Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology

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Biochemistry and Molecular Biology Program

The Biochemistry and Molecular Biology program within the Department of BCH-EPP involves disciplines at the cutting edge of a revolution in biology. Molecular methods and the use of genetic engineering have given scientists unprecedented power to begin to understand the chemistry of life processes. The Department of BCH-EPP aims to prepare students at Mississippi State in this exciting area. In addition to the undergraduate curriculum in biochemistry and molecular biology, the department provides opportunities for an M.S. degree in Agricultural Life Sciences with a concentration in Biochemistry and a Ph.D. in Molecular Biology (See the Graduate Bulletin for description of programs and requirements for advanced degrees). For the Bachelor of Science degree in biochemistry, the objective of this curriculum is to provide the student with a strong background in science, and to prepare the student for entry into professional schools, graduate study and/or highly technical scientific careers after graduation. There are sufficient individual choices in the curriculum to allow students to tailor their programs to any of several areas of specialization by appropriate use of elective hours.

Biochemistry Minor

The Biochemistry minor is offered to allow undergraduate students in other majors to develop specific skills needed by graduates entering the science-related workforce. Students will enhance their written and oral communication skills and develop problem-solving/application skills. Students must complete 19 to 20 hours of approved coursework.

Entomology Minor

The Entomology minor is offered to help students in other programs develop specific disciplinary skills to prepare them for entry into the science-related workforce. Agriculture, forestry, and service sector industries recruit and employ a diversity of personnel variously trained in the biological sciences, business, chemistry, human health, law, natural resource management, and veterinary medicine for whom expertise in entomology would be considered an asset. The minor in Entomology provides these individuals with enhanced employment opportunities in these industries.

Students seeking an Entomology minor are required to complete at least 18 credit hours as specified to receive a minor in Entomology. Additionally, students in the IPM concentration of the Agronomy major must complete EPP 4164 Insect Taxonomy as a requirement for receiving a minor in Entomology.

Plant Pathology Minor

The Plant Pathology minor is offered to help students in other programs develop specific disciplinary skills to prepare them for entry into the science-related workforce. Agriculture, forestry, and service sector industries recruit and employ a diversity of personnel variously trained in the biological sciences, business, chemistry, human health, law, natural resource management, and veterinary medicine for whom expertise in plant pathology would be considered an asset. The minor in Plant Pathology provides these individuals with enhanced employment opportunities in these industries.

Students seeking a Plant Pathology minor are required to complete at least 18 credit hours as specified to receive a minor in Plant Pathology. Additionally, students in the IPM concentration of the Agronomy major must complete EPP 4254 Introduction to Mycology as a requirement for receiving a minor in Plant Pathology.

Graduate Studies Track

Students aiming for a career requiring graduate education should take Genetics and Cell Biology as technical electives. Since many graduate programs require some form of physical chemistry, it is strongly suggested that students take CH 4413/CH 4423 Quantum Mechanics and Spectroscopy or CH 4404 Biophysical Chemistry as technical electives.

Preparation for entry into an accelerated Master's Program (THESIS) in Biochemistry and Molecular Biology

This program requires careful planning by the student in order to complete the requirements for the B.S. while beginning a research program that should result in successful completion of a Master's thesis at the end of the second summer after the B.S. Only exceptional and motivated students should attempt this program. It is critical that BCH 4603 General Biochemistry I be scheduled in the spring of the sophomore year. The student will be expected to begin a research project in the senior year by taking up to nine hours of Directed Individual Study courses (BCH 4000). Research will continue during the summer after completion of the B.S. degree. The student must register for BCH 8000 (3 hours), Thesis Research during the summer. In addition, the student should schedule a graduate level BCH course and ST 8114 in the spring of the senior year.

The student interested in the five year program should apply early in the undergraduate program to facilitate the scheduling of courses to conform to time constraints. In addition to applying for admission to the graduate program, the student must also take the Graduate Record Examination early enough so that the results are available by the beginning of the semester in which the student expects to graduate. The student must complete the courses required for completion of the BS degree with no more than 10 hours remaining in the semester of expected graduation.

Preparation for entry into an accelerated Master's Program (NON-THESIS) in Biochemistry and Molecular Biology

This program requires careful planning by the student in order to complete the requirements for the B.S. while initiating graduate work that should result in completion of courses leading to a Master's Degree, non-thesis concentration. This curriculum allows completion of the two degrees in a minimum of five years. Required courses and electives must be scheduled so that the student has only eight hours of undergraduate course work remaining in the spring of the senior year. The student should then schedule ST 8114 Statistical Methods and an 8000 level BCH course in that same semester. Graduate work must include BCH 8654 Intermediary Metabolism and BCH 7000 (3 hrs) Directed Individual Study (to allow completion of an independent research paper).

The student interested in the five year program should apply early in the undergraduate program to facilitate the scheduling of courses to conform to time constraints. In addition to applying for admission to the graduate program, the student must also take the Graduate Record Examination early enough so that the results are available by the beginning of the semester in which the student expects to graduate. The student must complete the courses required for completion of the B.S. Degree with no more than 10 hours remaining in the semester of expected graduation.

Preparation for entry into an accelerated Ph.D. Program in Molecular Biology

This program requires careful planning by the student in order to complete the requirements for the B.S. while beginning a research program that should meaningfully accelerate progress towards early completion of the Ph.D. degree in Molecular Biology. By initiating a research program in the senior year, a student should reduce the time to completion of the Ph.D. by a year. Only exceptional and motivated students should attempt this program. It is critical that BCH 4603 General Biochemistry I be scheduled in the spring of the sophomore year.

The student will be expected to begin a research project in the senior year by taking the Directed Individual Study Courses. Research will continue during the summer after completion of the B.S. degree. The student must register for BCH 9000 Dissertation Research/ Dissertation in Biochemistry,Molecular Biology,Entomology and Plant Pathology during the summer.

The student should plan his/her complete graduate program of study in conjunction with research Director and Graduate Committee. Since the Ph.D. is primarily a research degree, ultimate time to completion will be dependent upon the period necessary to satisfy the research requirements of the Graduate Committee. This concentration allows the student to begin that research substantially earlier than usual.

BS in Biochemistry & Molecular Biology

Degree Requirements

English Composition		
EN 1103	English Composition I	3
or EN 1163	Accelerated Composition I	
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	
Mathematics		
MA 1713	Calculus I	3
MA 1723	Calculus II	3
Science		
Satisfied in major core		9
Humanities		
Select from General Education courses		6
Fine Arts		
Select from General Education courses		3
Social Sciences		
See concentration requirements		6
Major Core		
CH 1213	Chemistry I	3
CH 1211	Investigations in Chemistry I	1
CH 1223	Chemistry II	3
CH 1221	Investigations in Chemistry II	1

CH 4513	Organic Chemistry I	3
CH 4511	Organic Chemistry Laboratory I	1
CH 4523	Organic Chemistry II	3
CH 4521	Organic Chemistry Laboratory II	1
BCH 1001	Introduction to Biochemistry	1
BCH 3901	Senior Seminar	1
BCH 4414	Protein Methods	4
BCH 4503	Scientific Communication Skills	3
BCH 4603	General Biochemistry I	3
BCH 4613	General Biochemistry II	3
BCH 4623	Biochemistry of Specialized Tissues	3
BCH 4713	Molecular Biology	3
BCH 4804	Molecular Biology Methods	4
BIO 1134	Biology I	4
BIO 1144	Biology II	4
BIO 3304	General Microbiology	4
PH 1113	General Physics I [1]	3
or PH 2213	Physics I	
PH 1123	General Physics II [1]	3
or PH 2223	Physics II	
Technical Electives (concentration dependent) [2]		21-32
General Electives (concentration dependent)		0-10
Oral Communication Requirement		
CO 1003	Fundamentals of Public Speaking	3
Writing Requirement		
BCH 4414	Protein Methods	4
BCH 4804	Molecular Biology Methods	4
Computer Literacy		
BCH 4414	Protein Methods	4
BCH 4713	Molecular Biology	3
BCH 4804	Molecular Biology Methods	4

Pre-Medicine Concentration (MED)

Biochemistry is an excellent preparation for medical school. In order to be better prepared for the Medical College Admissions Test (MCAT), medical school classes, and to meet medical school entrance requirements, the following courses are required in lieu of technical or general electives. These courses are also appropriate for students interested in dental school.

Social Sciences (See General Education list)		6
BIO 2103	Cell Biology	3
or BIO 4114	Cellular Physiology	
Choose one of the following:		4
BIO 3004	Human Anatomy	
BIO 3014	Human Physiology	
VS 3014	Anatomy and Physiology	
BIO 4514	Animal Physiology	
BIO 3103	Genetics I	3
or BIO 4133	Human Genetics	
Choose one of the following:		3
PH 1133	General Physics III	
PH 2233	Physics III (OR a technical elective if transferring 8 hours of Physics to the program)	
Choose one of the following:		3
PHI 1123	Introduction to Ethics	
PHI 3323	Medical Ethics	

Science Elective		
Technical electives		6
General or Free electives		8-9
Total hours		120

Pre-Dental Concentration (DENT)

Biochemistry is an excellent preparation for dental school. This concentration prepares students for the Dental Admissions Test, dental school classes, and to meet dental school requirements. The following courses are required as either Social Science core courses or in lieu of technical or general electives.

PSY 1013	General Psychology	3
Social Science (See General Education courses)		3
BIO 2103	Cell Biology	3
or BIO 4114	Cellular Physiology	
BIO 3014	Human Physiology	4
or BIO 4514	Animal Physiology	
ST 2113	Introduction to Statistics	3
Choose one of the following:		3
PHI 1123	Introduction to Ethics [1]	
PHI 3323	Medical Ethics	
Science Elective		
PH 1133	General Physics III (OR Science elective if transferring 8 hours of Physics to the program)	3
Science electives		6
General or Free electives		8-9
Total hours		120

[1] PHI 1123 Introduction to Ethics may be used to fulfill three of the six hours of General Education Humanities requirements. Students taking this course may apply this as a humanities elective (if they so choose) and then take either PHI 3323 Medical Ethics or any other approved Science elective to fulfill this technical elective requirement.

Pre-Pharmacy Concentration (PPHR)

Pharmacy school typically requires only two to three years of college work for entry. However, four-year undergraduate programs can be of benefit to students and Biochemistry graduates have been very successful in Pharmacy School and perform well on the Pharmacy College Admissions Test. The following courses are required as either Social Science core courses or in lieu of technical or general electives.

PSY 1013	General Psychology	3
or SO 1003	Introduction to Sociology	
EC 2113	Principles of Macroeconomics	3
EC 2123	Principles of Microeconomics	3
ST 2113	Introduction to Statistics	3
BIO 3103	Genetics I	3
or BIO 4113	Evolution	
BIO 4405	Pathogenic Microbiology	5
BIO 4413	Immunology	3
BIO 4514	Animal Physiology	4
PHI 3323	Medical Ethics	3
PH 1133	General Physics III (OR Science elective if transferring 8 hours of Physics to the program)	3
General or Free electives		4
Total hours		120

Pre-Optometry Concentration (OPT)

Biochemistry is an excellent preparation for optometry school. This concentration prepares students for the Optometry Admissions Test, optometry school classes, and to meet optometry school requirements. The following courses are required as either Social Science core courses or in lieu of technical or general electives.

PSY 1013	General Psychology	3
Social Science (See General Education courses)		3
BIO 2103	Cell Biology	3
or BIO 4114	Cellular Physiology	
BIO 3014	Human Physiology	4
or BIO 4514	Animal Physiology	
ST 2113	Introduction to Statistics	3
Choose one of the following:		3
PHI 1123	Introduction to Ethics [1]	
PHI 3323	Medical Ethics	
Science Elective		
PH 1133	General Physics III (OR Science elective if transferring 8 hours of Physics to the program)	3
Science elective		6
General or Free electives		8-9
Total hours		120

[1] PHI 1123 Introduction to Ethics may be used to fulfill three of the six hours of General Education Humanities requirements. Students taking this course can apply this as a humanities elective (if they so choose) and then can take either PHI 3323 Medical Ethics or any other approved Science elective to fulfill this technical elective requirement.

Science Concentration (SCI)

The Science concentration provides students with core classes towards a degree in biochemistry coupled with undergraduate research and/or internship requirements. Additional coursework as technical electives concentrate on cell biology, anatomy and/or physiology, with much of the coursework remaining flexible to allow students to explore specialized subject matter or broad areas of interest in the sciences. This concentration is intended for students that may pursue graduate research after their undergraduate degree, or those seeking to tailor a specialization to their interest or intended career track. The following courses are required in lieu of technical or general electives.

Social Sciences (see General Education list)		6
BCH 4100	Biochemistry and Molecular Biology Internship	1-6
or BCH 4000	Directed Individual Study in Biochemistry, Molecular Biology, Entomology, and Plant Pathology	
Choose one of the following:		4
BIO 3014	Human Physiology	
VS 3014	Anatomy and Physiology	
BIO 4514	Animal Physiology	
BIO 2103	Cell Biology	3
or BIO 4114	Cellular Physiology	
Science or business technical electives		12
General/free electives		8-9
Total hours		120

Bioinformatics Concentration (BINF) [1]

This concentration provides the student with a B.S. in Biochemistry and Molecular Biology incorporating a strong background in the biochemical sciences along with a rigorous preparation in the field of computer science. The graduate will be able to either enter graduate school or directly enter a career requiring knowledge of bioinformatics. This exciting field applies computational and database skills to molecular biological problems. Practitioners routinely mine genomic databases for information relating to basic understanding of life processes as well as information providing clues for medical and agricultural advances. This program also constitutes a minor in computer science. Students MUST take the following courses in lieu of technical and general electives.

Social Sciences (See General Education courses)		6
CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 2813	Discrete Structures	3
CSE 3813	Introduction to Formal Languages and Automata	3
CSE 4613	Bio-computing	3

CSE 4633	Artificial Intelligence	3
CSE 4623	Computational Biology	3
CSE 4833	Introduction to Analysis of Algorithms	3
ST 3123	Introduction to Statistical Inference (OR Computer Science Elective)	3
Total hours		121

[1] Completion of the Bioinformatics program also constitutes a minor in Computer Science from the Department of Computer Science and Engineering, and students receive a Certificate in Computational Biology from the Institute of Digital Biology. Note that students must declare to the appropriate program and/or departmental advisor to receive credit for a degree minor and/or to receive a Certificate.

Pre-MBA Concentration (PMBA)

This concentration provides the student with a B.S. in Biochemistry incorporating a strong background in science while preparing the student for immediate entry into a graduate program leading to an advanced business degree (either the Master of Business Administration or the Master of Agribusiness Management). Either program can be completed in a minimum of three semesters. Students thus educated may enter into management level positions in the biotech or agribusiness industry. The following courses are required as either Social Science core courses or in lieu of technical or general electives.

ACC 2013	Principles of Financial Accounting	3
ACC 2023	Principles of Managerial Accounting	3
EC 2113	Principles of Macroeconomics	3
EC 2123	Principles of Microeconomics	3
BQA 2113	Business Statistical Methods I	3
BQA 3123	Business Statistical Methods II	3
MGT 3114	Principles of Management and Production	4
MKT 3013	Principles of Marketing	3
FIN 3123	Financial Management	3
Computer elective		3
General/Free electives		6
Total hours		120

Forensic Sciences Concentration (FOSC)

This concentration provides the student with a B.S. in Biochemistry incorporating a strong background in the biochemical sciences along with a rigorous preparation in the general area of criminology and forensics. Because of the ever increasing use of molecular sciences in forensics, graduates with this specialization should be employable by crime labs or by industry using DNA profiling or other biometric techniques. Internships are encouraged. The following courses are required as either Social Science core courses or in lieu of technical or general electives.

PSY 1013	General Psychology	3
SO 1003	Introduction to Sociology	3
Choose one of the following:		3
CH 2313	Analytical Chemistry I	
ST 2113	Introduction to Statistics	
PSY 3104	Introductory Psychological Statistics	
SO 3603	Criminological Theory	3
CRM 3103	Contemporary Issues in Criminal Justice	3
SO 3313	Deviant Behavior	3
or PSY 3213	Psychology of Abnormal Behavior	
Choose one of the following:		3
PSY 4373	Forensic Psychology	
AN 4313	Human Osteology	
CSE 4273	Introduction to Computer Forensics	
BIO 3103	Genetics I	
BIO 2103	Cell Biology	3
or BIO 4114	Cellular Physiology	
BCH 2013	Introduction to Forensic Science	3
BCH 4333	Advanced Forensic Science	3

SO 4513	Correctional Systems (OR Science elective)	3
General/free electives		3-4
Total hours		120

Entomology Concentration (ENT)

This concentration provides a student with a B.S. in Biochemistry but incorporates a focal area in entomology. Students receive excellent training in the biochemical sciences, coupled with general and specific entomology subject areas from which the student can choose subject matter in their areas of interest. The following courses are required in lieu of technical or general electives.

Social Sciences (see General Education courses)		6
EPP 4154	General Entomology	4
EPP 4164	Insect Taxonomy	4
EPP 4263	Principles of Insect Pest Management	3
EPP 4335	Anatomy and Physiology of Insects	5
Choose three of the following:		6-8
EPP 3124	Forest Pest Management	
EPP 3423	Ornamental and Turfgrass Insects	
EPP 4173	Medical and Veterinary Entomology	
EPP 4234	Field Crop Insects	
EPP 4244	Aquatic Entomology	
EPP 4543	Toxicology and Insecticide Chemistry	
General/free electives		
Total hours		120

Plant Pathology Concentration (PPTH)

This concentration provides a student with a B.S. in Biochemistry but incorporates a focal area in plant pathology. Students receive excellent training in the biochemical sciences, coupled with general and specific plant pathology subject areas in plant disease epidemiology, pathology and disease identification/diagnostics. The following courses are required in lieu of technical or general electives.

Social Sciences (see General Education courses)		6
EPP 3124	Forest Pest Management	4
EPP 4113	Principles of Plant Pathology	3
EPP 4163	Plant Disease Management	3
EPP 4214	Diseases of Crops	4
EPP 4254	Introduction to Mycology	4
EPP 4523	Turfgrass Diseases	3
BIO 2113	Plant Biology	3
or PSS 1313	Plant Science	
Choose one of the following:		3-4
PSS 4553	Plant Growth and Development	
BIO 4214	General Plant Physiology	
General/free electives		3-4
Total hours needed for major		120

Pre-Veterinary Medicine Concentration (PVBC)

Biochemistry is an excellent preparation for veterinary medical school. In order to be better prepared for the Graduate Record Examination (GRE) or Veterinary College Admissions Test, veterinary medical school classes, and to meet veterinary medical school entrance requirements, the following courses are required in lieu of technical or general electives.

BIO 3103	Genetics I	3
or BIO 4133	Human Genetics	
VS 3014	Anatomy and Physiology	4
or BIO 4514	Animal Physiology	
BIO 2103	Cell Biology	3
or BIO 4114	Cellular Physiology	

Science or business technical electives	12
Social Sciences (See General Education courses)	6
General/free electives	8-9
Total hours	120

Three year program (3+1) for early admission into the College of Veterinary Medicine

The aim of this curriculum is to allow a student to matriculate through the Department of Biochemistry and Molecular Biology for three years and then proceed into the College of Veterinary Medicine under their early admissions policy. Successful completion of the courses taken during the first year in Veterinary Medicine will satisfy the Department's requirements for technical electives and allow the University to grant the student a B.S. in Biochemistry and Molecular Biology after this period.

General Education requirements		30
CH 1213	Chemistry I	3
CH 1211	Investigations in Chemistry I	1
CH 1223	Chemistry II	3
CH 1221	Investigations in Chemistry II	1
CH 4513	Organic Chemistry I	3
CH 4511	Organic Chemistry Laboratory I	1
CH 4523	Organic Chemistry II	3
CH 4521	Organic Chemistry Laboratory II	1
BCH 1001	Introduction to Biochemistry	1
BCH 4503	Scientific Communication Skills	3
BCH 4603	General Biochemistry I	3
BCH 4414	Protein Methods	4
BCH 4613	General Biochemistry II	3
BCH 4623	Biochemistry of Specialized Tissues	3
BCH 4713	Molecular Biology	3
BCH 3901	Senior Seminar	1
BCH 4804	Molecular Biology Methods	4
BIO 1134	Biology I	4
BIO 1144	Biology II	4
BIO 3304	General Microbiology	4
PH 1113	General Physics I	3
PH 1123	General Physics II	3
VS 3014	Anatomy and Physiology	4
or BIO 4514	Animal Physiology	
BIO 3103	Genetics I	3
or BIO 4133	Human Genetics	

95 hours required plus successful completion of the first year curriculum of the College of Veterinary Medicine

Mississippi State requires a minimum of 120 hours for the undergraduate degree. Therefore, the first year in the College of Veterinary Medicine will contribute 25 hours of technical electives to this program.

Biochemistry Minor

BCH 4603	General Biochemistry I	3
BCH 4613	General Biochemistry II	3
BCH 4414	Protein Methods	4
or BCH 4804	Molecular Biology Methods	
BCH 4713	Molecular Biology	3
Select a minimum of 6 hours (any two courses) from the following:		6-7
BCH 2013	Introduction to Forensic Science	
BCH 4000	Directed Individual Study in Biochemistry, Molecular Biology, Entomology, and Plant Pathology	

BCH 4100	Biochemistry and Molecular Biology Internship	
BCH 4253	Macronutrients: Human Metabolism	
BCH 4333	Advanced Forensic Science	
BCH 4414	Protein Methods	
or BCH 4804	Molecular Biology Methods	
BCH 4623	Biochemistry of Specialized Tissues	
BCH 4990	Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology	
Total Hours		19-20

Entomology Minor

EPP 2213	Introduction to Insects	3-4
or EPP 4154	General Entomology	
EPP 4263	Principles of Insect Pest Management	3
EPP 4000	Directed Individual Study in Entomology and Plant Pathology	3-5
Choose 6-9 hours from the following:		6-9
EPP 3124	Forest Pest Management	
EPP 3423	Ornamental and Turfgrass Insects	
EPP 4164	Insect Taxonomy (required for AGR-IPM majors)	
EPP 4173	Medical and Veterinary Entomology	
EPP 4234	Field Crop Insects	
EPP 4244	Aquatic Entomology	
EPP 4335	Anatomy and Physiology of Insects	
EPP 4543	Toxicology and Insecticide Chemistry	
EPP 4613	Forensic Entomolgy	
Total Hours		18

Plant Pathology Minor

EPP 4000	Directed Individual Study in Entomology and Plant Pathology	3-5
EPP 4113	Principles of Plant Pathology	3
EPP 4163	Plant Disease Management	3
Choose 7-9 hours from the following:		7-9
EPP 3124	Forest Pest Management	
EPP 4152	Advanced Fungal Taxonomy-Fungi Imperfecti	
EPP 4214	Diseases of Crops	
EPP 4254	Introduction to Mycology (required for AGR-IPM majors)	
EPP 4264	Advanced Mycology	
EPP 4523	Turfgrass Diseases	
Total Hours		18