionals. The course will orient students to the educational/career opportunities in biotechnology and assist them in developing a focus for their individualized degree programs. The course is also designed to acquaint students with ethical issues associated with agricultural biotechnology. Students will take considerable advantage of resources available on the internet. Students will acquire information that would enable them to participate in national debates about the ethics of biotechnology. Lecture, two hours per week.

BT 526 – ECONOMIC ASPECTS OF BIOTECHNOLOGY
(3 Credits)
This course surveys microeconomics, macroeconomics, agribusiness and finance topics relevant to conceptual analyses of problems and decision-making situations in the agricultural and non-agricultural biotechnology industries. Credit: Lectures, three hours per week.

BT 540 – MOLECULAR GENETICS
(3 Credits)
This course introduces students to methods of analyzing DNA sequences and the use of sequence information available in international databases. Topics include assembly of raw data into a contiguous sequence, finding open reading frames, translating nucleotide sequences into amino acid sequences, determining protein and DNA characteristics, identifying genes by database searches, determining which database searching method to use, motif searches to identify amino acid signature sequences, searching for and downloading sequences from the GenBank database, importing and interconversion of sequences, aligning sequences, calculating and drawing phylogenetic trees, and genome analysis.

BT 544 – ADVANCED PLANT BREEDING
(3 Credits)
Principles of plant breeding will be emphasized, along with its application to the practical breeding of agronomic, horticultural, and forest plants. Students will be trained in the decision-making process that plant breeders encounter. Effective strategies for cultivar development will be discussed. Students will be able to understand alternative methods used in plant breeding, evaluate the genetic improvement that can be realized from each method, and understand the advantages and disadvantages associated with each plant breeding method. The role of cellular and molecular biology in genetic improvement of plant species will be discussed. Students will understand the process of selection, testing, release, and distribution of new cultivars. Pre-requisites: genetics and consent of the instructor.

BT 545 – LABORATORY METHODS IN TISSUE/CELL CULTURE
(3 Credits)
Students will learn several techniques necessary for the culture of animal tissue and cells in the laboratory. This will include protocols for sterile technique and laboratory safety and useful assays such as cell proliferation, ELISA, RNA isolation and PCR. Students will not only learn the methodology and theory behind various protocols but also develop skills via hands-on experience.

BT 546 – PRINCIPLES OF POPULATION GENETICS
(3 Credits)
This course, an introduction to the field of population genetics, is concerned with the genetic structure of populations and how it changes through time. This is a general introductory course on empirical and theoretical population genetics. The course will cover primary forces and processes involved in shaping genetic variation in natural populations (mutation, drift, selection, migration, recombination, mating patterns, population size, and population subdivision), methods of measuring genetic variation in nature, experimental tests of important ideas in population genetics, transposable elements, the evolution of multigene families, and molecular clocks.

BT 551 – GENOMICS
(3 Credits)
This course is designed to give students a solid understanding of plant and animal gene and protein research and the tools required for such research. The first part of the course will involve analysis of genes and genomes with an emphasis on function, transmission, mutation and evolution in plants. Topics include: genetic, molecular, and quantitative and bioinformatics approaches. Pre-requisites include Advanced Biochemistry, (CH 580) and Molecular Genetics (BT 540).

BT 552 – PROTEOMICS
(3 Credits)
This course involves an in-depth study of research methods and techniques used to study proteomes. Research utilizing methods such as ELISA, HPLC, Mass Spectrometry, and Electrophoresis to study proteins will be discussed.

BT 565 – ADVANCED CELL AND MOLECULAR BIOLOGY
(3 Credits)
This course is an integrated cell and molecular biology course. It is designed to thoroughly introduce the student to the mechanisms of DNA replication, recombination, repair, transcription, protein synthesis, gene regulation and signal transduction. At the conclusion of this course, the student will be able to describe, in detail, the mechanisms of DNA metabolism, protein synthesis, gene regulation, and signal transduction. The student will also be able to describe and indicate the basis for current diagnostic tests that incorporate modern cell and molecular biology techniques.

BT 570A – TECHNIQUES IN BIOTECHNOLOGY
(3 Credits)
This course is designed to provide students with hands on experience with common and advanced tools used in molecular biology and biotechnology. Students will become familiar with each piece of equipment and learn how to choose the correct device for a specific type of procedure. These approaches will be coupled with short-term workshops and hands on experiences. The second half of the course will cover research involving techniques such as protein extraction, protein sequencing, electrophoresis, chromatography, mass spectrometry, X-ray crystallography, and enzyme-linked immunosorbent assay (ELISA), and spectrophotometry and high performance liquid chromatography.

BT 570B – TECHNIQUES IN BIOTECHNOLOGY
(3 Credits)
The course will cover research involving techniques such as protein extraction, protein sequencing, electrophoresis, chromatography, mass spectrometry, X-ray crystallography, and enzyme-linked immunosorbent assay (ELISA), and spectrophotometry and high performance liquid chromatography.

BT 590 – BIO-INFORMATICS
(3 Credits)
This course is designed to provide an introduction to the types of information analysis obtained from DNA sequencing projects, ranging from the sequences of individual genes to those of entire genomes, as well as, the massive data obtained microarrays. There will be two core themes in the class: the analytical techniques that can be used to evaluate data, and examples of the biological significance of such analyses.

BT 650 – THESIS RESEARCH
(3 Credits)
This course is designed to synthesize the knowledge and skills developed in previous research courses and apply them in the preparation of the Master's thesis. Candidates to the Master's Degree in Biotechnology will learn about all aspects of the process of developing and carrying out the production of an acceptable manuscript. Students will gain an understanding of standards and expectations that must be met in order to successfully complete the thesis. Throughout the course, students are required to work closely with their major advisor/thesis director and committee, as appropriate.

Biotechnology Curriculum Courses in Other Disciplines

BI 515 – COMPUTER APPLICATIONS IN BIOLOGICAL SCIENCES
(3 Credits)
This course provides introduction to computer applications in the biological sciences. The three major applications involved in this course are data interpretation, presentation in appropriate formats, charts, graphs, tables, database usage, and statistical analysis.

BI 523 – ADVANCED BIOSTATISTICS
(3 Credits)
Methods of collection, tabulation, analysis, and application of biological data specifically related to various problem solving activities in biology using descriptive statistics probability theory and statistical inference.

BI 526 – ADVANCED PHARMACOLOGY
(3 Credits)
This course is designed to study various classes of drugs relative to their specific mechanisms of action and clinical application.

BI 546 – ADVANCED HISTOLOGY
(3 Credits)
An advanced study of the microscopic and chemical structures of organs, tissues, and their cellular constituents.

BI 556 – MICROBIAL GENETICS
(3 Credits)
This course provides a detailed description of the processes of heredity in bacteria including a discussion of gene structure and evolution, gene expression and its control, the exchange of genetic material in the microbial world and genetic engineering and its applications. Also included are studies on the genetics of bacterial viruses and other infectious agents of bacteria and fungi.

BI 581 – ADVANCED TOXIOLOGY
(3 Credits)
This course is designed to fill the need for a comprehensive source of information concerning toxicology. It presents a definite description of basic concepts and methods employed in environmental toxicology studies as well as examples of typical data and its interpretation. Specific topics covered in this course include: toxicity of generic types of chemicals (such as pesticides and metals) to organisms; the distribution and fate of chemicals in the environment.

Note: (*) These supporting courses are offered in the Department of Biology as shown in the university catalog

Chemistry (CH)

CH 580 – ADVANCED BIOCHEMISTRY
(3 Credits)
This course stresses the techniques involved in purification and modification of enzymes and polynucleotides, expression of genetic information, and recombinant DNA technology.

Plant Science (PS)

PS 595 – EXPERIMENTAL DESIGN AND METHOD
(3 Credits)
Fundamental principles of experimental designs especially in relation to computation and analyses of biological research data.