

CLEMSON[®]
U N I V E R S I T Y
DEPARTMENT OF BIOLOGICAL SCIENCES



UNDERGRADUATE HANDBOOK
2017-2018

Department of Biological Sciences

Undergraduate Handbook

2017-2018

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CONTACT INFORMATION

TITLE	NAME	OFFICE	E-MAIL (@clemsun.edu)	TELEPHONE (864)
Biological Sciences				
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Administrative Coordinator	S. Elliott	132B Long Hall	SELLIO4	656-3057
Administrative Assistant	T. Elliott	132 Long Hall	TELLTT	656-2328
Academic Advising				
Director	L. Means	124 Long Hall	LONDANM	656-3604
Faculty Advisor	R. Ballard	G22 Jordan Hall	BALLARD	656-3579
Advisor	N. Waggett	129 Long Hall	NWAGGET	656-5074
Special Programs				
Pre-Medical, Pre-Dental	C. Richardson	102 Long Hall	CMRICHA	656-4154
Pre-Pharmacy	A. Hunter	105 Long Hall	HUNTER3	656-3288
Pre-Rehabilitation Sciences	C. Richardson	102 Long Hall	CMRICHA	656-4154
MUSC Accelerated Pathways	A. Hunter	105 Long Hall	HUNTER3	656-3288
Pre-Vet. Med.	G. Birrenkott	134 P&AS	GBRRNKT	656-4019
	J. Jones	140 P&A	JERLY	656-2142
Double Major –EDSEC	M. Cook	418E Tillman Hall	MCOOK	656-2037
Study Abroad Liaison	A. Hunter	105 Long Hall	HUNTER3	656-3288
Departmental Honors Advisor	C. Wells	150 Long Hall	CEWELLS	656-6940
Registration				
Registration Coordinator	J. Van Strien	127 Long Hall	VANJ	656-0854
CU Records/Registration				
Enrolled Student Services		104 Sikes Hall		656-2174
Center for Career and Professional Development		Hendrix Student Center, 3 rd floor		656-0440

Major Codes

BA-BIOS-G	BA Biological Sciences
E076	Prerehabilitation Sciences Emphasis Area
BS-BIOS-G	BS Biological Sciences
E077	Entomology Emphasis Area
E078	Prepharmacy Emphasis Area
E080	Toxicology Emphasis Area
BS-MICR-G	BS Microbiology
BIOM	Biomedicine Concentration
UD-PRPH-G	UD Prepharmacy – Non-degree

A NOTE TO ALL MAJORS:

Please keep this handbook for reference throughout your college career at Clemson University. Requirements may change in the future but you will only be responsible for those in effect at the time of your entrance – either as a freshman or transfer or as returning student if you leave school for one or more semesters.

We have attempted, in this unofficial publication, to be as accurate as possible, but typographical errors or errors of omission are possible. Requirements and courses are officially listed in the Clemson University Undergraduate Announcements 2017-2018, ([Undergraduate Announcements 2017-2018](#))

INTRODUCTION TO THE CURRICULA

Biology is the study of life from the study of individual molecules to that of whole organisms and ecosystems. The primary goal of the various curricula is to explore the descriptive, structural, functional, and evolutionary questions through this hierarchy of the organization of life. A second goal of these curricula is to explore how advances in biology apply to the health and well-being of man and society and to the continuation of earth as a balanced ecosystem. A third goal is to help produce informed citizens who can contribute to the dialog involving the many ethical, social, and political issues that have biological context or consequences.

In addition to these themes, woven throughout the curriculum will be an emphasis on the importance and use of communication, modern information technology, and mathematics. A technical writing class designed for biologists will enhance the scientific writing skills of students over and above the experiences gained in the writing of traditional lab reports and papers.

Students are encouraged to undertake research projects with faculty, and students enrolled in the honors program are required to do so with the end result being an honors thesis. Research may be performed through individually mentored projects with any faculty conducting biological research regardless of their department. In addition, our department offers a series of creative inquiry (team research) projects each semester. Students are also encouraged to have experience away from Clemson. These experiences might include study abroad programs, internships, or participation in an REU (Research Experience for Undergraduates) program sponsored by the National Science Foundation at many universities.

B.S. and B.A. Biological Sciences. Both the Bachelor of Science (B.S.) and the Bachelor of Arts (B.A.) degrees in Biological Sciences cover the spectrum of biological organization through classroom, laboratory, and fieldwork. The B.S. is a more comprehensive degree and is recommended for those who will continue in graduate programs. The B.A. provides a strong foundation in biology and is ideal for students desiring a more liberal education. They are both excellent courses of study for those who wish to enter professional school. They both require coursework in calculus, physics, chemistry, organic chemistry, biochemistry, genetics, evolutionary biology, and plant or animal diversity. They also both require that students take courses in the areas of physiology, cell biology, and ecology. The major distinction between the two degrees includes additional major course requirements for the B.S. while the B.A. requires four semesters of a foreign language (or its equivalent) and a minor. (See page 32 for a comparison of the B.S. and B.A. degrees)

Entomology Emphasis in Biological Sciences. Entomology is the biological discipline devoted to the study of insects. Insects are by far the largest animal group and can be found in virtually every habitat on Earth. They are significant as transmitters of human and other animal disease, as pests on crops and other plants and are vital to the stability of the ecosystem.

The Entomology Emphasis of the B.S. degree is distinct from the standard B.S. in Biological Sciences in that an insect diversity course substitutes for the normal animal diversity course. There are specific requirements for insect morphology and taxonomy plus additional course work in entomology to be selected from a defined list. Comparative physiology is recommended to fulfill the physiology requirement of the major. In addition, many Entomology courses are cross-listed in Biological Sciences allowing any student to receive credit in their major for courses about insect science.

Prepharmacy Emphasis in Biological Sciences. This curriculum is suited for students who want to receive a baccalaureate degree before applying to a college of pharmacy.

The prepharmacy emphasis of the B.S. degree is distinct from the standard B.S. in Biological Sciences in that specific courses in human anatomy, human physiology, microbiology, chemistry, and economics are required.

Prerehabilitation Sciences Emphasis in Biological Sciences. This curriculum is suited for students who want to receive a baccalaureate degree before applying to a rehabilitation sciences

program. Prerehabilitation sciences include physical therapy, occupational therapy, communication sciences and disorders, physician assisting, and allied health areas. This curriculum is designed to meet the requirements of these programs in the College of Health Professions at the Medical University of South Carolina and other professional schools

The Prerehabilitation sciences emphasis area is distinct from the standard B.A. in Biological Sciences in that specific courses in human anatomy and physiology and the American Heart Association Basic Life Support for Healthcare Providers certification are required. See [Basic Life Support](#) for information about the BLS. Depending on the graduate program sought, other recommendations include particular courses in exercise physiology, foreign languages, health sciences, and mathematics, microbiology, movement science, with psychology as the minor recommendation.

Toxicology Emphasis in Biological Sciences. Toxicology is the scientific study of the adverse effects of drugs and other foreign agents on the body and the environment. Toxicologists study the absorption and distribution of the foreign substance in the body, how the body metabolizes and eliminates these substances, and the mechanisms of action of these substances. Environmental toxicology is the study of the decomposition, fate, and effects of contaminants in aquatic and terrestrial ecosystems.

The toxicology emphasis area is distinct from the standard B.S. in Biological Sciences in that an introductory and advanced toxicology course, a quantitative analysis course with the lab, an environmental chemistry course, and an additional toxicology course are required. In addition, one of the animal physiology courses is recommended to fulfill the physiology requirement of the major.

Double Major in Biological Sciences/Science Teaching. The Bachelor of Arts Degree in Biological Sciences and Science Teaching: Biological Sciences prepares students for teaching biology on the secondary school level and for graduate studies in any of the life science areas.

B.S. Microbiology. Microbiology is the study of microorganisms (also known as microbes), which include bacteria, viruses, yeasts, filamentous fungi, protozoa and unicellular algae. Much of what we know about how cells grow, differentiate, replicate, move, and behave has come from studies of microbes. Microbes are important in our everyday lives. Some are the causative agents for diseases in humans and other organism, while others are essential in the prevention of diseases and/or in the maintenance and modification of our environment. Still others play essential roles in industry, where they are used to ferment beer, increase food production, and to produce antibiotics and other medically useful compounds. Microbiology also encompasses immunology, the study of the body's ability to ward off infections.

Both the standard MICR and the Biomedicine Concentration curricula are excellent courses of study for graduate or professional school. Both require courses in calculus, physics, chemistry including organic, and biochemistry. Both also require microbial diversity and ecology, microbial genetics and bacterial physiology as recommended by the American Society for Microbiology. The standard degree requires a course from a select list in each of the areas of the following areas: (1) biomedicine, (2) environmental microbiology, (3) food safety, industrial and technology, and (4) virology.

B.S. Microbiology - Biomedicine Concentration. This concentration allows students to take more courses related to human health and disease and includes courses in genetics, cell biology, immunology, virology, and cancer and aging.

CAREER OPPORTUNITIES

The Biological Sciences and Microbiology curricula have sufficient flexibility to enable the major to obtain coursework relevant to his or her future plans. The programs are designed to expose the student to a wide variety of biological areas. Furthermore, the background obtained by Biological Sciences and Microbiology majors enables them to better understand and relate to the modern world with its complex problems, many of which are biological in nature.

Job opportunities exist in both the academic and non-academic communities. For Biological Sciences and Microbiology majors who enter graduate school and obtain advanced degrees, jobs are available to teach in colleges and universities, as well as research and management opportunities in government and industry. Many biologists and microbiologists, some with a B.A. or B.S. degree, are employed by industry, environmental engineers and consulting firms. City, state and federal agencies are prime employers of biologists and microbiologists.

Career opportunities in biology are exciting and often adventurous. Jobs with universities, state and federal government agencies, the military and private businesses often include a chance to travel and explore exotic regions of the world.

A variety of career objectives is outlined in a Carolina Tips® publication entitled “Biology Careers for the Next Century” written by John A. Snyder. This information is available on-line at [Biology Careers](#). Additional career information for microbiology majors is available at [Microbiology Careers](#)

Employment. In the Southeast, jobs are available at agencies such as the Energy Research and Development Administration's (ERDA) Savannah River Ecology Lab at Aiken, SC (SREL), Oak Ridge National Laboratory (TN), Tennessee Valley Authority in Tennessee and North Carolina, Yerkes Primate Center in Atlanta, the Environmental Protection Agency, Department of Agriculture, Centers for Disease Control and Prevention in Atlanta, GA, Bureau of Sport Fisheries and Wildlife, and many zoos and zoological parks, to list only a few. A more extensive list of potential job opportunities for biologists is as follows:

Technician (laboratory/field) in a research laboratory at a University, U.S. Forest Service, industries dependent upon microbiology (e.g., food, fermentation, public health, pharmaceuticals, environmental consulting), Home Land Security, National Park Service, State Park Service, Environmental Protection Agency, both state and federal levels, State Public Health Department (e.g., SC DHEC), sales with a pharmaceutical biotech, or chemical company, underwriter for an insurance company, field/laboratory researcher for a large company/industry that has the potential for pollution of the environment (e.g., Duke Power, Dow Chemical Co., DHEC), genetic counseling, law enforcement (e.g., use of genetics background for DNA finger-printing), scientific illustrator, writer/editor for a popular science publication (e.g., Discover magazine), assistant to an Editor for a scientific journal (e.g., Science), environmental consulting firms, eco-tourism (in tropical countries as a naturalist), Disney World/Land, botanical gardens (e.g., Callaway Gardens), museums (e.g., Smithsonian Institution), zoos (e.g., Riverbanks Zoo in Columbia, SC), optometry, chiropractics, and forensics.

Graduate Programs. In addition to job opportunities immediately upon graduation, the Biological Sciences and Microbiology degrees prepare students for admission into a wide variety of graduate programs in biology, botany, microbiology, and zoology. With a careful selection of courses in allied fields or an emphasis area, a student can prepare for more specialized programs in areas such as cancer biology; regenerative medicine; molecular, cell and developmental biology; bioengineering; bioinformatics; environmental toxicology, plant biology; ecology, conservation biology; evolutionary biology; biomechanics; marine biology; wildlife biology and others. The student's faculty advisor can suggest courses relevant to the student's particular interests and objectives. Upon focusing on an area of study, the student is advised to check the requirements for specific graduate programs at various institutions that he/she might like to attend.

Professional Programs. Doctors, physician assistants, pharmacists, physical therapists and veterinarians are biologists. Some of these health care professionals work directly with patients, while others are involved in the rapidly advancing frontiers of medical research. In both cases, a degree in Biological Sciences or Microbiology is excellent preparation for professional school in the health sciences. In fact, Biological Sciences is one of the most popular major at Clemson University for students with an interest in human medicine and health care and is one of two majors most commonly selected by students wishing to apply for admission into a school of veterinary medicine.

As an additional aid to students in exploring possible career opportunities available to biologists, a number of informational websites are listed below.

WEBSITES

Careers in Biology – The Society for Integrative and Comparative Biology Educational Council – [Integrative and Comparative Biology](#)

Careers in Microbiology – [Microbe World](#)

Links to Sites with General Career Information – [Furman University Home Page](#)

Careers in Biology – Emporia State University – information about and other links to information about careers in specific fields of biology, including a listing/links to “places to look for specific jobs” – [Careers in Biology](#)

National Academy of Science Career Page – [Careers in Science and Engineering](#)

Careernet – links to jobs and career related websites – [Careers](#)

Biocom Career Center – information concerning Biotech, Biotechnology & Pharmaceutical careers – [Career Center](#)

Environmental Career Opportunities – The Brubach Corporation, Publishers [Environmental Careers](#)

Biowww.net - Biotech, pharmaceutical, and healthcare jobs – [bioJobs](#)

Science – Career Development Center for postdocs and junior Faculty – [Life-Science Careers](#)

American Association for the Advancement of Science – [Science Careers](#)

Clemson University Center for Career and Professional Development – [Careers](#)

ADVISING INFORMATION

<u>BIOS Advisor</u>	<u>Office</u>	<u>Lab</u>	<u>E-mail (@clemsn.edu)</u>	<u>Phone (864)</u>
J. A. Baeza	226 Long Hall	102/103 Jordan Hall	JBAEZAM	656-2157
L. T. Bain	239 Long Hall	300 Jordan Hall	LBAIN	656-5050
W. S. Baldwin	235 Long Hall	318 Jordan Hall	BALDWIN	656-2416
R. E. Ballard	G22 Jordan Hall		BALLARD	656-3579
D. G. Bielenberg	155 Long Hall	118C Jordan Hall	DBIELEN	656-2416
R. W. Blob	342 Long Hall	400 E-H 401-D Jordan Hall	RBLOB	656-2416
S. C. Chapman	340 Long Hall	320/321 Jordan	SCHAPM2	656-2416
M. J. Childress	105-A Jordan Hall	105 Jordan Hall	MCHILDR	656-2416
R. S. Cohen	132C Long Hall		RSCOHEN	656-1112
J. R. Cummings	146 Long Hall		CUMMINJ	656-3601
S. J. DeWalt	338 Long Hall	217 Jordan	SAARAD	502-8430
D. R. Dittrich-Reed	134 Long Hall	220 Jordan Hall	DDITTRI	656-2416
Z. Dou	151-B LSF	160-E LSF	ZDOU	656-2460
D. M. Feliciano	326 Jordan Hall	323/324 Jordan	DFELICI	656-2416
V. S. Gallicchio	122 Long Hall		VSGALL	650-6702
J. J. Hains	143 Long Hall	Cherry Farm	JHAINS	506-1111
R. C. Hardwick	148 Long Hall	202/210 Jordan Hall	RHARDWI	656-2416
T. L. McNutt-Scott	308 Jordan Hall		TMCNUTT	656-2416
L. C. Means	124 Long Hall		LONDANM	656-3604
C. M. Minor	330C Long Hall	326 Long Hall	MMINOR	656-2416
K. E. Powder	055 LSF		KPOWDER	656-3196
S. A. Price	136 Long Hall			
M. B. Ptacek	213 Jordan Hall	212/214 Jordan Hall	MPTACEK	656-6964
C. D. Rice	233 Long Hall	313 Jordan Hall	CDRICE	656-0449
V. P. Richards	111C Long Hall	111 Jordan Hall	VPRICHA	656-2207
M. W. Sears	323 Long Hall	306 Jordan Hall	SEARS3	656-2416
S. A. Sparace	336 Long Hall	112/213-A Jordan Hall	SMSPRC	314-5400
W. M. Surver	330A Long Hall		SURVERW	656-2416
L. A. Temesvari	255B LSF	260-D LSF	LTEMESV	656-6387
M. W. Turnbull	327 Jordan Hall	229 Jordan Hall	TURNBUL	
P. van den Hurk	237 Long Hall	224/225 Jordan Hall	PVDHURK	656-3594
N. R. Waggett	129 Long Hall		NWAGGET	656-5074
C. Wei	055-B LSF	060-D LSF	YWEI	656-7393
C. E. Wells	150 Long Hall	118 Jordan Hall	CEWELLS	656-2416
<u>MICR Advisor</u>	<u>Office</u>	<u>Lab</u>	<u>E-mail</u>	<u>Phone</u>
B. J. Campbell	155B LSF	160-E LSF	BCAMPB7	656-0559
M. Cao	116 Jordan Hall	103 Jordan Hall	MCAO	507-7270
J. M. Henson	157-A LSF	160-D LSF	HHENSON	656-2416
T. A. Hughes	155A LSF	160-C LSF	T020509	656-5433
H. D. Kurtz, Jr.	151A LSF	160-A LSF	HKURTZ	656-6915
K. B. Rudolph	330-E Long Hall	128 LSF	KRUDOLP	656-3838
S. W. Scott	231 Long Hall	226 Jordan Hall	SSCOTT	656-5745
J. Tzeng	149 LSF	160-A LSF	TZUENRT	986-0825
K. J. Whitehead	140 Long Hall	200 Jordan Hall	KWHITEH	656-4146
<u>Special Programs</u>	<u>Advisor</u>	<u>Office</u>	<u>E-mail</u>	<u>Phone</u>
Declared Major Pre-Professional School*	Chad Richardson	102 Long Hall	CMRICHA	656-4154
Pre-Veterinary Medicine*	Jeryl Jones	140 P&A	JERLY	656-2142
	Glenn Birrenkott	134 P&A	GBRRNKT	656-4019
Undeclared Major Pre-Pharmacy*	Adam Hunter	105 Long Hall	HUNTER3	656-3288
MUSC Accelerated Pathways	Adam Hunter	105 Long Hall	HUNTER3	656-3288
Entomology	Pat Zungoli	264 P&A	PZNGL	656-3137
Environmental Toxicology	Lisa Bain	239 Long Hall	LBAIN	656-5050
Double Major – EDSEC	Michelle Cook	418E Tillman Hall	MCOOK	656-2037

*Students interested in health profession or veterinary medicine graduate programs should choose a major as soon as possible after entering Clemson and must do so by the end of the first year. Mr. Richardson, Mr. Hunter, Dr. Jones, and Dr. Birrenkott, will continue to provide information, advice and help, relative to admission requirements for the appropriate professional school, but students should receive their academic advising within their chosen major to insure that all Clemson requirements for graduation are met.

B. S. BIOLOGICAL SCIENCES 2017-2018

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I.....1(1,0)	BIOL 1110 Prin. of Biol. II ¹5(4,3)
BIOL 1100 Prin. of Biol. I ¹5(4,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Calculus of One Var. I4(4,0)	Mathematical Sciences Requirement ³ <u>3</u>
Oral Communication Requirement ² <u>3</u>	15
17	

SOPHOMORE YEAR

CH 2230 Organic Chemistry ^{4,5}3(3,0)	BCHM 3050 Essential Elements of Bioch ⁸3(3,0)
CH 2270 Organic Chemistry Lab ^{4,5}1(0,3)	Major Requirement ^{4,9}4
GEN 3000 Fundamental Genetics ⁶3(3,0)	Social Science Requirement ¹⁰3
Arts and Humanities (Literature) Req. ²3	Electives..... <u>6</u>
Organismal Diversity Requirement ⁷4	16
Elective <u>2</u>	
16	

JUNIOR YEAR

BIOL 3350 Evolutionary Biology3(3,0)	ENGL 3150 Scientific Writing and Comm. ¹³3(3,0)
BIOL 4610 Cell Biology3(3,0)	PHYS 2080 General Physics II ¹⁴3(3,0)
BIOL 4620 Cell Biology Lab2(1,2)	PHYS 2100 General Physics II Lab ¹⁴1(0,2)
PHYS 2070 General Physics I ¹¹3(3,0)	Arts and Humanities (Non-Lit) Req. ¹⁰3
PHYS 2090 General Physics Lab I ¹¹1(0,3)	Functional Biol. Requirement ¹⁵3
Ecology Requirement ¹² <u>3</u>	Major Requirement ⁹ <u>2</u>
15	15

SENIOR YEAR

BIOL 4930 Senior Seminar or MICR 4930 Senior Seminar.....2(2,0)	Major Requirement ⁹9
Major Requirement ⁹6	Elective <u>3</u>
Social Science Requirement ¹⁰3	12
Elective <u>4</u>	
15	

Total Semester Hours = 121

¹ BIOL 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credit hours required must be satisfied by completing 1-2 extra credits.

² See General Education Requirements.

³ MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements.

⁴ Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.

⁵ CH 2010 and CH 2020 may substitute.

⁶ GEN 3020 may substitute.

⁷ At least one lecture and associated laboratory selected from BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, 4250/4260.

⁸ BCHM 3010 may substitute.

⁹ Twenty-one credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280, including at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.

¹⁰ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements. The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

¹¹ PHYS 1220/1240 may substitute.

¹² At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.

¹³ ENGL 3140 may substitute.

¹⁴ PHYS 2210/2230 may substitute.

¹⁵ At least one course selected from selected from BIOL 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, or MICR 4140.

2017/2018 B.S. BIOLOGICAL SCIENCES CURRICULUM

	SEM/Yr	Grade
BIOL Core Requirement: (31 cr.)		
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	5(4,3) ¹	_____
BIOL 1110/1111	5(4,3) ¹	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
Organismal Diversity Requirement (4 cr.)		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
Ecology (3 cr.)		
BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
Functional Biology Requirement (3 cr.)		
BIOL 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140	_____	_____
Major Requirement: (21 cr.)²		
Laboratory Course req. _____	_____	_____
Laboratory Course req. _____	_____	_____
Laboratory Course req. _____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Required Science Courses (33 cr.)		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ^{3,4}	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) ⁵	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁶	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁶	_____
Required Non-Science Courses (21 cr.)		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁷	_____
Arts & Humanities – Non-Literature	3(3,0) ^{7,8}	_____
Oral Communication Requirement	3(3,0) ⁷	_____
Social Sciences	_____	_____
_____	3(3,0) ^{7,8}	_____
_____	3(3,0) ^{7,8}	_____

- ¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL 1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.
- ² Twenty-one credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280, including at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.
- ³ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- ⁴ CH 2240/2280 satisfies 4 credits of Major Requirement.
- ⁵ Although Math, Statistics and Research Methods are not actual new MCAT topics and the Association of American Medical Colleges does not recommend any specific college courses in these areas, you are expected to have been exposed to these topics sufficiently during your education in order to be adequately prepared for the new MCAT.
- ⁶ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.
- ⁷ See General Education Requirements.
- ⁸ Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS). The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

Other Courses	SEM/Yr	Grade
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____

Electives (15 cr.)	SEM/Yr	Grade
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

2017/2018 B.S. BIOLOGICAL SCIENCES CURRICULUM PREMEDICINE WORKSHEET

BIOL Core Requirement: (31 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	5(4,3) ¹	_____
BIOL 1110/1111	5(4,3) ¹	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<i>Organismal Diversity Requirement (4 cr.)</i>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
<i>Ecology (3 cr.)</i>		
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (3 cr.)</i>		
BIOL 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140	_____	_____
Major Requirement: (21 cr.) ²		
<i>Laboratory Course req.</i> BIOL 3151 0(3)	_____	_____
<i>Laboratory Course req.</i> BIOL 3161 0(3)	_____	_____
<i>Laboratory Course req.</i> MICR 3051 0(3)	_____	_____
BIOL 3150/3151	4(3)	_____
BIOL 3160/3161	4(3)	_____
CH 2240, 2280	3(3,0) & 1(0,3)	_____
MICR 3050	4(3)	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Required Science Courses (33 cr.)		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ^{3,4}	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) ⁵	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁶	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁶	_____
Required Non-Science Courses (21 cr.)		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁷	_____
Arts & Humanities – Non-Literature	3(3,0) ^{7,8}	_____
Oral Communication Requirement	3(3,0) ⁷	_____
Social Sciences		
PSYC 2010	3(3,0) ⁸	_____
SOC 2010	3(3,0) ⁸	_____
Electives (15 cr.) ^{5, 9}		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL 1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.

² Twenty-one credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280, including at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.

³ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.

⁴ CH 2240/2280 satisfies 4 credits of Major Requirement.

⁵ Although Math, Statistics and Research Methods are not actual new MCAT topics and the Association of American Medical Colleges does not recommend any specific college courses in these areas, you are expected to have been exposed to these topics sufficiently during your education in order to be adequately prepared for the new MCAT.

⁶ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.

⁷ See General Education Requirements.

⁸ Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS). The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

⁹ In addition to challenging coursework, applicants should look for opportunities to demonstrate a range of competencies. To gain experience, applicants should consider volunteering at a local hospital or clinic to gain practical experience in the health professions. The applicant must demonstrate the ability to work successfully with others toward a common goal. A significant experience requiring teamwork is therefore expected in the course of the applicant's academic and/or extracurricular activities and should be documented in the application.

Other Courses	SEM/Yr	Grade
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____

Electives Cont'd

_____	_____	_____
_____	_____	_____
_____	_____	_____

2017/2018 B.S. BIOLOGICAL PREREHABILITATION SCIENCES WORKSHEET
Occupational Therapy (OT), Physical Therapy (PT), Speech Disorders, and Physician Assistant (PA)

BIOL Core Requirement: (31 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	5(4,3) ¹	_____
BIOL 1110/1111	5(4,3) ¹	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<i>Organismal Diversity Requirement (4 cr.)</i>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
<i>Ecology (3 cr.)</i>		
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (3 cr.)</i>		
BIOL 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140	_____	_____
Major Requirement: (21 cr.)²		
Laboratory Course req. BIOL 3151	0(3)	_____
Laboratory Course req. BIOL 3161	0(3)	_____
Laboratory Course req. BIOL 3150	4(3) ³	_____
BIOL 3160	4(3) ³	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Required Science Courses (33 cr.)		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ^{4,5}	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁶	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁶	_____
STAT 2300	3(3,0) ⁷	_____
Required Non-Science Courses (21 cr.)		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁸	_____
Arts & Humanities – Non-Literature	3(3,0) ^{8,9}	_____
Oral Communication Requirement	3(3,0) ⁸	_____
Social Sciences		
PSYC 2010	3(3,0) ^{8,9,10}	_____
_____	3(3,0) ^{8,9,10}	_____

- ¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL 1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.
- ² Twenty-one credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280, including at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.
- ³ Students applying to professional schools that require a course in exercise physiology, **which is offered spring semester, odd numbered years only**, may substitute BIOL 2220 and 2230 for BIOL 3150 and 3160 during their sophomore year **if BIOL 4780 Exercise Physiology is not offered during their senior year.**
- ⁴ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- ⁵ CH 2240/2280 satisfies 4 credits of Major Requirement.
- ⁶ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.
- ⁷ Healthcare professional schools have specific prerequisite MATH course requirements that vary by discipline and school of interest. Students, who plan to pursue a career in healthcare, should be sure to research these requirements as they make course selections for each upcoming semester.
- ⁸ See General Education Requirements.
- ⁹ Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- ¹⁰ The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.
- ¹¹ These hours should be used to satisfy specific prerequisite requirements for your professional school program. For example, some PT and OT schools require exercise physiology, medical terminology, abnormal psychology, and/or lifespan development courses. MICR 3050 is recommended for PA programs.

Other Courses	SEM/Yr	Grade
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____
Electives (15 cr.)¹¹		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

B. S. BIOLOGICAL SCIENCES 2017-2018 ENTOMOLOGY EMPHASIS

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I1(1,0)	BIOL 1110 Prin. of Biol. II ¹5(4,3)
BIOL 1100 Prin. of Biol. I ¹5(4,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Calculus of One Var. I4(4,0)	Mathematical Sciences Requirement ³ <u>3</u>
Oral Communication Requirement ² <u>3</u>	15
17	

SOPHOMORE YEAR

CH 2230 Organic Chemistry3(3,0)	BCHM 3050 Essential Elements of Bioch. ⁷3(3,0)
CH 2270 Organic Chemistry Lab ^{4,5}1(0,3)	BIOL 3350 Evolutionary Biology3(3,0)
ENT (BIOL) 3010 Insect Biol. & Div.4(3,3)	Major Requirement ^{4,8}4
GEN 3000 Fundamental Genetics ⁶3(3,0)	Social Science Requirement ⁹3
Arts and Humanities (Literature) Req. ²3	Elective <u>3</u>
Elective <u>2</u>	16
16	

JUNIOR YEAR

BIOL 4610 Cell Biology3(3,0)	ENGL 3150 Scientific Writing and Comm. ¹³3(3,0)
BIOL 4620 Cell Biology Laboratory2(1,2)	PHYS 2080 General Physics II ¹⁴3(3,0)
PHYS 2070 General Physics I ¹⁰3(3,0)	PHYS 2100 General Physics II Lab ¹⁴1(0,2)
PHYS 2090 General Physics Lab I ¹⁰1(0,3)	Arts and Humanities (Non-Lit) Req. ⁹3
Ecology Requirement ¹¹3	Entomology Requirement ¹²3
Entomology Requirement ¹² <u>3</u>	Functional Biol. Requirement ¹⁵ <u>3</u>
15	16

SENIOR YEAR

BIOL 4930 Senior Seminar or	Entomology Requirement ¹²4
MICR 4930 Senior Seminar2(2,0)	Major Requirement ^{4,8}3
Entomology Requirement ¹²4	Elective <u>6</u>
Social Science Requirement ⁹3	13
Elective <u>4</u>	
13	

Total Semester Hours = 121

¹ BIOL 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credit hours required must be satisfied by completing 1-2 extra credits.

² See General Education Requirements.

³ MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements.

⁴ Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.

⁵ CH 2010 and CH 2020 may substitute.

⁶ GEN 3020 may substitute.

⁷ BCHM 3010 may substitute.

⁸ Seven credit hours must be selected from BIOL or MICR courses at the 3000-level or above or CH 2240/2280.

⁹ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements.

¹⁰ PHYS 1220/1240 may substitute.

¹¹ At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.

¹² ENT (BIOL) 4000, (BIOL) 4150 and seven additional credits selected from ENT 3000, 3080, 4040/4090, 4070, (BIOL) 4360, (BIOL, WFB) 4690, 4900, (GEN) 4950, or PLPA (ENT) 4060.

¹³ ENGL 3140 may substitute.

¹⁴ PHYS 2210/2230 may substitute.

¹⁵ At least one course selected from selected from BIOL 3160, 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, or MICR 4140.

2017/2018 B.S. BIOLOGICAL SCIENCES CURRICULUM – ENTOMOLOGY EMPHASIS

BIOL Core Requirement: (31 cr.)	SEM/Yr	Grade	
BIOL 1010	1(1,0)	_____	_____
BIOL 1100/1101	5(4,3) ¹	_____	_____
BIOL 1110/1111	5(4,3) ¹	_____	_____
BIOL 3350	3(3,0)	_____	_____
BIOL 4610	3(3,0)	_____	_____
BIOL 4620/4621	2(1,2)	_____	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____	_____
<i>Organismal Diversity Requirement (4 cr.)</i>			
ENT (BIOL) 3010/3011	4(3,3)	_____	_____
<i>Ecology (3 cr.)</i>			
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030		_____	_____
<i>Functional Biology Requirement (3 cr.)</i> ²			
BIOL 3160, 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140.		_____	_____
Major Requirement: (7 cr.) ³			
_____		_____	_____
_____		_____	_____
_____		_____	_____
Entomology Requirement (14 cr.) ⁴			
ENT (BIOL) 4000/4001	4(3,3)	_____	_____
ENT (BIOL) 4150	3(3,0)	_____	_____
_____		_____	_____
_____		_____	_____
Required Science Courses (33 cr.)			
BCHM 3050	3(3,0)	_____	_____
CH 1010/1011	4(3,3)	_____	_____
CH 1020/1021	4(3,3)	_____	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ^{5,6}	_____	_____
GEN 3000	3(3,0)	_____	_____
MATH 1060	4(4,0)	_____	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) ⁷	_____	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁸	_____	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁸	_____	_____
Required Non-Science Courses (21 cr.)			
ENGL 1030/1031	3(3,1)	_____	_____
ENGL 3150 OR 3140	3(3,0)	_____	_____
Arts & Humanities – Literature	3(3,0) ⁹	_____	_____
Arts & Humanities – Non-Literature	3(3,0) ^{9,10}	_____	_____
Oral Communication Requirement	3(3,0) ⁹	_____	_____
Social Sciences		_____	_____
_____	3(3,0) ^{9,10}	_____	_____
_____	3(3,0) ^{9,10}	_____	_____

- ¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.
- ² Credit hours above 3 will be used for Major Requirement credits.
- ³ Seven credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.
- ⁴ Seven additional credits selected from ENT 3000, 3080/3081, 4000, 4040/4090, 4070, (BIOL) 4360/4361, (BIOL, WFB) 4690/4691, 4900, (GEN) 4950, or PLPA (ENT) 4060
- ⁵ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- ⁶ CH 2240/2280 satisfies 4 credits of Major Requirement.
- ⁷ Although Math, Statistics and Research Methods are not actual new MCAT topics and the Association of American Medical Colleges does not recommend any specific college courses in these areas, you are expected to have been exposed to these topics sufficiently during your education in order to be adequately prepared for the new MCAT.
- ⁸ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.
- ⁹ See General Education Requirements.
- ¹⁰ Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS). The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

Other Courses	SEM/Yr	Grade
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____
Electives (15 cr.)		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**B. S. BIOLOGICAL SCIENCES 2017-2018
PREPHARMACY EMPHASIS**

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I.....1(1,0)	BIOL 1040 General Biology II ¹3(3,0)
BIOL 1030 General Biology I ¹3(3,0)	BIOL 1060 General Biology Lab II.....1(0,3)
BIOL 1050 General Biology Lab I.....1(0,3)	CH 1020 General Chemistry.....4(3,3)
CH 1010 General Chemistry.....4(3,3)	ENGL 1030 Composition and Rhetoric.....3(3,1)
MATH 1060 Calculus of One Var. I.....4(4,0)	Mathematical Sciences Requirement ³ <u>3</u>
Oral Communication Requirement ² <u>3</u>	14
16	

SOPHOMORE YEAR

CH 2230 Organic Chemistry.....3(3,0)	BCHM 3050 Essential Elements of Bioch. ⁶3(3,0)
CH 2270 Organic Chemistry Lab.....1(0,3)	BIOL 3350 Evolutionary Biology.....3(3,0)
GEN 3000 Fundamental Genetics ⁴3(3,0)	CH 2240 Organic Chemistry.....3(3,0)
Arts and Humanities (Literature) Req. ²3	CH 2280 Organic Chemistry Lab.....1(0,3)
Organismal Diversity Requirement ⁵4	Social Science Requirement ⁷3
Elective..... <u>2</u>	Elective..... <u>3</u>
16	16

JUNIOR YEAR

BIOL 3150 Functional Human Anatomy.....4(3,3)	BIOL 3160 Human Physiology.....4(3,3)
BIOL 4610 Cell Biology.....3(3,0)	ENGL 3150 Scientific Writing and Comm. ⁹3(3,0)
BIOL 4620 Cell Biology Laboratory.....2(1,2)	PHYS 2080 General Physics II ¹⁰3(3,0)
PHYS 2070 General Physics I ⁸3(3,0)	PHYS 2100 General Physics II Lab ¹⁰1(0,2)
PHYS 2090 General Physics Lab I ⁸1(0,3)	Arts and Humanities (Non-Lit) Req. ⁷3
PSYC 2010 Introduction to Psychology..... <u>3</u>	Economics Requirement ¹¹ <u>3</u>
16	17

SENIOR YEAR

BIOL 4930 Senior Seminar or	MICR 3050 General Microbiology.....4(3,3)
MICR 4930 Senior Seminar.....2(2,0)	Major Requirement ¹³3
Ecology Requirement ¹²3	Elective..... <u>6</u>
Major Requirement ¹³3	13
Elective..... <u>5</u>	
13	

Total Semester Hours = 121

¹ Pharmacy programs require BIOL 1030/1050 and BIOL 1040/1060, or equivalent; however, BIOL 1100 and BIOL 1110 may substitute. The additional 1-2 credit hours will be subtracted from the Major Requirement credits.

² See General Education Requirements.

³ MATH 1080, STAT 2300, or other approved coursework. See advisor. Professional schools have different mathematics requirements.

⁴ GEN 3020 may substitute.

⁵ At least one lecture and associated laboratory selected from BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, 4250/4260.

⁶ BCHM 3010 may substitute.

⁷ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements.

⁸ PHYS 1220/1240 may substitute.

⁹ ENGL 3140 may substitute.

¹⁰ PHYS 2210/2230 may substitute.

¹¹ ECON 2000, 2110, or 2120

¹² At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.

¹³ Six credit hours must be selected from BIOL or MICR courses at the 3000-level or above.

2017/2018 B.S. BIOLOGICAL SCIENCES CURRICULUM PREPHARMACY EMPHASIS

BIOL Core Requirement: (30 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1030 & 1050	3(3,0) & 1(0,3) ¹	_____
BIOL 1040 & 1060	3(3,0) & 1(0,3) ¹	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<i>Organismal Diversity Requirement (4 cr.)</i>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
<i>Ecology (3 cr.)</i>		
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (4 cr.)</i>		
BIOL 3160/3161	_____	_____
Major Requirement: (18 cr.)²		
BIOL 3150/3151	4(3,3)	_____
CH 2240, 2280	3(3,0) & 1(0,3)	_____
MICR 3050/3051	4(3,3)	_____
_____	_____	_____
Required Science Courses (33 cr.)		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270	3(3,0) & 1(0,3)	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) ³	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁴	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁴	_____
Required Non-Science Courses (24 cr.)		
ECON 2000 OR 2110 OR 2120	3(3,0)	_____
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁵	_____
Arts & Humanities – Non-Literature	3(3,0) ^{5,6}	_____
Oral Communication Requirement	3(3,0) ⁵	_____
Social Sciences	_____	_____
PSYC 2010	3(3,0)	_____
_____	_____	_____

¹ Prepharmacy programs require BIOL 1030/1050 and 1040/1060 or equivalent; however, BIOL 1100/1101 and 1110/1111 may substitute. The additional 1–2 credit hours will be subtracted from Major Requirement credits.

² Eighteen credit hours must come from BIOL or MICR courses at the 3000-level or above or from CH 2240/2280,

³ Healthcare professional schools have specific prerequisite MATH course requirements that vary by discipline and school of interest. Students, who plan to pursue a career in healthcare, should be sure to research these requirements as they make course selections for each upcoming semester.

⁴ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.

⁵ See General Education Requirements.

⁶ Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS). The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

Other Courses	SEM/Yr	Grade
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____
_____	_____	_____

Electives (16 cr.)

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Total Semester Hours = 121

B. S. BIOLOGICAL SCIENCES 2017-2018 TOXICOLOGY EMPHASIS

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I1(1,0)	BIOL 1110 Prin. of Biol. II ¹5(4,3)
BIOL 1100 Prin. of Biol. I ¹5(4,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Calculus of One Var. I4(4,0)	Mathematical Sciences Requirement ³ <u>3</u>
Oral Communication Requirement ² <u>3</u>	15
17	

SOPHOMORE YEAR

BIOL 2110 Introduction to Toxicology.....3(3,0)	BCHM 3050 Essential Elements of Bioch ⁸3(3,0)
CH 2230 Organic Chemistry ^{4,5}3(3,0)	BIOL 3350 Evolutionary Biology3(3,0)
CH 2270 Organic Chemistry Lab ^{4,5}1(0,3)	Major Requirement ^{4,9}4
GEN 3000 Fundamental Genetics ⁶3(3,0)	Organismal Diversity Requirement ¹⁰4
Social Science Requirement ⁷3	Elective <u>3</u>
Elective <u>2</u>	16
16	

JUNIOR YEAR

BIOL 4610 Cell Biology3(3,0)	ENGL 3150 Scientific Writing and Comm. ¹³3(3,0)
BIOL 4620 Cell Biology Laboratory.....2(1,2)	PHYS 2080 General Physics II ¹⁴3(3,0)
ETOX 4300 Toxicology3(3,0)	PHYS 2100 General Physics II Lab ¹⁴1(0,2)
PHYS 2070 General Physics I ¹¹3(3,0)	Arts and Humanities (Literature) Req. ²3
PHYS 2090 General Physics I Lab ¹¹1(0,3)	Functional Biol. Requirement ¹⁵3
Ecology Requirement ¹² <u>3</u>	Elective <u>2</u>
15	15

SENIOR YEAR

BIOL 4930 Senior Seminar or	CH 4130 Chemistry of Aqueous Systems or
MICR 4930 Senior Seminar.....2(2,0)	ETOX 4210 Chemical Fate in Environ.3(3,0)
CH 3130 Quantitative Analysis3(3,0)	Arts and Humanities (Non-Lit) Req. ⁸3
CH 3150 Quantitative Analysis Lab.....2(0,6)	Toxicology Requirement ¹⁶3
Social Science Requirement ⁸3	Elective <u>3</u>
Elective <u>5</u>	12
15	

Total Semester Hours = 121

- ¹ BIOL 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credit hours required must be satisfied by completing 1-2 extra credits.
- ² See General Education Requirements.
- ³ MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements.
- ⁴ Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.
- ⁵ CH 2010 and CH 2020 may substitute.
- ⁶ GEN 3020 may be substituted.
- ⁷ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements.
- ⁸ BCHM 3010 may substitute.
- ⁹ Four credit hours must be selected from BIOL or MICR courses at the 3000-level or above or CH 2240/2280.
- ¹⁰ At least one lecture and associated laboratory selected from BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, 4250/4260.
- ¹¹ PHYS 1220/1240 may substitute.
- ¹² At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.
- ¹³ ENGL 3140 may substitute.
- ¹⁴ PHYS 2210/2230 may substitute.
- ¹⁵ At least one course selected from selected from BIOL 3160, 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, or MICR 4140.
- ¹⁶ Any 4000-level ETOX course.

2017/2018 B.S. BIOLOGICAL SCIENCES CURRICULUM – TOXICOLOGY EMPHASIS

BIOL Core Requirement: (34 cr.)	SEM/Yr	Grade	
BIOL 1010	1(1,0)	_____	_____
BIOL 1100/1101	5(4,3) ¹	_____	_____
BIOL 1110/1111	5(4,3) ¹	_____	_____
BIOL 2110	3(3,0)	_____	_____
BIOL 3350	3(3,0)	_____	_____
BIOL 4610	3(3,0)	_____	_____
BIOL 4620/4621	2(1,2)	_____	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____	_____
<i>Organismal Diversity Requirement (4 cr.)</i>			
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260		_____	_____
<i>Ecology (3 cr.)</i>			
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030		_____	_____
<i>Functional Biology Requirement (3 cr.)²</i>			
BIOL 3160, 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140.		_____	_____
Major Requirement: (4 cr.)³			
_____		_____	_____
_____		_____	_____
Toxicology Requirement (6 cr.)⁴			
ETOX 4300	3(3,0)	_____	_____
_____	3(3,0)	_____	_____
Required Science Courses (41 cr.)			
BCHM 3050	3(3,0)	_____	_____
CH 1010/1011	4(3,3)	_____	_____
CH 1020/1021	4(3,3)	_____	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ^{5,6}	_____	_____
CH 3130 & 3150	3(3,0) & 2(0,6)	_____	_____
CH 4130 OR ETOX 4210	3(3,0)	_____	_____
GEN 3000 (OR 3020)	3(3,0)	_____	_____
MATH 1060	4(4,0)	_____	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) ⁷	_____	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁸	_____	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁸	_____	_____
Required Non-Science Courses (21 cr.)			
ENGL 1030/1031	3(3,1)	_____	_____
ENGL 3150 OR 3140	3(3,0)	_____	_____
Arts & Humanities – Literature	3(3,0) ⁹	_____	_____
Arts & Humanities – Non-Literature	3(3,0) ^{9,10}	_____	_____
Oral Communication Requirement	3(3,0) ⁹	_____	_____
Social Sciences		_____	_____
_____	3(3,0) ^{9,10}	_____	_____
_____	3(3,0) ^{9,10}	_____	_____

Other Courses	SEM/Yr	Grade
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____

Electives (15 cr.)		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.

² Credit hours above 3 will be used for Major Requirement credits.

³ Four credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280.

⁴ Any 4000-level ETOX course.

⁵ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.

⁶ CH 2240/2280 satisfies 4 credits of Major Requirement.

⁷ Although Math, Statistics and Research Methods are not actual new MCAT topics and the Association of American Medical Colleges does not recommend any specific college courses in these areas, you are expected to have been exposed to these topics sufficiently during your education in order to be adequately prepared for the new MCAT.

⁸ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.

⁹ See General Education Requirements.

¹⁰ Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS). The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

**COMBINED BACHELOR OF SCIENCE IN BIOLOGICAL
SCIENCES/MASTER OF SCIENCE IN BIOENGINEERING (Revised 9/25/2015)**

BIOL Undergraduate Advisor: Londa Means, londanm@clemson.edu, 656-5074

BIOE Graduate Advisor: Maria Torres, mariam@clemson.edu, 656-7276.

Biological Sciences undergraduates at Clemson University may begin a Master of Science (MS) degree in Bioengineering while completing their Bachelor of Science (BS) degree by using a limited number of courses to satisfy both degrees. The following specific requirements apply:

1. To be eligible for this plan (to file GS6BS/MS form), students must have completed their bachelor's curriculum through their junior year (minimum 90 credits) and have a minimum overall grade point ratio of 3.4. **Note:** The GRE requirement for admissions is eliminated for students with approved GS6BS/MS forms: [Combined Bachelor's/Masters Plan](#)
2. Students should select the PHYS 1220, 1240 and PHYS 2210, 2230 options to fulfill the physics requirement for their BS degree.
3. Students will be required to take the following courses (a-d) as undergraduates:
 - a. Calculus of Several Variables (MATH 2060, 4 credits) **and** Intro to Ordinary Differential Equations (MATH 2080, 4 credits)
 - b. Statics (CE 2010, 3 credits)
 - c. Introduction to Materials Science (MSE 2100, 3 credits) **or** Introductory Circuit (ECE 2070/2080, 4 credits)
 - d. An additional junior-level engineering course: e.g., Biomechanics (BIOE 3200), Biofluid Mechanics (BIOE 3210) Bioinstrumentation (BIOE 3700), Thermodynamics of Materials (MSE 3260), Transport Phenomena (MSE 3270), Mechanical Behavior of Materials (MSE 4220)
4. Up to 6 credit hours of 6000 level elective courses from BIOE, BIOL or BCHM may be used to satisfy both the BS and MS requirements. However, the core requirement courses for the BIOL BS degree (e.g., BIOL 4610/6610, Cell Biology) cannot be counted twice for both degrees. Biotechnology for Bioengineers (BIOE 6400) is recommended. For other courses, see advisor.
5. Students will most often enroll into the non-thesis MS program. Students may take the MS thesis option if they are able to arrange for a faculty member in either Biological Sciences or Bioengineering to be their thesis advisor for a defined research project. Those who intend to follow the thesis option may start their research as BIOL 4910 during their junior year and continue under this during their senior year. Beginning in the summer after their senior year students will enroll in BIOE 8910 (6 credits total required) for thesis option or BIOE 8920 (6 credits total required) for a non-thesis option. The intended outcome for the thesis student is publishable experimental research. The intended outcome for the non-thesis student is a paper based on library or limited laboratory work or both. Both types of students will undergo an oral exam in which they defend their project work and are tested on relevant general knowledge of biology and bioengineering.
6. As part of the graduate program students will be required to take Seminar in Bioengineering Research (BIOE 8000, 1 credit each semester – only 1 credit counted towards degree requirements), Research Principles (BIOE 6150, 1 credit), Biomaterials (BIOE 8010, 3 credits); Biomedical Basis for Engineered Replacement (BIOE 8460, 3 credits), and one of the following three courses: Structural Biomechanics (BIOE 8200, 3 credits), Transport Processes in Bioengineering (BIOE 8470, 4 credits), or Bioinstrumentation (BIOE 8700, 3 credits). During the summer following their senior year students will enroll in Statistical Methods I (STAT 8010/8011, 4 credits). These courses with an additional elective (6000- or 8000-level BIOE or BIOL, 2-3credit) course will fully satisfy the total of 30 credits required for the thesis option. Non-thesis students will need to take additional 5-6 credit hours as necessary to meet the 33 credits required; course selection to satisfy these additional credit hours should be made in consultation with the student's research advisor.
7. Students in a combined degree program are conditionally accepted to the graduate program until completion of the BS degree requirements. Students enrolled in the MS degree program should anticipate covering the full amount of tuition, fees, and living expenses for their MS degree. Under special circumstances, research assistantship support for MS thesis projects may be available from individual faculty members or teaching assistantship support from the Department of Biological Sciences.

Students interested in this combined BS/MS degree program should consult with Ms. Londa Means as early as possible in their undergraduate curriculum. Application should be made by the end of their junior year (minimum 90 credits), but can be made at any time so long as the requirements for the program are met. The GS6BS/MS form is submitted to the Graduate School.

BIOE COURSES – BIOMATERIALS TRACK

BIOE 3200 Biomechanics 3 (3) Study of relation between biological and mechanical functions of musculoskeletal tissues such as bone, ligaments, muscles, cartilage, etc.; mechanics of human joints; analysis of implants and implant failure. Preq: CE 2010 and MATH 2080. Fall & Spring.

BIOE 6120 Orthopaedic Engineering and Pathology 3 (3) Interdisciplinary study of clinical orthopaedic cases (bone growth, bone remodeling, osteoarthritis, implant fixation and joint replacements); biomechanical, biomaterials, tribology and clinical diagnosis of failed implants (total joint replacements, fracture fixation and spinal instrumentation); basic concepts of orthopaedic pathology for engineers. Preq: BIOE 3020 and BIOE 3200; Preq or concurrent enrollment: BIOL 3150. Fall.

BIOE 6230 Cardiovascular Engineering and Pathology 3 (3) Medical and bioengineering aspects of artificial cardiovascular and vascular devices; physiology and pathological aspects of patients with need for such devices; diagnostic techniques and surgical management of diseases and pathology; design aspects of current devices and selection; state of the art in experiments and human clinical trials. Preq: BIOE 3020 and BIOE BIOL 3150; and either BIOE 3200 or BIOE 3210. Spring.

BIOE 6400 Biopharmaceutical Engineering 3 (3) This course examines the design principles necessary to use bacteria, fungi, and mammalian cells in bioengineering applications, including molecular techniques, fermentation, process scale-up, purification processes, and FDA regulations. The production of biopharmaceuticals derived from recombinant systems, including uses in medical systems, is emphasized. Preq: BCHM 3050. Fall.

BIOE 6820 Biomaterial Implantology 3 (2) Provides training in the planning and conduct of experimental surgery, including laws and regulations; institutional requirements; selection of animal models; ethical considerations of animal research; preparation of animals for surgery; general and special surgical techniques; aseptic surgical techniques; and basic and applied instrumentation. Preq: Junior standing in Bioengineering. Coreq: BIOE 4821. Summer.

CE 2010 Statics 3 (3) Forces and force systems and their external effect on bodies, principally the condition of equilibrium. The techniques of vector mathematics are employed, and the rigor of physical analysis is emphasized. Includes Honors sections. Preq: PHYS 1220 with a C or better. Preq or concurrent enrollment: ENGR 1070 and MATH 2060. Fall & Spring.

MSE 2100 Introduction to Materials Science 3 (3) Introductory course in materials science designed primarily for engineering students. Studies the relation between the electrical, mechanical, and thermal properties of products and the structure and composition of these products. All levels of structure are considered from gross structures easily visible to the eye through electronic structure of atoms. Preq: CH 1010 with a C or better. Preq or concurrent enrollment: MATH 1080. Fall & Spring.

BIOE COURSES – BIOINSTRUMENTATION TRACK

BIOE 3700 Bioinstrumentation and Bioimaging 3 (2) Introduction of fundamental topics in bioinstrumentation and bioimaging focused on the acquisition and monitoring of vital signals. Basic principles for the selection and appropriate use of instruments for solving bioengineering and medical problems such as microscopy, magnetic resonance imaging, and ultrasounds, among others, are addressed. Preq: MATH 2080; and ECE 2020 or ECE 2070. Coreq: BIOE 3701. Fall & Spring.

BIOE 6310 Medical Imaging 3 (2) Introduction to the history, physics, and basis of medical imaging devices; including X-ray, Computed Tomography, Magnetic Resonance Imaging, and Ultrasound. Students will understand imaging from both an engineering and clinical prospective. Students will have the opportunity to work with real medical-images, to understand the trade-offs between modalities. Preq: MATH 2080; and one of ECE 2020 or ECE 2070. Preq or concurrent enrollment: BIOE 3700. Coreq: BIOE 6311. Fall.

BIOE 6400 Biopharmaceutical Engineering 3 (3) This course examines the design principles necessary to use bacteria, fungi, and mammalian cells in bioengineering applications, including molecular techniques, fermentation, process scale-up, purification processes, and FDA regulations. The production of biopharmaceuticals derived from recombinant systems, including uses in medical systems, is emphasized. Preq: BCHM 3050. Fall.

BIOE 6710 Biophotonics 3 (3) Biophotonics is an interdisciplinary subject of applying photonics to study biological samples from individual cells to the entire body. Introduces fundamental and frontier topics in optical imaging aspects of biophotonics for senior-level undergraduates and graduate students to gain the ability to solve bioimaging-related biomedical problems. Preq: MATH 2080; and PHYS 2210; and either ECE 2070 or ECE 3200. Spring.

BIOE 6820 Biomaterial Implantology 3 (2) Provides training in the planning and conduct of experimental surgery, including laws and regulations; institutional requirements; selection of animal models; ethical considerations of animal research; preparation of animals for surgery; general and special surgical techniques; aseptic surgical techniques; and basic and applied instrumentation. Preq: Junior standing in Bioengineering. Coreq: BIOE 6821. Summer.

CE 2010 Statics 3 (3) Forces and force systems and their external effect on bodies, principally the condition of equilibrium. The techniques of vector mathematics are employed, and the rigor of physical analysis is emphasized. Includes Honors sections. Preq: PHYS 1220 with a C or better. Preq or concurrent enrollment: ENGR 1070 and MATH 2060. Fall & Spring.

ECE 2070 Basic Electrical Engineering 2 (2) A first course in electrical engineering to provide non-Electrical Engineering majors with a knowledge of DC and AC circuit theory, AC power distribution, and numerous electrical devices, apparatus, and digital systems. Credit may not be received for both ECE 2070 and ECE 3080. Preq: MATH 2060 and PHYS 2210. Fall & Spring.

ECE 2080 Electrical Engineering Laboratory II (2) Laboratory to accompany ECE 2070. Basic electrical circuits and instrumentation. Preq or enrollment: ECE 2070. Fall & Spring.

B. S. BIOLOGICAL SCIENCES / M.S. BIOENGINEERING ROADMAP 2017-2018

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I.....1(1,0)	BIOL 1110 Prin. of Biol. II ¹5(4,3)
BIOL 1100 Prin. of Biol. I ¹5(4,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Calculus of One Var. I4(4,0)	MATH 1080 Calculus of One Var. II.....4
Oral Communication Requirement ²3	16
17	

SOPHOMORE YEAR

CH 2230 Organic Chemistry and3(3,0)	BCHM 3050 Essential Elements of Bioch ⁷3(3,0)
CH 2270 Organic Chemistry Lab ^{3,4}1(0,3)	BIOL 3350 Evolutionary Biology3(3,0)
GEN 3000 Fundamental Genetics ⁵3(3,0)	MATH 2080 Intro. Ordin. Differ. Equ.....4(4,0)
MATH 2060 Calculus of Several Var4(4,0)	Social Science Requirement ⁸3
Organismal Diversity Requirement ⁶4	Major Requirement ⁹3
15	16

JUNIOR YEAR

BIOL 4610 Cell Biology3(3,0)	BIOE 3200 Biomechanics ¹⁰ or3(3,0)
BIOL 4620 Cell Biology Laboratory.....2(1,2)	BIOE 3700 Bioinstr and Bioimaging ¹¹3(2,3)
CE 2010 Statics3(3,0)	ENGL 3150 Scientific Writing and Comm. ¹²3(3,0)
MSE 2100 Intro. Material Science ¹⁰ or3(3,0)	PHYS 2210 Physics with Calculus II and3(3,0)
ECE 2070 Basic Elect Engineer ¹¹ and2(2,0)	PHYS 2230 Physics Laboratory II1(0,3)
ECE 2080 Elect Engineering Lab I.....1(0,2)	Arts and Humanities (Literature) Req. ²3
PHYS 1220 Physics with Calculus I and3(3,0)	Functional Biol. Requirement ¹³3
PHYS 1240 Physics Laboratory I.....1(0,3)	16
15	

SENIOR YEAR

BIOE 6400 Biopharmaceutical Engineer3(3,0)	Arts and Humanities (Non-Lit) Req. ⁸3
BIOL 3150 Functional Human Anatomy4(3,3)	BIOE, BIOL OR BCHM 6xxx.....3
BIOL 4930 Senior Seminar or	Ecology Requirement ¹⁴3
MICR 4930 Senior Seminar.....2(2,0)	Major Requirement ^{9, 15}3
Major Requirement ⁹3	12
Social Science Requirement ⁸3	
15	

Total Semester Hours = 122

¹ BIOL 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credit hours required must be satisfied by completing 1-2 extra credits.

² See General Education Requirements.

³ Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.

⁴ CH 2010 and CH 2020 may substitute.

⁵ GEN 3020 may substitute.

⁶ At least one lecture and associated laboratory selected from BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, 4250/4260

⁷ BCHM 3010 may substitute.

⁸ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements. The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

⁹ Credit hours must come from BIOL or MICR courses at the 3000-level or above, three classes of which must be laboratory. Two semesters of BIOL 4910 are recommended for BIOE MS thesis option.

¹⁰ Biomaterials track

¹¹ Bioinstrumentation track

¹² ENGL 3140 may substitute.

¹³ At least one course selected from selected from BIOL 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, or MICR 4140.

¹⁴ At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.

¹⁵ Students may take additional graduate courses during this semester. See advisor.

2017/2018 B.S. BIOLOGICAL SCIENCES/M.S. BIOENGINEERING WORKSHEET

BIOL Core Requirement: (31 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	5(4,3) ¹	_____
BIOL 1110/1111	5(4,3) ¹	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<i>Organismal Diversity Requirement (4 cr.)</i>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
<i>Ecology (3 cr.)</i>		
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (3 cr.)</i>		
BIOL 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140	_____	_____
Major Requirement: (21 cr.) ²		
Laboratory course req. BIOL 3151 (0)	_____	_____
Laboratory Course req.	_____	_____
Laboratory Course req.	_____	_____
BIOL 3150 (4)	_____	_____
MATH 2060 (4) ³	_____	_____
MATH 2080 (4) ³	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Required Science Courses (34 cr.)		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ⁴	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080	4(4,0)	_____
PHYS 1220, 1240	3(3,0) & 1(0,2)	_____
PHYS 2210, 2230	3(3,0) & 1(0,2)	_____
Required Non-Science Courses (21 cr.)		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁶	_____
Arts & Humanities – Non-Literature	3(3,0) ^{6,7}	_____
Oral Communication Requirement	3(3,0) ⁶	_____
Social Sciences	_____	_____
_____	3(3,0) ^{6,7}	_____
_____	3(3,0) ^{6,7}	_____

- ¹ BIOL 1100 and 1110 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.
- ² Twenty-one credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280, including at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits. Two semesters of BIOL 4910 are recommended for the Bioengineering M.S. Thesis Option.
- ³ Requires course substitution.
- ⁴ Most medical and dental schools require two semesters of organic chemistry with laboratory (CH 2230, 2270 and 2240, 2280).
- ⁵ CH 2240/2280 satisfies 4 credits of Major Requirement.
- ⁶ See General Education Requirements.
- ⁷ Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- ⁸ Biomaterials track. See advisor if this course is not available.
- ⁹ Bioinstrumentation track
- ¹⁰ Used to satisfy both the BS and MS requirements (6 credits total).
- ¹¹ Requires prerequisite override from Civil Engineering

Other Courses	SEM/Yr	Grade
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

Electives (15 cr.)		
BIOE 3200 ⁸ (3) OR BIOE 3700 ⁹ (3)	_____	_____
BIOE 6400 ¹⁰ (3)	_____	_____
CE 2010 (3) ¹¹	_____	_____
MSE 2100 (3) ⁸ OR ECE 2070 (2) ⁹ and ECE 2080 (1)	_____	_____
BIOE, BIOL OR BCHM 6xxx ¹⁰ (3)	_____	_____

B.A. BIOLOGICAL SCIENCES 2017-2018

FRESHMAN YEAR

First Semester	Second Semester
BIOL 1010 Frontiers in Biol. I ¹ 1(1,0)	BIOL 1110 Prin. of Biol. II ² 5(4,3)
BIOL 1100 Prin. of Biol. I ² 5(4,3)	CH 1020 General Chemistry 4(3,3)
CH 1010 General Chemistry 4(3,3)	ENGL 1030 Composition and Rhetoric 3(3,1)
MATH 1060 Calculus of One Var. I 4(4,0)	Mathematical Sciences Requirement ⁴ 3
Oral Communication Requirement ³ 3	15
17	

SOPHOMORE YEAR

CH 2230 Organic Chemistry 3(3,0)	BCHM 3050 Essential Elements of Bioch. ¹⁰ 3(3,0)
CH 2270 Organic Chemistry Lab ^{5,6} 1(0,3)	Modern Language Requirement ⁸ 4
GEN 3000 Fundamental Genetics ⁷ 3(3,0)	Major Requirement ^{5,11} 4
Arts and Humanities (Literature) Req. ³ 3	Organismal Diversity Requirement ¹² 4
Modern Language Requirement ⁸ 4	15
Social Science Requirement ⁹ 3	
17	

JUNIOR YEAR

BIOL 3350 Evolutionary Biology 3(3,0)	Arts and Humanities (Non-Lit) Req. ⁹ 3
BIOL 4610 Cell Biology 3(3,0)	Modern Language Requirement ⁸ 3
BIOL 4620 Cell Biology Laboratory 2(1,2)	Ecology Requirement ¹⁵ 3
ENGL 3150 Scientific Writing & Comm ¹³ 3(3,0)	Minor Requirement ¹⁴ 6
Modern Language Requirement ⁸ 3	15
Minor Requirement ¹⁴ 3	
17	

SENIOR YEAR

BIOL 4930 Senior Seminar ¹⁶ or 2(2,0)	PHYS 2080 General Physics II ¹⁹ 3(3,0)
MICR 4930 Senior Seminar ¹⁶ 2(2,0)	PHYS 2100 General Physics II Lab ¹⁹ 1(0,2)
PHYS 2070 General Physics I ¹⁷ 3(3,0)	Minor Requirement ¹⁴ 6
PHYS 2090 General Physics I Lab ¹⁷ 1(0,2)	Elective 3
Functional Biology Requirement ¹⁸ 3	13
Social Science Requirement ⁹ 3	
12	

Total Semester Hours = 121

- ¹ Students seeking a double major in Science Teaching/Biological Sciences should substitute ED 1050 for BIOL 1010.
- ² BIOL 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.
- ³ See General Education Requirements.
- ⁴ MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements.
- ⁵ Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.
- ⁶ CH 2010 and CH 2020 may substitute.
- ⁷ GEN 3020 may substitute.
- ⁸ Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement on page 27.
- ⁹ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements. The Medical Colleges Admission Test (MCAT) includes questions on psychology and sociology.
- ¹⁰ BCHM 3010 may substitute.
- ¹¹ Four credit hours must be selected from BIOL or MICR courses at the 3000-level or above or CH 2240/2280. Students seeking a double major in Science Teaching/Biological Sciences should substitute EDSC 4470 for Major Requirement.
- ¹² At least one lecture and associated laboratory selected from BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, 4250/4260.
- ¹³ ENGL 3140 may substitute.
- ¹⁴ See page 136 for approved minors.
- ¹⁵ At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.
- ¹⁶ Students seeking a double major in Science Teaching/Biological Sciences should substitute EDSC 4570 for BIOL 4930 or MICR 4930.
- ¹⁷ PHYS 1220/1240 may substitute.
- ¹⁸ At least one course selected from selected from BIOL 3160, 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, or MICR 4140.
- ¹⁹ PHYS 2210/2230 may substitute.

2017/2018 B.A. BIOLOGICAL SCIENCES CURRICULUM

BIOL Core Requirement: (31 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	5(4,3) ¹	_____
BIOL 1110/1111	5(4,3) ¹	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<i>Organismal Diversity Requirement (4 cr.)</i>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
<i>Ecology (3 cr.)</i>		
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (3 cr.)²</i>		
BIOL 3160/3161, 4010, 4080, 4200, 4400, 4590, 4750, 4800, 4830, 4840, OR MICR 4140	_____	_____
Major Requirement: (4 cr.)³		
_____	_____	_____
Required Science Courses (33 cr.)		
BCHM 3050 (OR 3010)	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ^{4,5}	_____
GEN 3000 (OR 3020)	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) ⁶	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁷	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁷	_____
Required Non-Science Courses (35 cr.)		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁸	_____
Arts & Humanities – Non-Literature	3(3,0) ^{8,9}	_____
Modern Language	4(3,1) ¹⁰	_____
Modern Language	4(3,1) ¹⁰	_____
Modern Language	3(3,0) ¹⁰	_____
Modern Language	3(3,0) ¹⁰	_____
Oral Communication Requirement	3(3,0) ⁸	_____
Social Sciences	_____	_____
_____	3(3,0) ^{8,9,11}	_____
_____	3(3,0) ^{8,9,11}	_____
Minor Courses (15 cr.)¹²		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

- ¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL 1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.
- ² Credit hours above 3 will be used for Major Requirement credits.
- ³ Four credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280.
- ⁴ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- ⁵ CH 2240/2280 satisfies 4 credits of Major Requirement.
- ⁶ Although Math, Statistics and Research Methods are not actual new MCAT topics and the Association of American Medical Colleges does not recommend any specific college courses in these areas, you are expected to have been exposed to these topics sufficiently during your education in order to be adequately prepared for the new MCAT.
- ⁷ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.
- ⁸ See General Education Requirements.
- ⁹ Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- ¹⁰ Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement on page 27.
- ¹¹ The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.
- ¹² Minors as listed under Degree Programs and Minors in the Undergraduate Announcements, pg. 137.

Other Courses	SEM/Yr	Grade
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____
Electives (3 cr.)		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

B. A. BIOLOGICAL SCIENCES 2017-2018 PREREHABILITATION SCIENCES EMPHASIS

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I.....1(1,0)	BIOL 1040 General Biology II ¹ and3(3,0)
BIOL 1030 General Biology I ¹ and3(3,0)	BIOL 1060 General Biology II Lab1(0,3)
BIOL 1050 General Biology I Lab.....1(0,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Cal. of One Var. I4(4,0)	Statistics Requirement ³ <u>3</u>
Oral Communication Requirement ² <u>3</u>	14
16	

SOPHOMORE YEAR – See Footnote 11

CH 2230 Organic Chemistry and3(3,0)	BCHM 3050 Essential Elements of Bioch. ⁹3(3,0)
CH 2270 Organic Chemistry Lab ^{4,5}1(0,3)	PSYC 2010 Introduction to Psychology.....3(3,0)
GEN 3000 Fundamental Genetics ⁶3(3,0)	Arts and Humanities (Literature) Req. ²3
Modern Language Requirement ⁷4	Modern Language Requirement ⁷4
Organismal Diversity Requirement ⁸ <u>4</u>	Social Science Requirement ¹⁰ <u>3</u>
15	16

JUNIOR YEAR

BIOL 3150 Functional Human Anatomy ¹¹4(3,3)	BIOL 3160 Human Physiology ¹¹4(3,3)
BIOL 3350 Evolutionary Biology3(3,0)	Arts and Humanities (Non-Lit) Req. ¹⁰3
BIOL 4610 Cell Biology3(3,0)	Modern Language Requirement ⁸3
BIOL 4620 Cell Biology Laboratory.....2(1,2)	Minor Requirement ¹² <u>6</u>
Modern Language Requirement ⁷ <u>3</u>	16
15	

SENIOR YEAR

BIOL 4930 Senior Seminar or	PHYS 2080 General Physics II ¹⁶3(3,0)
MICR 4930 Senior Seminar.....2(2,0)	PHYS 2100 General Physics II Lab ¹⁶1(0,2)
ENGL 3150 Scientific Writing and Comm ¹³3(3,0)	Minor Requirement ¹²6
PHYS 2070 General Physics I ¹⁴3(3,0)	Elective ¹⁷ <u>5</u>
PHYS 2090 General Physics I Lab ¹⁴1(0,2)	15
Ecology Requirement ¹⁵3	
Minor Requirement ¹² <u>3</u>	
15	

Total Semester Hours = 122

¹ Rehabilitation programs require BIOL 1030/1050 and BIOL 1040/1060, or equivalent; however, BIOL 1100 and BIOL 1110 may substitute.

² See General Education Requirements.

³ STAT 2300 or other approved coursework. See advisor. Professional schools have different mathematics requirements.

⁴ CH 2010 Survey of Organic Chemistry and CH 2020 Survey of Organic Chemistry may substitute.

⁵ Most professional health sciences schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.

⁶ GEN 3020 may substitute.

⁷ Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement on page 27.

⁸ At least one lecture and associated laboratory selected from BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, and 4250/4260.

⁹ BCHM 3010 may substitute.

¹⁰ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements.

¹¹ Students applying to professional schools that require a course in exercise physiology, **which is offered spring semester, odd numbered years only**, may substitute BIOL 2220 and 2230 for BIOL 3150 and 3160 during their sophomore year **if BIOL 4780 Exercise Physiology is not offered during their senior year.**

¹² See page 136 in the Undergraduate Announcements for approved minors. Psychology is recommended. The Medical University of South Carolina and other Rehabilitation Sciences programs require PSYC 2010 and 3830.

¹³ ENGL 3140 may substitute.

¹⁴ PHYS 1220/1240 may substitute.

¹⁵ At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, or 4030.

¹⁶ PHYS 2210/2230 may substitute.

¹⁷ These hours should be used to satisfy specific prerequisite requirements for your professional school program. For example, some Physical Therapy and Occupational Therapy schools require exercise physiology, medical terminology, abnormal psychology, and/or lifespan development courses. MICR 3050 is recommended for Physician Assistant programs.

2017/2018 B.A. BIOLOGICAL SCIENCES CURRICULUM – PREREHABILITATION SCIENCES EMPHASIS
Occupational Therapy (OT), Physical Therapy (PT), Speech Disorders, and Physician Assistant (PA)

BIOL Core Requirement: (37 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1030 & 1050	3(3,0) & 1(0,3) ¹	_____
BIOL 1040 & 1060	3(3,0) & 1(0,3) ¹	_____
BIOL 3150/3151	4(3,3) ²	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<i>Organismal Diversity Requirement (4 cr.)</i>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260		_____
<i>Ecology (3 cr.)</i>		
BIOL 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030		_____
<i>Functional Biology Requirement (4 cr.)²</i>		
BIOL 3160/3161		_____
Required Science Courses (33 cr.)		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) ³	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ⁴	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ⁴	_____
STAT 2300	3(3,0) ⁵	_____
Required Non-Science Courses (35 cr.)		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁶	_____
Arts & Humanities – Non-Literature	3(3,0) ^{6,7}	_____
Modern Language	4(3,1) ⁸	_____
Modern Language	4(3,1) ⁸	_____
Modern Language	3(3,0) ⁸	_____
Modern Language	3(3,0) ⁸	_____
Oral Communication Requirement	3(3,0) ⁶	_____
Social Sciences		_____
PSYC 2010	3(3,0)	_____
	3(3,0) ^{6,7,9}	_____
Minor Courses (15 cr.)¹⁰		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

- ¹ Prerehabilitation programs require BIOL 1030/1050 and 1040/1060 or equivalent; however, BIOL 1100/1101 and 1110/1111 may substitute.
- ² BIOL 4780 or MICR 3050. BIOL 4780 is recommended for physical and occupational therapy programs. Students applying to professional schools that require a course in exercise physiology, **which is offered spring semester, odd numbered years only**, may substitute BIOL 2220 and 2230 for BIOL 3150 and 3160 during their sophomore year **if BIOL 4780 Exercise Physiology is not offered during their senior year**. MICR 3050 is required for physician assistant programs.
- ³ Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- ⁴ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.
- ⁵ Healthcare professional schools have specific prerequisite MATH course requirements that vary by discipline and school of interest. Students, who plan to pursue a career in healthcare, should be sure to research these requirements as they make course selections for each upcoming semester.
- ⁶ See General Education Requirements.
- ⁷ Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- ⁸ Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement on page 27.
- ⁹ The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.
- ¹⁰ Minors as listed under Degree Programs and Minors in the Undergraduate Announcements, pg. 137.
- ¹¹ These hours should be used to satisfy specific prerequisite requirements for your professional school program. BIOL 4780 or MICR 3050. BIOL 4780 is recommended for physical and occupational therapy programs.

Other Courses	SEM/Yr	Grade
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____
Electives (5 cr.)¹¹		
_____	_____	_____
_____	_____	_____

B.A. BIOLOGICAL SCIENCES & B.A. SCIENCE TEACHING: BIOLOGICAL SCIENCES 2017-2018

FRESHMAN YEAR

First Semester

BIOL 1030 General Biology I and	3(3,0)
BIOL 1050 General Biology Laboratory I or	1(0,3)
BIOL 1100 Principles of Biology I	5(4,3)
CH 1010 General Chemistry	4(3,3)
ED 1050 Orientation to Education	2(2,0)
MATH 1060 Calculus of One Variable I	4(4,0)
Modern Language Requirement ¹	3(3,0)
	<u>17-18</u>

Second Semester

BIOL 1040 General Biology II and	3(3,0)
BIOL 1060 General Biology Laboratory II or	1(0,3)
BIOL 1110 Principles of Biology II	5(4,3)
CH 1020 General Chemistry	4(3,3)
ENGL 1030 Composition and Rhetoric	3(3,0)
Modern Language Requirement ¹	3(3,0)
Statistics Requirement ²	3(3,0)
	<u>17-18</u>

SOPHOMORE YEAR

CH 2010 Survey of Organic Chemistry and	3(3,0)
CH 2020 Survey of Organic Chem. Lab	1(0,3)
HIST 1220 History, Technology and Society or	
HIST 1240 Environmental History Survey	3(3,0)
PHYS 2070 General Physics I	3(3,0)
PHYS 2090 General Physics I Lab.	1(0,2)
Arts and Humanities (Literature) Requirement ³	3
Biochemistry or Genetics Requirement ⁴	3
	<u>17</u>

EDF 3010 Principles of American Education	3(3,0)
EDF 3020 Foundations of Digital Media and Learning...	3(3,0)
PHYS 2080 General Physics II	3(3,0)
PHYS 2100 General Physics II Lab.	1(0,2)
Biochemistry or Genetics Requirement ⁴	3
Organismal Diversity Requirement ⁵	4
	<u>17</u>

JUNIOR YEAR

ANTH 2010 Introduction to Anthropology or	
GEOG 1030 World Regional Geography	3(3,0)
BIOL 4610 Cell Biology	3(3,0)
BIOL 4620 Cell Biology Laboratory	2(1,2)
EDLT 4800 Foundations of Adolescent Literacy	3(3,0)
EDSC 3270 Practicum in Secondary Science	3(3,0)
Ecology Requirement ⁶	3
	<u>17</u>

BIOL 3350 Evolutionary Biology	3(3,0)
BIOL (EDSC) 4820 Laboratory Tech. for Teaching Sci.	3(1,6)
EDF 3350 Adolescent Growth & Development	3(3,0)
ENGL 3150 Scientific Writing and Comm.	3(3,0)
Functional Biology Requirement ⁷	3
	<u>15</u>

SENIOR YEAR

COMM 1500 Intro to Human Communication or	
COMM 2500 Public Speaking	3(3,0)
EDSP 3700 Introduction to Special Education	3(3,0)
EDSC 4270 Teaching Secondary Science ⁸	3(2,2)
EDLT 4980 Secondary Content Area Reading ⁸	3(2,2)
Arts and Humanities (Non-Lit.) Requirement ³	3
	<u>15</u>

EDSC 4470 Teaching Intern. in Sec. Sci. ⁹	9(0,27)
EDSC 4570 Sec. Science Capstone Sem. ⁹	3(2,3)
	<u>12</u>

Total Semester Hours = 127-129

¹ Two semesters (through 2020) in any modern language. See Modern Languages Requirement at Clemson University statement on page 27.

² STAT 2300 or 3090

³ See General Education Requirements

⁴ One lecture course must be completed for both biochemistry (BCHM 3010 or BCHM 3050) and for genetics (GEN 3000 or GEN 3020).

⁵ One lecture and associated laboratory must be selected from BIOL 3010/3011; BIOL 3020/3060; BIOL 3030/3070; BIOL 3040/3080; BIOL 3200/3201; BIOL 4060/4070; or BIOL 4250/4260.

⁶ At least one selected from BIOL 4410, 4420, 4430, 4460, 4700, or MICR 4010.

⁷ At least one selected from BIOL 3160, 4010, 4080, 4590, 4750, or 4800.

⁸ To be taken the semester prior to EDSC 4470 and 4570. EDSC 4270 and EDLT 4980 must be taken concurrently.

⁹ EDSC 4470 and EDSC 4570 must be taken concurrently. Offered spring semester only.

2017/2018 B.A. BIOLOGICAL SCIENCES & SCIENCE TEACHING: BIOLOGICAL SCIENCES

	SEM/Yr.	Grade	
BIOL Core Requirement: (29 cr.)			
BIOL 1030/1050 OR BIOL 1100/1101	3(3,0) & 1(0,3)	_____	_____
BIOL 1040/1060 OR BIOL 1110/1111	3(3,0) & 1(0,3)	_____	_____
BIOL 3350	3(3,0)	_____	_____
BIOL 4610	3(3,0)	_____	_____
BIOL 4620/4621	2(1,2)	_____	_____
BIOL 4820	3(1,6)	_____	_____
<i>Organismal Diversity Requirement (4 cr.)</i>			
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070 OR 4250/4260		_____	_____
<i>Ecology (3 cr.)</i>			
BIOL 4410, 4420, 4430, 4460, 4700 OR MICR 4010		_____	_____
<i>Functional Biology Requirement (3 cr.)</i>			
BIOL 3160, 4010, 4080, 4590, 4750, OR 4800		_____	_____
Required Science Courses (33 cr.)			
BCHM 3050	3(3,0)	_____	_____
CH 1010/1011	4(3,3)	_____	_____
CH 1020/1021	4(3,3)	_____	_____
CH 2010 & CH 2020	3(3,0) & 1(0,3) ¹	_____	_____
GEN 3000	3(3,0)	_____	_____
MATH 1060	4(4,0)	_____	_____
STAT 2300 OR 3090	3(3,0)	_____	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) ²	_____	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) ²	_____	_____
Req. Non-Science Courses (27 cr.)			
ENGL 1030/1031	3(3,1)	_____	_____
ENGL 3150	3(3,0)	_____	_____
ENGL 2120, 2130, 2140, OR 2150 (Modern Language)	3(3,0)	_____	_____
(Modern Language)	4(3,1) ³	_____	_____
(Modern Language)	4(3,1) ³	_____	_____
Modern Language	3(3,0) ³	_____	_____
Modern Language	3(3,0) ³	_____	_____
ANTH 2010 OR GEOG 1030 - CCA	3(3,0)	_____	_____
HIST 1220 OR HIST 1240 – STS	3(3,0)	_____	_____
Arts & Humanities – Non-Literature	3(3,0) ⁴	_____	_____
Oral Communication Requirement	3(3,0) ⁴	_____	_____
Education Courses (38 cr.)			
ED 1050	2(2,0)	_____	_____
EDF 3010	3(3,0)	_____	_____
EDF 3020	3(3,0)	_____	_____
EDF 3350	3(3,0)	_____	_____
EDLT 4800	3(3,0)	_____	_____
EDLT 4980	3(2,2) ⁵	_____	_____
EDSC 3270	3(3,0)	_____	_____
EDSC 4270	3(2,2) ⁵	_____	_____
EDSC 4470	9(0,27) ⁶	_____	_____
EDSC 4570	3(2,3) ⁶	_____	_____
EDSP 3700	3(3,0)	_____	_____

¹ CH 2230, 2270 and 2240, 2280 may be substituted for CH 2010. Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.

² Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.

³ Two semesters (through 2020) in any modern language. See Modern Languages Requirement at Clemson University statement on page 27.

⁴ See General Education Requirements.

⁵ To be taken the semester prior to EDSC 4470 and 4570. EDSC 4270 and EDLT 4980 must be taken concurrently.

⁶ EDSC 4470 and EDSC 4570 must be taken concurrently. Offered spring semester only.

Other Courses	SEM/Yr.	Grade
CU1000 _____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

B. S. MICROBIOLOGY 2017-2018 ^a

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I1(1,0)	BIOL 1110 Prin. of Biol. II ¹5(4,3)
BIOL 1100 Prin. of Biol. I ¹5(4,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Calculus of One Var. I4(4,0)	Mathematical Sciences Requirement ³3
Oral Communication Requirement ²3	15
17	

SOPHOMORE YEAR

CH 2230 Organic Chemistry3(3,0)	BCHM 3050 Essential Elements of Bioch ⁶3(3,0)
CH 2270 Organic Chemistry Lab1(0,3)	BIOL 4340 Bio. Chem. Lab Techniques2(1,3)
ENGL 3150 Scientific Writing and Comm ...3(3,0)	CH 2240 Organic Chemistry3(3,0)
Arts and Humanities (Literature) Req. ²3	CH 2280 Organic Chemistry Lab1(0,3)
Social Science Requirement ⁴3	MICR 3050 (MICR Majors) 4(3,3)
Elective ⁵3	Arts and Humanities (Non-Lit) Req ⁴3
16	16

JUNIOR YEAR

MICR 4010 Microbial Diversity and Ecol. 3(3,0)	MICR 4120 Bacterial Physiology3(3,0)
PHYS 2070 General Physics I ⁷3(3,0)	MICR 4500 Advanced Micro Lab I2(1,2)
PHYS 2090 General Physics Lab I ⁷1(0,3)	Microbiology Requirement ⁸3
Microbiology Requirement ⁸6	Social Science Requirement ⁴3
Elective ⁵3	Elective ^{5,9}3
16	14

SENIOR YEAR

BIOL 4610 Cell Biology3(3,0)	BIOL 4930 Senior Seminar or
MICR 4150 Microbial Genetics3(3,0)	MICR 4930 Senior Seminar2(2,0)
MICR 4510 Advanced Micro Lab II2(1,2)	MICR 4520 Advanced Micro Lab III2(1,2)
Virology Requirement ¹⁰3	Microbiology Requirement ⁸3
Elective ⁵3	Elective ⁵9
14	16

Total Semester Hours = 124

¹ BIOL 1100 and BIOL 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.

² See General Education Requirements.

³ MATH 1080 or STAT 2300 or other approved coursework. See advisor. Medical and dental schools have different mathematics requirements.

⁴ See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements. The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

⁵ Elective hours may be used toward satisfying the requirements of a minor.

⁶ BCHM 3010 may substitute.

⁷ PHYS 1220/1240 may substitute.

⁸ See advisor. Minimum of 12 credits is required. At least one course must be selected from each of the following fields:
Biomedicine—BIOL 4200, 4560, 4670, 4840, 4890, GEN 3000, 3020, HLTH 3800, MICR 4000, 4050, 4110, (BIOL) 4140, 4170
Environmental— BIOL (PLPA) 4250, MICR 4020, 4030, 4100
Food Safety, Industrial, and Technology — BIOL 4030, 4870, MICR 4070, 4130
 Remaining credits can be satisfied by any 3000 or 4000 MICR course, any of the above listed courses or any of the following:
 BCHM 4400, BIOL 3150, 3160, 3940, 4910, 4940

⁹ Students planning on applying to medical/dental schools should take PHYS 2080 and 2100 during the second semester junior year.

¹⁰ BIOL 4540 or MICR 4160

^a **The bolded courses must be taken in the sequence listed above to ensure a punctual graduation.**

B. S. MICROBIOLOGY 2017-2018 ^a BIOMEDICINE CONCENTRATION

FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I1(1,0)	BIOL 1110 Prin. of Biol. II ¹5(4,3)
BIOL 1100 Prin. of Biol. I ¹5(4,3)	CH 1020 General Chemistry4(3,3)
CH 1010 General Chemistry4(3,3)	ENGL 1030 Composition and Rhetoric3(3,1)
MATH 1060 Calculus of One Var. I4(4,0)	Mathematical Sciences Requirement ³3
Oral Communication Requirement ²3	15
17	

SOPHOMORE YEAR

CH 2230 Organic Chemistry3(3,0)	BCHM 3050 Essential Elements of Bioch ⁶3(3,0)
CH 2270 Organic Chemistry Lab1(0,3)	CH 2240 Organic Chemistry3(3,0)
ENGL 3150 Scientific Writing and Comm ...3(3,0)	CH 2280 Organic Chemistry Lab1(0,3)
Arts and Humanities (Literature) Req. ²3	GEN 3000 ⁷3(3,0)
Social Science Requirement ⁴3	MICR 3050 (MICR Majors)4(3,3)
Elective ⁵3	Arts and Humanities (Non-Lit) Req. ⁴3
16	17

JUNIOR YEAR

BIOL 4610 Cell Biology3(3,0)	MICR 4120 Bacterial Physiology3(3,0)
BIOL 4620 Cell Biology Lab2(1,2)	MICR 4500 Advanced Micro Lab I2(1,2)
MICR 4010 Microbial Diversity and Ecol. 3(3,0)	PHYS 2080 General Physics II ¹⁰3(3,0)
PHYS 2070 General Physics I ⁸3(3,0)	PHYS 2100 General Physics II Lab ¹⁰1(0,2)
PHYS 2090 General Physics Lab I ⁸1(0,3)	Social Science Requirement ⁴3
Biomedicine Requirement ⁹3	Elective ⁵3
15	15

SENIOR YEAR

MICR 4140 Basic Immunology3(3,0)	BIOL 4930 Senior Seminar or
MICR 4150 Microbial Genetics3(3,0)	MICR (BIOL) 4930 Senior Seminar 2(2,0)
MICR 4160 Introductory Virology3(3,0)	MICR 4110 Pathogenic Bacteriology 3(3,0)
MICR 4510 Advanced Micro Lab II2(1,2)	MICR 4170 Cancer & Aging 3(3,0)
Biomedicine Requirement ⁹3	MICR 4520 Advanced Micro Lab III 2(1,2)
14	Biomedicine Requirement ⁹ 3
	Elective ⁵3
	16

Total Semester Hours = 125

¹ BIOL 1100 and BIOL 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100 and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.

² See General Education Requirements.

³ MATH 1080 or STAT 2300 or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements.

⁴ See General Education Requirements. Six of these credits must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements. The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

⁵ Elective hours may be used toward satisfying the requirements of a minor.

⁶ BCHM 3010 may substitute.

⁷ GEN 3020 may substitute.

⁸ PHYS 1220/1240 may substitute.

⁹ See advisor. A minimum of 9 hours is required, selected from BCHM 4320, 4400, BIOL 3150, 3160, 3940, 4030, 4050, 4200, (PLPA) 4250, 4340, 4560, 4670, 4840, 4890, 4910, 4940, 4950, HLTH 3800, MICR 3940, 4000, 4910, 4940, or 4950.

¹⁰ PHYS 2210/2230 may substitute.

^a **The bolded courses must be taken in the sequence listed above to ensure a punctual graduation.**

2017/2018 B.S. MICROBIOLOGY - BIOMEDICINE CONCENTRATION CURRICULUM

MICR Core Requirement: (44 cr.)	SEM/Yr	Grade
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	5(4,3) ¹	_____
BIOL 1110/1111	5(4,3) ¹	_____
MICR 3050/3051 (SO)	4(3,3)	_____
MICR 4010 (Fall, JR)	3(3,0)	_____
MICR 4110 (Sp., SR)	3(3,0)	_____
MICR 4120 (Sp., JR)	3(3,0)	_____
MICR 4140 (Fall, SR)	3(3,0)	_____
MICR 4150 (Fall, SR)	3(3,0)	_____
MICR 4160 (Fall, SEN)	3(3,0)	_____
MICR 4170 (Spring, SR)	3(3,0)	_____
MICR 4500/4501 (Sp., JR)	2(1,2)	_____
MICR 4510/4511 (Fall, SR)	2(1,2)	_____
MICR 4520/4521 (Sp., SR)	2(1,2)	_____
MICR 4930 (or BIOL 4930)	2(2,0)	_____

Biomedicine Requirement (9 cr.)²	SEM/Yr	Grade
_____	_____	_____
_____	_____	_____
_____	_____	_____

Required Science Courses (42 cr.)	SEM/Yr	Grade
BCHM 3050	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620	2(1,2)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270	3(3,0) & 1(0,3)	_____
CH 2240, 2280	3(3,0) & 1(0,3)	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080	4(4,0)	_____
OR STAT 2300	3(3,0) ³	_____
PHYS 2070, 2090	3(3,0), 1(0,2) ⁴	_____
PHYS 2080, 2100	3(3,0), 1(0,2) ⁴	_____

Required Non-Science Courses (21 cr.)	SEM/Yr	Grade
ENGL 1030/1031	3(3,1)	_____
ENGL 3150	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) ⁵	_____
Arts & Humanities – Non-Lit	3(3,0) ^{5,6}	_____
Oral Communication Req.	3(3,0) ⁵	_____
Social Sciences	3(3,0) ^{5,6}	_____
_____	3(3,0) ^{5,6}	_____
_____	3(3,0) ^{5,6}	_____

Electives (9 cr.)⁷	SEM/Yr	Grade
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

¹ BIOL 1100/1101 and 1110/1111 are strongly recommended. However, BIOL 1030/1050 may substitute for BIOL 1100/1101 and BIOL 1040/1060 may substitute for BIOL 1110/1111; the remaining 1-2 credits required must be satisfied by completing 1-2 extra credits.

² See advisor. Minimum 9 hours required. BCHM 4320, 4400, BIOL 3150, 3160, 3940, 4030, 4050, 4200, (PLPA) 4250, 4340, 4560, 4670, 4840, 4890, 4910, 4940, 4950, HLTH 3800, MICR 3940, 4000, 4050, 4910, 4940 or 4950

³ Although Math, Statistics and Research Methods are not actual new MCAT topics and the Association of American Medical Colleges does not recommend any specific college courses in these areas, you are expected to have been exposed to these topics sufficiently during your education in order to be adequately prepared for the new MCAT.

⁴ Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230.

⁵ See General Education Requirements.

⁶ Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS). The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.

⁷ Elective hours may be used toward satisfying the requirements of a minor.

Other Courses	SEM/Yr	Grade
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

B.S. BIOSC and B.A. BIOSC Degrees Compared

B.S. BIOLOGICAL SCIENCES

BIOL Core Requirement: (31 cr.)

BIOL 1010 (1 cr.)
BIOL 1100/1101 (5 cr.)
BIOL 1110/1111 (5 cr.)
BIOL 3350 (3 cr.)
BIOL 4610 (3 cr.)
BIOL 4620/4621 (2 cr.)
BIOL 4930 OR MICR 4930 (2 cr.)
Organismal Diversity Requirement (4 cr.)
Ecology (3 cr.)
Functional Biology Requirement (3 cr.)

Major Requirement: (21 cr.)

Including Three Laboratory Course req.

Required Science Courses (33 cr.)

BCHM 3050 (3 cr.)
CH 1010/1011 (4 cr.)
CH 1020/1021 (4 cr.)
CH 2230, 2270 (3 cr.) & (1 cr.)
 OR CH 2010, CH 2020 (3 cr.) & (1 cr.)
GEN 3000 (3 cr.)
MATH 1060 (4 cr.)
MATH 1080 (4 cr.)
 OR STAT 2300 (3 cr.)
PHYS 2070, 2090 (3 cr.) & (1 cr.)
PHYS 2080, 2100 (3 cr.) & (1 cr.)

Required Non-Science Courses (21 cr.)

ENGL 1030/1031 (3 cr.)
ENGL 3150 OR 3140 (3 cr.)
Arts & Humanities – Literature (3 cr.)
Arts & Humanities – Non-Literature (3 cr.)
Oral Communication Requirement (3 cr.)
Social Sciences (6 cr.)

Electives (15 cr.)

Total Semester Hours = 121

B.A. BIOLOGICAL SCIENCES

BIOL Core Requirement: (31 cr.)

BIOL 1010 (1 cr.)
BIOL 1100/1101 (5 cr.)
BIOL 1110/1111 (5 cr.)
BIOL 3350 (3 cr.)
BIOL 4610 (3 cr.)
BIOL 4620/4621 (2 cr.)
BIOL 4930 OR MICR 4930 (2 cr.)
Organismal Diversity Requirement (4 cr.)
Ecology (3 cr.)
Functional Biology Requirement (3 cr.)

Major Requirement: (4 cr.)

Required Science Courses (33 cr.)

BCHM 3050 (3 cr.)
CH 1010/1011 (4 cr.)
CH 1020/1021 (4 cr.)
CH 2230, 2270 (3 cr.) & (1 cr.)
 OR CH 2010, CH 2020 (3 cr.) & (1 cr.)
GEN 3000 (3 cr.)
MATH 1060 (4 cr.)
MATH 1080 (4 cr.) **OR**
 OR STAT 2300 (3 cr.)
PHYS 2070, 2090 (3 cr.) & (1 cr.)
PHYS 2080, 2100 (3 cr.) & (1 cr.)

Required Non-Science Courses (35 cr.)

ENGL 1030/1031 (3 cr.)
ENGL 3150 OR 3140 (3 cr.)
Arts & Humanities – Literature (3 cr.)
Arts & Humanities – Non-Literature (3 cr.)
Modern Language (4 cr.)
Modern Language (4 cr.)
Modern Language (4 cr.)
Modern Language (4 cr.)
Oral Communication Requirement (3 cr.)
Social Sciences (6 cr.)

Minor Courses (15 cr.)

Electives (3 cr.)

Total Semester Hours = 121

B.S. MICROBIOLOGY and B.S. MICROBIOLOGY - BIOMEDICINE Degrees Compared

B.S. MICROBIOLOGY

MICR Core Requirement (32 cr.)

BIOL 1010 (1 cr.)
BIOL 1100 (5 cr.)
BIOL 1110 (5 cr.)
MICR 3050 (4 cr.)
MICR 4010 (3 cr.)
MICR 4120 (3 cr.)
MICR 4150 (3 cr.)
MICR 4500 (2 cr.)
MICR 4510 (2 cr.)
MICR 4520 (2 cr.)
MICR (BIOL) 4930 (2 cr.)

Microbiology Requirement (12 cr.)

Virology Requirement (3 cr.)

Req. Science Courses 35 cr.

BCHM 3050 (3 cr.)
BIOL 4340/4341 2(1,3)
BIOL 4610 (3 cr.)
CH 1010 (4 cr.)
CH 1020 (4 cr.)
CH 2230(3 cr.) & CH 2270 (1 cr.)
CH 2240 (3 cr.) & CH 2280 (1 cr.)
MATH 1060 (4 cr.)
MATH 1080 (4 cr.)
 OR STAT 2300 (3 cr.)
PHYS 2070 (3 cr.), 2090 (1 cr.)

Req. Non-Science Courses 21 cr.)

ENGL 1030, 1031 (4 cr.)
ENGL 3150 4 **OR** 3140 (3 cr.)
Arts & Humanities – Literature (3 cr.)
Arts & Humanities – Non-Literature (3 cr.)
Oral Communication (3 cr.)
Social Sciences (6 cr.)

Electives (21 cr.)

Total Semester Hours = 124

B.S. MICROBIOLOGY - BIOMEDICINE

MICR Core Requirement (44 cr.)

BIOL 1010 (1 cr.)
BIOL 1100 (5 cr.)
BIOL 1110 (5 cr.)
MICR 3050 (4 cr.)
MICR 4010 (3 cr.)
MICR 4110 (3 cr.)
MICR 4120 (3 cr.)
MICR 4140 (3 cr.)
MICR 4150 (3 cr.)
MICR 4160 (3 cr.)
MICR 4170 (3 cr.)
MICR 4500 (2 cr.)
MICR 4510 (2 cr.)
MICR 4520 (2 cr.)
MICR (BIOL) 4930 (2 cr.)

Biomedicine Requirement (9 cr.)

Req. Science Courses (42 cr.)

BCHM 3050 (3 cr.)
BIOL 4610 (3 cr.)
BIOL 4620 (2 cr.)
CH 1010 (4 cr.)
CH 1020 (4 cr.)
CH 2230 (3 cr.) & CH 2270 (1 cr.)
CH 2240 (3 cr.) & CH 2280 (1 cr.)
GEN 3000 (3 cr.)
MATH 1060 (4 cr.)
MATH 1080 (4 cr.)
 OR STAT 2300
PHYS 2070 (3 cr.), 2090 (1 cr.)
PHYS 2080 (3 cr.), 2100 (1 cr.)

Req. Non-Science Courses (21 cr.)

ENGL 1030, 1031 (4 cr.)
ENGL 3150 (3 cr.)
Arts & Humanities – Literature (3 cr.)
Arts & Humanities – Non-Literature (3 cr.)
Oral Communication (3 cr.)
Social Sciences (6 cr.)

Electives (9 cr.)

Total Semester Hours = 125

CALHOUN HONORS COLLEGE
(<http://www.clemson.edu/cuhonors/>)

Calhoun Honors College Advisor: Leah Moyer lboyd@clemson.edu

Honors Student Handbook <http://www.clemson.edu/cuhonors/studenthandbook/index.html>

Departmental Liaison to the Honors College: Dr. Christina Wells cwells@clemson.edu

Calhoun Honors College - Advising Form: Page 36.

Calhoun Honors students are eligible to pursue both **General Honors** and **Departmental Honors**. Both programs provide opportunities for Honors students to interact with one another and with Clemson's top faculty members. Typically, students take most of their General Honors courses during the freshman and sophomore years, although many students enroll in General Honors courses as juniors. Admission to the Calhoun Honors College is by on-line application ([Calhoun Honors College](#)).

To be considered for admission to the Honors College, applicants must have a combined critical reading and math SAT score of at least 1380 or an ACT score of 30. In exceptional situations we will consider applications from students who do not fully meet these qualifications. However, please keep in mind that admission to the Honors College is highly selective, with SAT scores historically averaging 1480 (new version) or higher, a 33 on the ACT and applicants typically ranking in the top three percent of their high school class. Freshman enrollment in the Honors College is limited to approximately 250.

In addition to the application submitted by the student, we require submission of a transcript (unofficial photocopies are acceptable), plus two electronically submitted letters of recommendation, one from the student's high school guidance counselor and one from a teacher. Instructions for submitting these materials are provided in the application.

Current Clemson University non-honors students can apply to join the Calhoun Honors College in the fall or spring semester if they have a cumulative grade point average of 3.50 or higher by the end of the semester in which they apply.

General Honors. Students are encouraged to take honors courses in many different areas of study. Most of the courses you will take for General Honors are 1000-2000 level courses that satisfy the university's General Education requirements or serve as introductory courses in your major. Typically, students take most of their General Honors courses during the freshman and sophomore years, although many students enroll in General Honors courses as juniors and seniors.

Members of the Calhoun Honors Program are required to take and complete at least one honors course (HON) each fall and spring semester. To be awarded General Honors, the following requirements must be satisfied:

- 1) Completion of a minimum of 18 credit hours from three or more groups (see below); **a)** At least three hours from three or more groups (see below); **b)** At least three hours in three or more subjects (e.g., ENGL, MATH).
- 2) A cumulative GPR of 3.40 or higher on all coursework taken at Clemson (non-honors as well as honors courses).
- 3) A grade of A or B in all courses taken to fulfill the requirements of General Honors.
- 4) Completion of all university requirements for graduation.

How do you know if the course is an honors course? The title of the course should have (HON) in the title of the course, for example, ENGL 1030 (HON) and in the online *Undergraduate Announcements* have "Includes Honors sections" just before the list of prerequisites,

The following courses have honors sections:

Group A. Composition and Communication: COMM 2500; ENGL 1030, 3140; HON 2230.

Group B. Science, Mathematics & Engineering: BIOL 1030, 1040, 1100, 1110; CH 1010, 1020; ECE 2020, 2620; EM 2020; ENGR 1050, 1060, 1070, 1080, 1090, 1200, 1410, 1900, 2900, 3900, 4900; GEOL 1010, 1020; MATH 1060, 1080, 2060, 2080; PHYS 1220, 2210, 2220.

Group C. Humanities and Languages: AAH 1010, 1020, 2030, 2040, 2100; ENGL 2120, 2130, 2140, 2150; FR 2010, 2020; GER 2010, 2020; HON 1900, 1910, 2010, 2030, 2210, 2220; ITAL 2010, 2020; MUSC 2100; PHIL 1010, 1020, 1030; RUSS 2010, 2020; SPAN 2010, 2020; THEA 2100

Group D. Social Science: ECON 2110, 2120, 3140, 3150; HIST 1220, 1240, 1720, 1730; HON 1920, 2020, 2200; LAW 3220; POSC 1010, 1020, 1030, 1040; PSYC 2010, 3400, 3520, 3830, 3850, 3900; SOC 2010

Group E. Cross Cultural Awareness: AAH 2100; HIST 1720, 1730; HON 1930, 2090; MUSC 2100; POSC 1020; REL 1020

Group F. Science and Technology in Society: HIST 1220, 1240; HON 1940, 2010, 2060

Group G. Other: ACCT 2010, 2020; GC 1040, 2070; HON 2050, 2070; MGT 2010; MKT 3010; PRTM 2010, 2700

Departmental Honors. Courses taken for Departmental Honors may not also count for General Honor's requirements. The Department of Biological Sciences offers a Senior Departmental Honors program in Biological Sciences and Microbiology for qualified majors (grade point ratio of 3.4 or better as designated by Calhoun College) who have demonstrated outstanding ability in the biological sciences.

To graduate with Senior Departmental Honors in Biological Sciences or Departmental Honors in Microbiology, the student must complete at least 12 hours of designated honors courses with a minimum grade of B in each course. Included in the required 12 semester hours will be at least 6 hours of independent research, BIOL or MICR 4910 (HON) or BIOL or MICR 3940 or 4940 (HON), taken under a single research advisor for six consequent semester hours. Research results will be written in a style appropriate for publication and presented in an open seminar to the Biological Sciences faculty. These credits may include BIOL 3940, BIOL 4940 or both. Since honors sections of BIOL 3940, 4910, and 4940 require the consent of the course instructor; students are expected to choose and to arrange to work with a faculty research advisor prior to registering for these courses.

Honors courses count towards either General Honors or Departmental but not for both General and Departmental Honors.

Honors Contracts. On a limited basis, students may earn honors credit for a 3000- or 4000-level course by means of an Honors Contract (in exceptional cases contracts for 2000-level classes may be approved). The purpose of such contracts is to enable students to experience the educational enrichment that typifies honors courses, and to explore topics in greater depth than is normally possible in a regular undergraduate course. Contact the Honors Office for details.

SENIOR ENROLLMENT IN GRADUATE COURSES

Enrollment of Clemson University seniors in any graduate course is subject to approval by the department offering the course and the Graduate School. This approval is required prior to registration. GS6 approval forms are available from the Graduate School Office in E-106 Martin Hall or at [GS6](#).

The total course workload for the semester must not exceed 18 hours, and the cumulative graduate credits earned by seniors shall not exceed 12 semester hours.

The credits and quality points associated with senior enrollment in graduate courses will be part of the undergraduate record. Graduate courses that are not satisfying undergraduate requirements cannot be used to meet enrollment requirements for financial aid.

Seniors with 3.4 or higher grade-point averages are eligible for participation in the combined bachelor's/master's plan (see "Combined Bachelor's/Master's Plan", [Academic Regulations](#), page 28).

Seniors with 3.0 or higher grade-point averages are eligible to request enrollment in graduate level courses to meet requirements for the bachelor's degree; however, courses used for this purpose cannot be counted later towards an advanced degree. Alternatively, these students may also take courses in excess of the requirements for their undergraduate degrees and may request that these courses be included as a part of their graduate program if they are subsequently admitted to the Graduate School. Courses cannot be taken at the 6000 level if their 4000-level counterparts are required for the undergraduate degree in the same academic major as the proposed graduate degree ([Academic Regulations](#), page 29).

Calhoun Honors College - Advising Form

General Honors

To be awarded the Certificate of Achievement in General Honors, the following requirements must be satisfied.

- 1) Completion of a **minimum of 18 credit hours from three or more groups** (see pages 34-35);
 - a) At least one course from three or more groups (see pages 34-35);
 - b) At least one course in three or more subjects (e.g., ENGL, MATH).
- 2) A cumulative GPR of 3.40 or higher on all coursework taken at Clemson (non-honors as well as honors courses).
- 3) A grade of A or B in all courses taken to fulfill the requirements of General Honors.
- 4) Completion of all university requirements for graduation.

Group A Composition and Communication

Group B Science, Mathematics & Engineering

Group C Arts and Humanities

Group D Social Science

Group E Cross Cultural Awareness

Group F Science and Technology in Society

Group G Other

Course	Number	Group	Grade	Credits		Course	Number	Group	Grade	Credits
1.	_____	_____	_____	_____		4.	_____	_____	_____	_____
2.	_____	_____	_____	_____		5.	_____	_____	_____	_____
3.	_____	_____	_____	_____		6.	_____	_____	_____	_____

Example:

Course	Number	Group	Grade	Credits		Course	Number	Group	Grade	Credits	
1.	<u>HON</u>	<u>2060</u>	<u>VI</u>	<u>A</u>	<u>3</u>	4.	<u>MUSC</u>	<u>2100</u>	<u>IV or V</u>	<u>A</u>	<u>3</u>
2.	<u>CH</u>	<u>1010</u>	<u>II</u>	<u>A</u>	<u>3</u>	5.	<u>CH</u>	<u>1020</u>	<u>II</u>	<u>A</u>	<u>3</u>
3.	<u>ECON</u>	<u>2110</u>	<u>III</u>	<u>A</u>	<u>3</u>	6.	<u>MATH</u>	<u>1060</u>	<u>II</u>	<u>A</u>	<u>4</u>

Departmental Honors

Departmental Honors requirements vary from major to major so please refer to the honors handbook on the Honors Website for exact requirements. **Honors courses count towards either General Honors or Departmental but not for both General and Departmental Honors.**

To graduate with Departmental Honors in Biological Sciences or Departmental Honors in Microbiology, the student must complete at least 12 hours of designated honors courses with a minimum grade of B in each course. Included in the required 12 semester hours will be at least 6 hours of independent research, BIOL or MICR 4910 (HON) or BIOL or MICR 3940 or 4940 (HON), taken under a single research advisor for six consequent semester hours **Research results will be written in a style appropriate for publication and presented in an open seminar to the Biological Sciences faculty.**

Departmental Honors in: _____

Course	Number	Group	Grade	Credits		Course	Number	Group	Grade	Credits
1.	_____	_____	_____	_____		4.	_____	_____	_____	_____
2.	_____	_____	_____	_____		5.	_____	_____	_____	_____
3.	_____	_____	_____	_____		6.	_____	_____	_____	_____

RESIDENTS IN SCIENCE AND ENGINEERING (RiSE)

[RiSE](#)

Email address: rise@clemsun.edu

RiSE is a living-learning community for freshmen in the College of Engineering, Computing, and Applied Sciences and the College of Science. RiSE exists to support first year STEM (Science, Technology, Engineering & Mathematics) students. At this time, RiSE supports the following disciplines — Biochemistry, Biological Sciences, Chemistry, Computer Science, Engineering, Genetics, Mathematical Sciences, Microbiology, and Physics. The RiSE program is designed to ease student's transition to college by promoting academic success, encouraging professional development, and providing opportunities to become engaged students. RiSE incorporates a number of features seen in other living-learning communities including academic support through in-hall tutoring services five nights a week, grouped courses with other RiSE students, behind the scenes industry tours, and increased opportunities for social interaction. Students apply to the RiSE program by selecting RiSE as your first choice on your housing application. Honors students are eligible to participate in RiSE as a first-time freshman. A student may select another RiSE freshman as a roommate. Please refer to the University Housing & Dining website for sign-up information ([Housing](#)).

MINORS

A minor consists of at least 15 semester credits, with no fewer than nine credits at the 3000 level or higher. A student cannot major and minor in the same field or acquire a minor that is not allowed by the degree program. In programs that require a minor, courses may not be used to fulfill both the major and minor requirements. Courses used to fulfill general education requirements, however, may be counted toward the minor. Courses that count towards a student's major, but are outside the major's course rubric, may also be used to fulfill minor requirements. Students are encouraged to contact the department offering the minor for advising. **Note: Some courses in the minors have prerequisite courses.** Students should select a minor and take any prerequisites as early as possible in their academic careers. Clemson University offers 89 minors ([Minors](#)). Minors popular with BIOL and MICR majors are as follows:

Psychology (18 credits)

A minor in Psychology requires PSYC 2010 and 15 credits from PSYC 2750 and/or 3000- and 4000-level psychology courses. At least nine hours from courses other than PSYC 4970 and 4980 must be taken.

Modern Languages (29 credits: 1010-2020 [14 credits] + 15 credits): Includes American Sign Language Studies, Chinese Studies, French Studies, Italian Studies, and Spanish Studies.

A minor in Spanish, French, Italian, or Chinese Studies requires 15 credits of 3000- and 4000-level courses, including at least one 4000-level literature course. SPAN 4380 and 4390 may not be used to satisfy requirements for the Spanish Studies minor. In French Studies, one of the 3000-level courses must be FR 3050 and FR 4380 and 4390 may not be used to satisfy requirements for the French Studies minor.

Business Administration (21 credits)

A minor in Business Administration requires ACCT 2010, ECON 2110, 2120, FIN 3060 (preq: ACCT 2010 & MATH 3010), LAW 3220, MGT 2010, and MKT 3010.

Microbiology (15 credits) – Biological Sciences majors

A minor in Microbiology requires MICR 3050 and 11 additional credits selected from 4000-level microbiology courses.

Biological Sciences (20 credits) – Microbiology majors

A minor in Biological Sciences requires either BIOL 1030/1050 or BIOL 1100; and either 1040/1060 or 1110; plus 12 additional credits selected from BIOL courses at the 3000 level or above, BCHM 3010, 3050, GEN 3000 or GEN 3020, or MICR 3050.

CREATIVE INQUIRY AND UNDERGRADUATE RESEARCH

[Creative Inquiry & Undergraduate Research](#)

Creative Inquiry (team-based) and Undergraduate Research (individual-based) include all intensive, discovery-oriented approaches to learning. Emphasis is placed on providing an experience that will be meaningful to undergraduate students, and will promote reasoning and critical thinking skills, ethical judgment, and communication skills as well as a deep understanding of the methods of scientific research. Students take on problems that spring from their own curiosity, from a professor's challenge or from the pressing needs of the world around them. Team-based and Individual-based investigations are mentored by a faculty mentor and may

span more than one semesters. Students take ownership of their projects and take the risks necessary to solve problems and get answers. Topics are boundless. Students often find themselves presenting their work at national conferences, fielding questions from professionals. This invaluable experience produces exceptional graduates. Our Creative Inquiry and Undergraduate Research participants develop critical thinking skills, learn to solve problems and hone their communication and presentation skills.

BIOL and MICR Creative Inquiry Courses:

BIOL 3940 Selected Topics in Creative Inquiry I 1-3 (1-3) Group research projects. Disciplinary and multidisciplinary group research projects develop the student's ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of 24 credits. Honors students must take at least six credits consequently with the same research advisor and write an honors thesis and make a public presentation. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. Preq: Consent of instructor.

BIOL (MICR) 4940 Selected Topics in Creative Inquiry II 2-3 (1) May be repeated for a maximum of 24 credits. Honors students must take at least six credits consequently with the same research advisor and write an honors thesis and make a public presentation. The two semesters may include BIOL 3940, BIOL 4940, or both. Includes Honors sections. Preq: Consent of instructor. Coreq: BIOL 4941.

BIOL (MICR) 4941 Selected Topics in Creative Inquiry II Laboratory 0 (3-6) Non-credit laboratory to accompany BIOL 4940. May also be offered as MICR 4941. Coreq: BIOL 4940.

MICR 3940 Selected Topics in Creative Inquiry I 2-3 (2-3) Disciplinary and multidisciplinary group research projects with the goal of developing the students' ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of 24 credits. Honors students must take at least six credits consequently with the same research advisor and write an honors thesis and make a public presentation. These credits may include MICR 3940, MICR 4940 or both. Includes Honors sections. Preq: Consent of instructor.

MICR (BIOL) 4940 Selected Topics in Creative Inquiry II 2-3 (1) Disciplinary and multidisciplinary group research projects with the goal of developing the students' ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of 24 credits. Honors students must take at least six credits consequently with the same research advisor and write an honors thesis and make a public presentation. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as BIOL 4940. Preq: Consent of instructor. Coreq: MICR 4941.

MICR (BIOL) 4941 Selected Topics in Creative Inquiry II Laboratory 0 (3-6) Non-credit laboratory to accompany MICR 4940. May also be offered as BIOL 4941. Coreq: MICR 4940.

BIOL and MICR Undergraduate Research Courses:

BIOL 4910 Special Problems in Biological Sciences 1-4 (3-12) Mentored research problems introduce undergraduate students to the planning and execution of research and the presentation of research findings. May be repeated for a maximum of eight credits. Honors students must take at least six credits consequently with the same research advisor and write an honors thesis and make a public presentation. Includes Honors sections. Preq: Consent of instructor.

MICR 4910 Undergraduate Research in Microbiology 1-4 (3-12) Individually mentored research problems in various areas of microbiology that introduce undergraduate students to the planning and execution of research experimentation and the presentation of research findings. May be repeated for a maximum of 24 credits with consent of instructor. Honors students must take at least six credits consequently with the same research advisor and write an honors thesis and make a public presentation. Honors thesis is required. Preq: Consent of instructor.

INTERNSHIPS

[Internship Programs](#)

Internships are a good way to learn about a career, make contacts, and gain experience in biology. Some internships may provide opportunities to do an original research project — a very rewarding experience that will show you how science works and get you thinking about graduate school. Internships may be either paid or unpaid. The student has to have actual work duties, not just be observing or shadowing.

BIOL and MICR Internship Courses

BIOL 4920 Internship for Biological Sciences 0-4 (3-12) Preplanned internship at an advisor-approved facility to give students learning opportunities beyond their classroom experiences. Students submit a Student Internship Contract and a one-page study plan before the internship and a comprehensive report within one week of the end of the internship. May be repeated for a maximum of six credits. To be taken Pass/no Pass only. Preq: Consent of instructor.

MICR 4920 Internship for Microbiology 0-4 (3-12) Preplanned internship at an advisor-approved facility to give students learning opportunities beyond their classroom experiences. Students submit a Student Internship Contract and a two-page study plan before the internship and a comprehensive report within one week of the end of the internship. May be repeated for a maximum of six credits. To be taken Pass/Fail only. Preq: Consent of advisor.

Student Internship Contracts are available from Dr. Kosinski (rjksn@clemson.edu.)

Internship Instructor: Dr. Robert Kosinski.

Procedure

1. Locate an internship and identify a mentor at the place of employment;
2. Fill out a Student Internship Contract that acts as a contract between the employer mentor and the student.
3. Student Internship Contract signed by both the student and the mentor
4. Return contract to Ms. Jackie Van Strien, 127 Long Hall, 656-0854, vanj@clemson.edu
5. Complete the internship;
6. File a final report and submit to Ms. Van Strien;
7. Have the mentor send a letter or e-mail to Ms. Van Strien evaluating the student;
8. Dr. Kosinski reviews the submitted documents and assigns a pass/fail grade.

Credits: Credit at the rate of 1 credit for 45 hours of employment.

Summer Enrollment: If the internship is performed during the summer and the student wants academic credit, the student must register for BIOL 4920 or MICR 4920 and pay for the credit hours desired (one for each 45 hours of work, up to four). If the student wants to avoid tuition costs, the student should register for zero credits or BIOL 4920 or MICR 4920. This will allow tracking of the student, and will *not* require a tuition payment. But it also means that the student will not get academic credit for the internship.

Internship Web Sites: A listing of internships available to students interested in obtaining valuable field and/or laboratory experience - the best way to spend your summer! Paid and volunteer opportunities are presented.

Clemson University Center for Career and Professional Development – [Internship Programs](#)

Alaska State Parks Volunteer Program – [Volunteer Internship Positions](#)

Ceiba Foundation For Tropical Conservation – [Volunteer](#)

Internships in Field Biology – [Paid and Volunteer Positions](#)

Internships in Microbiology – [Co-op/Internships](#)

Internships through the Nature Conservancy <http://nature.org/careers/>

Medical University of South Carolina (MUSC) <http://www.musc.edu> Search ‘Internships’

National Institutes of Health Summer Internship Program for Biomedical Research
[Biomedical Research \(SIP\)](#)

National Science Foundation Research Experiences for Undergraduates - REU – lists hundreds of summer programs. [REU](#)

National Wildlife Federation Internships [Internships, Fellowships, & Volunteer Opportunities](#)

Smithsonian's National Museum of Natural History Research Training Program – [Internships](#)

Walt Disney College Program – [Internships](#)

Yerkes (Emory University) – [Research and Internships](#)

SERVICE LEARNING

Students gain teaching experience by serving as undergraduate teaching assistants in laboratories that are offered by the Department of Biological Sciences or students learn to prepare and assist in laboratories offered to middle and high school students by the Life Sciences Outreach Center.

BIOL 4950 Service Learning in Biology 2-4 (1) Combines service and academic learning while helping pre-college or college students learn about the fundamental aspects of science. The course provides the science and laboratory experience as students learn to prepare and participate in supervised laboratory teaching for pre-college or college students. May be repeated for six credits. Preq: Consent of instructor. Coreq: BIOL 4951.

BIOL 4951 Service Learning in Biology Laboratory 0 (3-9) Non-credit laboratory to accompany BIOL 4950. Coreq: BIOL 4950.

MICR 4950 Service Learning in Biology 2-4 (1) Combines service and academic learning while helping pre-college or college students learn about the fundamental aspects of science. Provides lecture and laboratory experiences as students learn to prepare and participate in supervised laboratory teaching for pre-college or college students. May be repeated for a maximum of six credits. Preq: Consent of instructor. Coreq: MICR 4951.

MICR 4951 Service Learning in Biology Laboratory 0 (3-9) Non-credit laboratory to accompany MICR 4950. Coreq: MICR 4950.

SPECIALTY COURSES

Check the Registration Information web page below for course availability, the registration process, and associated costs, e.g., travel, accommodations, food, study abroad fee, and/or local transportation:

http://www.clemson.edu/cafls/departments/biosci/undergraduates/advising_center1/registration.html

Pre-Medical & Pre-Dental in Costa Rica (BIOL 4880 Health Professions Practicum)

These summer programs in Costa Rica are designed for students interested in health care professions who desire to engage in hands-on patient interactions not available in the United States. No application is necessary. For more information contact Dr. Vincent Gallicchio at vsgall@clemson.edu.

Clinical Applications & Medical Practice (BIOL 4890)

This hybrid course involves classroom instruction along with visits to local hospital and medical facilities. The purpose is to provide students with exposure to the various fields, specialties, and subspecialties within clinical medicine. Students will have the opportunity to shadow physicians and learn about current issues and advances in medicine as well as become acquainted with the requirements for admission to medical school. This course is intended for sophomores and juniors. Applications for these programs are available in February and September for the fall and spring respectively. Submit application and one page essay about why you are interested in medicine, career goals, and benefits of the course to Jackie Van Strien, vanj@clemson.edu. Seats in this course are highly competitive. Finalists will be contacted to schedule an interview. For more information contact Dr. Vincent Gallicchio at vsgall@clemson.edu.

Freshwater Ecology in Dominica (BIOL 4430/4440 Fresh Water Ecology)

This course is offered during the summer and is designed as an investigation of the abundant and exotic aquatic habitats of Dominica. You will participate in on-going investigations as well as explore the island and its natural treasures: lakes, streams, a boiling lake, waterfalls, and snorkeling. Study the characteristics of the lakes and rivers of this island paradise. Limited enrollment is available. For availability email Dr. John Hains at jhains@clemsun.edu.

Emergency Medical Responder (BIOL 2300)

Students are prepared to provide emergency pre-hospital assessment and care for patients with a variety of medical conditions and traumatic injuries. Study areas include medical emergencies, trauma, and working in the pre-hospital setting. Intended primarily for pre-professional health and nursing students. Sponsored by Greenville Health System and Clemson Fire and EMS, students learn new skills and gain real world experience associated with responding to an emergency. No application is required. Prerequisites include BIOL 1030/1050 and BIOL 1050/1060 or 1100 and 1110. NREMR Certification required. Spring Semester. Interested parties should email ems@g.clemson.edu in September for registration approval.

EMR Practicum (BIOL 4970)

This course is a companion to Emergency Medical Responder. The practicum applies skills directly to patient assessment and treatment. Intended for students with current NREMT EMR certification. Fall semester. No application is required. Interested students should e-mail ems@g.clemson.edu in March for registration approval.

ACADEMIC FORGIVENESS POLICY

The Academic Forgiveness Policy (AFP) allows a student enrolled beginning Fall 2013 or after to eliminate from the grade-point average (GPA) calculation up to three courses in which a D or F was earned. Students enrolled prior to Fall 2013 who were under the former Academic Redemption Policy will be allowed academic forgiveness on a modified scale. Detailed information is available at [Academic Forgiveness](#)

The following conditions apply:

- Courses taken prior to fall semester 2003 may not be considered for academic forgiveness. While D or F grades in required courses may be eliminated before the course is repeated, the required course must be repeated satisfactorily at Clemson University before graduation. Both grades will remain on the transcript, degree progress report, and other official documents.
- For financial aid purposes, courses repeated under this policy resulting in duplicate credit do not count for satisfactory academic progress.
- Courses required for degree must be retaken at Clemson. Course substitutions are not permitted. If the course is not required for the degree, it can be forgiven and does not have to be retaken.
- Candidates for graduation must request AFP by the deadline to submit candidate grades. See [Academic Calendars](#).
- Students may not invoke the AFP after they have graduated. After graduation, students may repeat coursework, but both grades will be calculated in the grade-point average.
- The AFP may not be applied to a course taken on a Pass/no Pass basis or to any course in which the student was previously found in violation of the academic integrity policy.

Academic Forgiveness can be used for a course that was repeated at Clemson where the student has previously received AP or IB credit. The student may elect to retake the course at Clemson or to use the AP or IB Credit.

FINANCIAL AID

The Financial Aid Office at Clemson University administers and/or coordinates various types of undergraduate financial aid, which includes scholarships, loans, grants, and part-time employment. One such program that has been of significant benefit to both faculty and students in the Department of Biological Sciences is the College Work-Study Program. For most types of financial assistance, application must be made to the Financial Aid Office beginning in December each year for assistance the next academic year; however, the deadline for application for the College Work-Study Program routinely has been April 1. For more information, students are encouraged to contact the Financial Aid Office or visit their web site at [Financial Aid](#).

STATE OF SOUTH CAROLINA SCHOLARSHIPS PROGRAMS

PALMETTO FELLOWS Scholarship Program. The Palmetto Fellows Scholarship offers up to \$6,700 in renewable scholarship assistance to entering freshmen. The amount of the award increases to \$7,500 for upperclassmen and may be "[Enhanced](#)" to \$10,000 for upperclassmen in declared science and mathematics related majors. The South Carolina Commission on Higher Education (CHE) makes selection and initial notification. Application is made during the senior year of high school through the high school guidance office. General and Initial eligibility requirements are at [Palmetto Fellows](#)

Renewal Eligibility Requirements

- Must earn a total of 30 credit hours each academic year (fall, spring, summer). Any hours earned prior to high school graduation, hours exempted by examination and advanced placement credit do not count towards the 30-hour requirement.
- You must maintain a minimum 3.0 cumulative GPR on all courses taken at Clemson. Courses taken at other institution will not affect the grade point ratio requirement for Palmetto Fellows.
- If you do not meet the above criteria at the end of the spring semester, your Palmetto Fellows award will be withdrawn. If you make up the deficiency during summer school, please notify us and the award will be reinstated.
- Course work taken at other institutions and accepted for credit by Clemson University can be used to satisfy the 30-credit hour requirement.
- If you have a cumulative 3.0 GPR at Clemson at the end of the spring semester and choose to attend summer school at Clemson, you will NOT be eligible for Palmetto Fellows if your cumulative GPR drops below a 3.0 at the conclusion of summer school.

Terms of Eligibility

You may receive Palmetto Fellows for up to eight semesters of undergraduate study. Landscape Architecture students may be eligible for the LIFE Scholarship during their 9th and 10th semesters.

LIFE (Legislative Incentives for Future Excellence) Scholarships. The LIFE Scholarship is a renewable scholarship for residents of South Carolina who are enrolled full-time. Awards are made automatically; no scholarship application is required. The amount is \$5,000 per year and may be "[enhanced](#)" to \$7,500 per year for upperclassmen in declared science and mathematics related majors. General and Initial eligibility requirements are at ([LIFE Scholarship](#))

Eligibility Requirements for Continuing Students

- Must meet all general eligibility
- Earn an average of 30 credit hours per academic year (Fall, Spring, Summer).
- A total of 30 hours is required for a rising second year student, 60 for a rising third year student and 90 for a rising fourth year student.
- Any credit hours earned before high school graduation, hours exempted by examination and advance placement credit approved by Clemson University will be used toward the credit hour requirement. Duplicate credit courses do not count in the total.
- Earn a minimum cumulative LIFE GPR of at least a 3.0 on a 4.0 scale by the end of the academic year. The LIFE GPR must include all grades earned at Clemson University plus all grades attempted (excluding remedial) at all other institutions, both in state and out-of-state.
- If you have earned a 3.0 LIFE GPR after the spring semester and choose to enroll in summer school at Clemson or any other institution, you will NOT be eligible for the LIFE Scholarship if your LIFE GPR falls below a 3.0 at the end of summer school.

The LIFE GPR is used for determining eligibility for the LIFE Scholarship only. It is distinctively different from your cumulative Clemson GPR that is used for graduation purposes and the awarding of other merit-based scholarships.

Eligibility Requirements for Transfer Students

- Must meet all general eligibility requirements
- Eligibility for the first year at Clemson is based on your initial college enrollment and the cumulative GPR and hours earned (non-remedial) all your previous institution(s). This will

include both in-state and out-of-state institutions.

- After your first year at Clemson, all of the requirements for continuing students (above) will apply.

Terms of Eligibility

You may receive the LIFE Scholarship through the eighth consecutive semester following initial college enrollment. The eight-semester limit is a time limit only. The limit is not determined by the number of semesters the LIFE Scholarship has actually been received and may include periods of non-enrollment. An exception is granted to Landscape Architecture majors to allow for ten semesters if they are enrolled in the five-year program.

LIFE GPA Location

Under the SC LIFE Scholarship GPA link on your [iROAR](#) account, you will be able to calculate your current LIFE GPA.

HOPE Scholarship Program. The HOPE Scholarship is a nonrenewable, two-semester scholarship for entering freshmen that achieve academically but are not eligible for the LIFE Scholarship. The value of the Hope Scholarship is \$2,800 for the year. Initial eligibility requirements are at [HOPE Scholarship Program](#).

Terms of Eligibility

The HOPE Scholarship may be received for no more than two semesters and only during first year of college enrollment. After the first year, eligibility may be established for the LIFE Scholarship.

Enhanced LIFE Scholarship and Palmetto Fellows Scholarships ([Enhanced Scholarships](#))

BIOSC and MICRO majors may qualify for an additional financial aid stipend beginning with their sophomore years. Basic eligibility requirements for the enhanced awards are as follows:

LIFE Scholarship

- Recipients with over 30 hours, and who, as a freshman, earned 14 hours of math or life science or physical sciences in any combination and who are math and science majors will receive an additional amount of up to \$2,500 for a maximum of \$7,500.
- Entering freshmen, regardless of major, and upperclassmen that do not meet the above conditions, will receive a maximum award of \$5,000.

Palmetto Fellows

- Recipients with at least 30 hours, and who, as a freshman, earned 14 hours of math or life science or physical sciences in any combination and who are math and science majors will receive an additional amount of up to \$3,300 for a maximum of \$10,000.
- Palmetto Fellows with at least 30 hours, but do not meet the conditions above, will receive an additional amount of up to \$800 for a maximum of \$7,500.
- Entering freshmen, regardless of major, will receive a maximum of \$6,700.

SUMMER DISBURSEMENTS OF STATE SCHOLARSHIPS

A summer semester scholarship disbursement yields a potential for those eligible students who demonstrate they are on an accelerated track to graduation to earn a degree at a faster pace than on a traditional academic calendar. The availability of summer awards allows for a decreased time-to-degree alternative, which in turn assists students in attaining educational goals at lower costs.

More information on summer course offerings can be found on the [Summer Programs](#) page.

General Requirements for Determination of Summer Award Eligibility

- The program for summer awards applies to Palmetto Fellows and LIFE programs.
- For purposes of the summer awards, summer term is defined as the period between the end of the spring term and prior to the opening of the fall term.
- A student who has been verified as meeting all general and continued eligibility requirements at the end of the spring semester is eligible to participate in summer scholarship disbursements.
- A student can only receive a summer scholarship disbursement at their home institution.

Student Scholarship Eligibility Requirements

To participate, a student must meet the following requirements by the end of the spring term in addition to meeting all general scholarship eligibility requirements.

- **Palmetto Fellows Scholarship-** For participation in summer scholarship disbursement, at the end of the spring semester a recipient must:
 - Earn a cumulative 3.0 institutional GPA
 - Earn at least 30 credit hours of non-remedial coursework during the fall and spring terms, excluding AP, IB, Dual Enrollment, CLEP, or exempted credit hours.
 - A summer term cannot be a scholarship recipient's first term of enrollment.
- **LIFE Scholarship-** For participation in summer scholarship disbursement, at the end of the spring semester a recipient must:
 - Earn a cumulative 3.0 LIFE GPA
 - Earn an average of at least 30 credit hours of non-remedial coursework during the fall and spring terms, including AP, IB, Dual Enrollment, CLEP or exempted credit hours.
 - A summer term cannot be a scholarship recipient's first term of enrollment.
- **General Eligibility Requirements**
 - A student must demonstrate having attempted and/or enrolled in a total of at least twelve credit hours over the course of the entire summer term to be awarded. Students who drop below 12 hours at any point during the summer and after receiving their Summer State Scholarship may lose their scholarship and will owe the University for any incurred expenses previously paid by the scholarship.
 - Participating students who are determined to be a Palmetto Fellows Scholarship or a LIFE Scholarship recipient and have met the continued eligibility requirements at the end of the spring term are eligible for a fall award regardless of their academic performance over the summer. Continued eligibility for the scholarship will be reviewed at the end of the following spring term.

Palmetto Fellows and LIFE Scholarship Enhancements

A student who has been determined to have met continued eligibility for the PFS and LIFE Scholarship and has met the scholarship Enhancement eligibility requirement, is eligible to receive Enhancement funds for the summer term.

- A student shall be verified for enrollment in an eligible major after the last day to drop/add a course of the first summer term of their enrollment.
- A student who is in the first academic year and has met continued eligibility for the PFS scholarship and has met the Enhancement eligibility requirement at the end of the spring term, is eligible to receive Enhancement funds starting the immediate succeeding summer term.
- A student who has not met the Enhancement eligibility requirement at the end of the spring term is still eligible to use the PFS or LIFE Scholarship for the summer term. The summer term still may be used to earn PFS or LIFE Scholarship Enhancement eligibility during the first academic year only.
- A student does not have the option of deferring Enhancement funds for a summer term, if the student opts into the program for receipt of the base PFS or LIFE Scholarship.

Summer Enrollment Form

Prior to disbursement of summer award, student must complete the following:

- Complete Summer Enrollment Form and choose Summer LIFE or Palmetto Fellows Scholarship option.
- Mandatory meeting with a financial aid representative.

SCHOLARSHIPS AND ACADEMIC FORGIVENESS POLICY

In 2013, Clemson University replaced the University's Academic Redemption policy with the new Academic Forgiveness Policy. Students now have control over which courses may be removed from their GPA and hours earned. Since many scholarship programs have minimum GPA and completed

hours requirements, this new policy will have a significant impact on students' eligibility for scholarship renewal. As more than 80% of our in-state students are attending Clemson on state scholarship support, we are beholden to the regulations that govern the renewal of these scholarships. In order to be clear with our students, we align our university scholarship policies to match state regulations where possible.

The process for a student to regain a state or university scholarship after having a grade forgiven is as follows:

1. The student's new GPA and earned hours must both be at or above the minimum required for the scholarship(s). This is important to note, as there will be cases where a forgiven grade will result in a GPA that meets the scholarship minimum, but the loss of those credit hours causes the student to no longer meet the credit hour requirement.
2. All requests for academic forgiveness must be submitted to the Registrar's Office before the start of the academic year for which the student is looking to regain scholarship eligibility.
3. After the grade change has been processed on the student's academic record, the student must write to the Office of Student Financial Aid and request re-instatement of the relevant scholarship(s).

Due to the workloads in both offices at the start of a new school year, processing the grade changes and re-instating the aid may not happen immediately. Unfortunately, state regulations just do not allow us the ability to be flexible with the dates. Please do not hesitate to contact me if you have additional questions about the implementation of this change. FAQs regarding Academic Forgiveness are posted at [Academic Forgiveness Policy](#)

WHAT YOU NEED TO KNOW AND DO BEFORE WITHDRAWING FROM A CLASS

Before withdrawing from any class, do the following, in this order:

1. Go to Financial Aid in G-01 Sikes (if you have scholarships or loans).
 - Ask about the conditions of your scholarships or loans.
 - Get the facts in writing.
 - Write down the name of the person you speak with there.
2. Make an appointment to see your academic advisor in person.
3. Your academic advisor will:
 - Ask your reasons for wanting to withdraw from the class.
 - Discuss the pros and cons of withdrawing (including):
 - Implications for your GPR (keeping vs. dropping the class)
 - Academic forgiveness policy
 - Scholarship implications
 - Medical insurance implications (you need to research this)
 - Car insurance implications (you need to research this)
 - Map out a course plan for subsequent semesters (including the possibility of attending summer school)
 - Direct you to Financial Aid (G-01 Sikes) if you have not been there yet
 - Tell you to discuss all of this with your family before dropping

GRADUATION REQUIREMENTS

A candidate for an undergraduate degree is a student who has submitted a completed diploma application by the deadline prescribed in the University calendar for a particular graduation date. Candidates for degrees are required to apply for their diplomas within three weeks following the opening of the final semester or the opening of the first summer session prior to the date the degrees are to be awarded. The graduation application is currently available under the student records tab in [iROAR](#). Only candidates who have completed all graduation requirements are permitted to participate in the graduation ceremony.

RESIDENCE REQUIREMENT

To qualify for an undergraduate degree, a student **must complete** through instruction from Clemson a minimum of **37 of the last 43 credits** presented for the degree. A waiver may be obtained for approved study abroad experiences through the Undergraduate Studies Office, E-103 Martin Hall.

CLUBS AND SOCIETIES

Biological Sciences Club: [Biological Sciences Club](#)

The Biological Sciences Club is a social/service club that unites students and professors in the biological sciences department. Activities this year will include various trips and events that the club is interested in (past events have included trips to the Georgia Aquarium, white water rafting, camping, and a fall bon fire). Our major service projects are the roadside cleanup on Isaqueena Trail, the production of Clemson's Darwin Day, and Relay For Life in the spring. You don't have to be a biology major and you can join anytime throughout the year. Each meeting features a professor or student (undergrad or grad) with an interesting research project, and there is always free pizza! Dissecting kit sales and plant sales are the two major fund-raising projects that help to support these trips. **Membership:** Open to all students majoring in the Biological Sciences or a related biology field. **Meetings:** Regular meetings, generally including an invited speaker, are held on the first Wednesday evening of each month. **Field Trips:** Generally, one weekend trip or community service activity is scheduled each month. **Faculty Advisor:** Dr. Michael Sears, sears3@clemson.edu, 323 Long Hall.

Clemson University Microbiological Society: [Clemson University Microbiological Society](#)

The Clemson University Microbiological Society is an organization designed for undergraduate students with an interest in microbiology. You don't have to be a microbiology major to join! The organization offers students a discounted membership to the American Society of Microbiology as well as the opportunity to make connections in the Microbiology department at Clemson. Meetings consist of presentations from professors and other microbiology professionals. We go on field trips regularly and previous field trip locations include Thomas Creek Brewery, Mushroom Mountain, and Chateau Elan. **Membership:** Open to all CU students and faculty **Meetings:** First Monday of the month. **Faculty Advisor:** Dr. Harry Kurtz (hkurtz@clemson.edu).

Alpha Epsilon Delta: Students with medical and dental interests [Alpha Epsilon Delta](#)

Alpha Epsilon Delta (AED) is a national pre-health honor society with an on-campus chapter. It is designed for distinguished students who want to pursue a career in one of the health fields. AED hosts weekly meeting in which physicians, dentists, pharmacists, and other health professionals come who speak to students on various topics. Being in AED exposes you to many aspects of various health professions, and also offers opportunities for you to get involved potentially with free clinics and trips to professional schools. Joining AED does not automatically improve your chance of getting into a professional health institution or program, but if you get involved and participate actively, it will help you. **Meetings:** Varies. **Faculty Advisor:** Dr. Michael Sehorn, msehorn@clemson.edu, phone 864-656-2572 or visit

Pre-Pharmacy Club: [Pre-Pharmacy Club](#)

Clemson University Pre-Pharmacy Club is an organization devoted to guiding students towards a profession in pharmacy. The mission of the club is to promote educational importance, encourage dedication to a pharmaceutical discipline, stimulate contact between undergraduate students and professionals, and bind those with similar interests. The Clemson University Pre-Pharmacy Club hosts meetings throughout the year as well as guest speaker events and PCAT study sessions. **Meetings:** First Tuesday of every month. Faculty Advisor: Dr. Thomas Hickman (hickma2@clemson.edu).

The Pre-Dental Club: ([Pre-dentistry](#))

Provides students with numerous opportunities to further their knowledge of the field of dentistry and the expectations associated with acceptance into dental school. The Pre-Dental Club also strives to be active in the community and give back through volunteer service and philanthropic support. **Meeting Day:** Tuesday. Faculty Advisor: Dr. Vincent Gallicchio (vsgall@clemson.edu).

American Medical Student Association: [Medical School Association](#)

The American Medical Student Association (AMSA), with a half-century history of medical student activism, is the oldest and largest independent association of physicians-in-training in the United States. Today, AMSA is a student-governed, national organization committed to representing the concerns of physicians-in-training. AMSA members are medical students, premedical students, interns, residents and practicing physicians. Founded in 1950, AMSA continues its commitment to improving medical training and the nation's health. As a part of Clemson's premedical AMSA chapter, you will join a committee and work on a year-long healthcare-related project to engage the chapter, campus, and community. **Meeting Day:** Tuesday. Faculty Advisor: Dr. Vincent Gallicchio (vsgall@clemson.edu).

Clemson University Emergency Medical Responder Service: ([Emergency Medical Responder](#))

Club for students, who have taken or are currently enrolled in the EMR course, are able to come together with fellow students. The purpose of the club is to promote the health and safety of Faculty, Staff, Students, and visitors on the main campus of Clemson University. **Meetings:** TBA. Advisor: William Shivar (shivarw@clemson.edu).

Pre-Vet Club: Students with veterinary medicine interests [Pre-Vet Club](#)

Provides an informal social setting in which students gain additional information concerning admission requirements and career opportunities in the area of veterinary medicine. Activities include visits by various practicing veterinarians in the area, campus visits by area Vet Schools and trips to the University of Georgia to tour the facilities of the College of Veterinary Medicine. **Meeting Day:** 2nd and 4th Wednesdays. Faculty Advisors: Dr. Glenn Birrenkott (gbrnkt@clemson.edu), 864-656-4019, 134 P&AS Building; Dr. Jeryl Jones (jerly@clemson.edu), 864-656-2142, 140 P&A.

βββ Biological Sciences Honor Society, Pi Theta Chapter [Tri-Beta](#)

Tri-Beta is an honorary society for undergraduate and graduate students who are interested in improving the understanding and appreciation of study in the life sciences. In addition, the organization is committed to service and to increasing knowledge through scientific research opportunities. Tri-Beta members provide service to the department and college by serving as ambassadors to future Clemson students interested in fields of science as well as assisting with varied philanthropic projects by fundraising and donation of time. Tri-Beta is a relatively new honor society at Clemson University and is looking for enthusiastic members to enrich our chapter. **Membership:** 2nd semester sophomore with at least a 3.0 GPA in the sciences. **Meetings:** Once each month. Faculty Advisor, Dr. T. McNutt-Scott (tmcnutt@clemson.edu), 308 Jordan Hall.

Institute for Healthcare Improvement Open School Chapter [IHI Open School](#)

The Institute for Healthcare Improvement's (IHI) new Open School initiative is an opportunity for students and healthcare workers to supplement or expand their education through a network of those interested in improvement. The IHI Open School offers a variety of online courses and aims to connect students, faculty, and practitioners through campus chapters. Though Clemson does not have a medical school, there are a variety of majors, projects and research that focus on healthcare improvement around campus. Clemson's chapter of the Open School aims to engage multiple, non-traditional disciplines to discuss healthcare improvement and create a network of similar interests across campus. Clemson's chapter is supported by the South Carolina Hospital Association and administrators and clinicians at local facilities that further extend students' networking and volunteer opportunities. **Meeting Day:** Wednesdays (one or two meetings/events per month). Faculty Advisor: Ashley Kay Childers (childer@clemson.edu).

SCIENCE EDUCATION, GRADUATE AND PROFESSIONAL SCHOOLS

I. Biological Sciences/Science Teaching

A trend at the national level is for students who desire to teach biology in middle (grades 5 – 8) or high schools (grades 9 – 12) to major in the discipline (e.g., Biological Sciences) and to complete courses required for certification as electives or a minor.

Double Major in Biological Sciences/Science Teaching. The Bachelor of Arts Degree in Biological Sciences and Science Teaching: Biological Sciences prepares students for teaching biology on the secondary school level and for graduate studies in any of the life science areas.

In addition, The Eugene T. Moore School of Education offers the **Master of Arts in Teaching (MAT) in Secondary Science or Secondary Mathematics** that leads to teacher certification. [MAT-Secondary Science](#)

The Master of Arts in Teaching in Secondary Science or Secondary Mathematics is a 39-semester-hour program that can be completed in 13 months and is offered in the Greenville area. It consists of online and face-to-face instruction and more than 100 hours of field experience prior to student teaching.

The MAT program is a technologically rich program in which students master the fundamentals of teaching and become skilled at motivating and helping students learn either science or mathematics at deep levels. The program addresses content directly related to the secondary classroom, educational foundations and specific teaching methods that reflect current research in the field.

The program also provides the courses required for initial certification for grades 9-12 in South Carolina. The program is geared primarily toward adults with a background in science, mathematics or a related discipline that wish to change careers and enter the teaching field.

Clemson University is proud to offer the National Science Foundation-funded *TigersTeach* Noyce Scholarship to qualified individuals. Eligible applicants entering the MAT for Secondary Science and Mathematics program can receive up to \$10,000. Those interested in applying for a scholarship should contact Leigh Haltiwanger, program coordinator, to determine eligibility and admissions procedures **prior** to submitting an application for the MAT program. Information about the Robert Noyce Teacher Scholarship Program is at [Noyce](#)

The optimal entry point into the MAT program is during the Summer I term with a projected graduation the following summer. The program application deadline is April 1.

To be considered for admission, individuals must complete the following requirements:

- Complete the online application to the Clemson University Graduate School. To ensure full consideration, applications must be received by the April 1 deadline. On the application, select Program Code 385 (Secondary Education) and indicate either science or mathematics within the application.
- Submit official transcripts from all prior institutions from which a degree was awarded and from which transfer credit is desired. A bachelor's degree or higher is required from an accredited institution. Prior course work must show completion of at least 30 semester credits with a C or better in the certification area or closely related discipline. Note: additional course work may be required to address deficiencies in certain content areas (e.g., science requires course work in physics, chemistry and biology).
- Submit scores for the Praxis II Exam (science: 0030 or 0070; math: 0061). Note: Applicants may be considered for admission without the Praxis scores. However, all individuals must submit passing scores for these exams prior to the directed internship (student teaching).
- Complete the departmental interview (can be scheduled before or after all application materials have been submitted).
- Include two recommendations. Note: Recommendation forms may be sent to recommenders electronically from the online application, or PDF recommendation forms can be sent for recommenders to complete and return to the Clemson University Graduate School.
- Submit TOEFL scores if English is not your first language.
- Submit a resume and indicate relevant professional work experience. Three or more years of professional experience beyond the bachelor's degree is recommended.
- Submit competitive Graduate Record Exam (GRE) or Miller Analogies Test (MAT) scores.

II. Graduate School

The Biological Sciences and Microbiology curricula are designed for students whose career goals require advanced study in basic biological disciplines. The core requirements of the Biological Sciences B.S. and B.A. degrees in conjunction with appropriate optional major courses can provide an excellent preparation for advanced study in botany, cell biology, ecology and evolutionary biology, genetics, immunology, marine biology or zoology. Similarly, the B.S. degrees in Microbiology can provide excellent preparation for advanced study in cell and molecular biology, immunology and all areas of microbiology.

Your advisor will be the best source of advice about graduate school. Graduate programs typically require from 2 to 5 years of post-graduate study and lead to the M.S. (Master of Science) or Ph.D. (Doctor of Philosophy). Most schools have admission requirements that include a baccalaureate degree (B.A. or B.S.), the Graduate Record Examination (GRE), transcripts, letters of recommendation, and a letter of intent. Enrollment in BIOL or MICR 4910 (Special Problems) with a faculty member whose research is in the field of the student's intended research is recommended. A [Guide to Applying to Graduate Schools](#) is at the following URL: [Graduate School Guide](#)

III. Professional School. Students interested in health profession or veterinary medicine graduate programs should choose a major as soon as possible after entering Clemson and must do so by the end of the first year. Ms. Owens, Mr. Hunter, Dr. Birrenkott, and Dr. Jones will continue to provide information, advice and help, relative to admission requirements for the appropriate professional school, but students should receive their academic advising within their chosen major to insure that all Clemson requirements for graduation are met.

Pre-Medical/Pre-Dental. Health Professions Advisor: Chad Richardson (cmricha@clemson.edu) Most Medical and Dental Schools have identical basic course requirements ([Admission Requirements](#)). These requirements are all included in the Biological Science B.S. curricula as:

2 semesters of English	ENGL 1030 plus any 2000 or 3000 English course
2 semesters of Math	MATH 1060 & STAT 2300
2 semesters of Biology	BIOL 1100 & 1110 (recommended) or BIOL 1030/1050 & 1040/1060
2 semesters of Physics	PHYS 2070/2090 & 2080/2100
4 semesters of Chemistry	CH 1010 & 1020, CH 2230/2270 & 2240/2280
2 semesters Behavioral Sciences	PSYC 2010 & SOC 2010

The Biological Sciences B.S. and B.A. curricula require the addition of CH 2240/2280.

Major courses of value to Medical or Dental School applicants:

Introductory Genetics	GEN 3020/3000
General Biochemistry	BCHM 3010/3050
Functional Human Anatomy	BIOL 3150
Human Physiology	BIOL 3160
Basic Immunology	MICR (BIOL) 4140

Other major requirement courses to consider include:

Vertebrate Biology	BIOL 3030/3070
Neurobiology	BIOL 4200
Developmental Biology	BIOL 4400
Principles of Hematology	BIOL 4670
Vertebrate Endocrinology	BIOL 4800
Stem Cell Biology	BIOL 4830
Epidemiology	HLTH 3800
General Microbiology	MICR 3050
Public Health Microbiology	MICR 4000
Pathogenic Bacteriology	MICR 4110
Cancer and Aging	MICR 4170

Psychology Courses to consider include the following:

Developmental Psychology	PSYC 3400
Physiological Psychology	PSYC 3240
Abnormal Psychology	PSYC 3830

Excerpts from South Carolina Medical Schools

Medical University of South Carolina (Columbia) - Preference is given to applicants who have completed four years of college and earned a baccalaureate degree. There are no specific course requirements but the MCAT is required and students who wish to do well on the examination should consider studying college courses in introductory biology, chemistry, physics and organic chemistry prior to taking the MCAT. Students are advised to construct courses of study that are intellectually interesting and challenging for them individually. Any education that engenders curiosity and enthusiasm for learning is desirable.

University of South Carolina School of Medicine - Members of the Admissions Committee recognize that they are selecting future physicians. The admissions process is therefore an effort to select applicants who possess the individual characteristics required for both the study and the practice of medicine. Two semesters of English, Math, Introductory Biology, Behavioral Sciences, Chemistry, Physics and Organic Chemistry are required as is the MCAT. All science courses must include laboratory. For most students, a strong preparation in the natural sciences is the best basis for the study and understanding of medical sciences. For this reason, the Admissions Committee recommends that students take more than the minimum requirements in the natural science. Questions regarding requirements of, preparation for, and admission into medical and dental school are at [Health Professions Advising](#)

Prepharmacy Declared major. Advisor: Chad Richardson (cmricha@clemsun.edu), 102 Long Hall, 656-4154 **Prepharmacy Undeclared major.** Advisor: Adam Hunter (hunter3@clemsun.edu), 105 Long Hall, 656-3288.

The three-year Prepharmacy program requires 72-90 credit hours, depending on the pharmacy school of interest. Students in this program typically apply to a college of pharmacy upon completion of their second year. Upon completion of the program and one year at an accredited pharmacy school, students may be eligible to apply for the Bachelor of Science in Preprofessional Studies. The professional institution awards the degree in Pharmacy. It is important for students to work closely with their advisor, as there are variations in courses required by the pharmacy schools. For financial aid purposes, students in the Prepharmacy program are considered enrolled in a degree-seeking program. Frequently Asked Questions regarding requirements of, preparation for, and admission into pharmacy school is at: [Health Professions Advising](#)

For students who want to receive a baccalaureate degree before applying to a college of pharmacy, the Biological Sciences B.S. Prepharmacy Emphasis degree fulfills the requirements for pharmacy school.

Prerehabilitation Sciences. Advisor: Chad Richardson (cmricha@clemsun.edu), 102 Long Hall, 656-4154. Prerehabilitation Sciences includes concentrations in *occupational therapy, physical therapy, communication sciences and disorders, physician assistant* and other allied health areas. Most programs require a baccalaureate degree that may be in any area as long as the prerequisites courses are included in the degree program. In addition, students must apply to a professional school for acceptance into its program. Information regarding requirements and admission into rehabilitation sciences programs are at [Health Professions Advising](#)

For students who want to receive a baccalaureate degree before applying to a rehabilitation sciences program, the Biological Sciences B.A. Rehabilitation Sciences degree fulfills the requirements for rehabilitation sciences programs.

Accelerated Pathways to MUSC Professional Health Degree Programs.

Advisor: Adam Hunter (hunter3@clemsun.edu), 105 Long Hall, 656-3288.

Clemson undergraduate students can apply for admission to nine health-related graduate programs at the Medical University of South Carolina (MUSC), including medicine, dentistry, pharmacy, physical therapy, and public health, after three years at Clemson ([Accelerated Pathways](#)).

Pre-Veterinary Medicine Requirements for Biological Sciences Majors. Pre-Veterinary Medicine Advisor: Dr. Jeryl Jones, jerly@clemsun.edu, 140 P&A, 656-2142 and Dr. Glenn Birrenkott, gbrnkt@clemsun.edu, 134 P&AS, 656-4019.

Residents of South Carolina are able to apply for contract seats at the University of Georgia (17), Mississippi State University (5), and Tuskegee University (4). In addition to these contract seats, students can apply at-large to any veterinary school in the United States. Below are the minimum requirements for a South Carolina resident to be accepted to the three veterinary schools with contract seats.

University of Georgia ([Course Requirements](#))

Students must have completed the following courses with a grade of C (2.00) or better as prerequisites for admission: English (6 hrs.), Humanities and Social Studies (14 hrs.), General Biology (8 hrs.), Chemistry (8 hrs.), Organic Chemistry (8 hrs.), Physics (8 hrs.), and Biochemistry (3 hrs.), and Advanced Biology (8 hrs.); comparative anatomy, microbiology, cell biology, and genetics are recommended. Prerequisite course requirements cannot usually be met by online courses. A cumulative GPA of 3.00 or greater on a 4.00 scale, or a combined score on the GRE verbal and quantitative sections of 1200 or greater is required. AP credit must appear on official college transcripts and be equivalent to the appropriate college-level coursework. Additional requirements and considerations include a minimum of 250 veterinary experience hours, recommendations, evaluations, and essay.

Mississippi State University ([Entrance Requirements](#))

Students must have completed the following courses as prerequisites for admission: English Composition (6 hrs.), Speech (3 hrs.), Mathematics - college algebra or higher (6 hrs.), General Biology (8 hrs.), Microbiology with lab (4 hrs.), Advanced Science Electives (12 hrs.), e.g. anatomy, genetics, physiology, nutrition, etc., General Chemistry with lab (8 hrs.), Organic Chemistry with lab (8 hrs.), Biochemistry (3 hrs.), Physics with lab – may be trig-based (6 hrs.), and Humanities, Social/Behavioral Sciences and Fine Arts (15 hrs.). A minimum GPA is 2.80 on a 4.00 scale. No grade lower than C- is acceptable for a required course. The GRE general test is required (no minimum score). AP credit must appear on official college transcripts and be equivalent to the appropriate college-level coursework. Additional requirements and considerations include evaluation of written application (including veterinary/research experience), confidential evaluations, and interview (by invitation on a competitive basis).

Tuskegee University ([Course Requirements](#))

Students must have completed the following courses with a grade of C (2.00) or better as prerequisites for admission: English or Written Composition (6 hrs.), Social Science and Humanities (6 hrs.), Liberal Arts (6 hrs.), Mathematics (6 hrs.), Advanced Biology (9 hrs. 300 level or above), Organic Chemistry with lab (4 hrs.), Biochemistry with lab (4 hrs.), Physics with lab (8 hrs.), Science Electives (8 hrs.) – Anatomy, Genetics, Microbiology, Physiology, and others, Introduction to Animal Science (3 hrs.), and Animal Nutrition (3 hrs.), a minimum cumulative and science GPA of 2.70 on a 4.00 scale, and VCAT, MCAT, or GRE scores from exams taken within 3 years of application.. Verbal plus quantitative GRE scores are required. AP credit is acceptable for English.

Frequently Asked Questions regarding requirements of, preparation for, and admission into veterinary school is at: [Health Professions Advising](#)

BIOLOGICAL SCIENCES FACULTY / *RESEARCH EMPHASIS* / OFFICE

- John G. Abercrombie** (M.S., Clemson University) 127 LSF
Senior Lecturer of Biological Sciences
The biology of bacteriocin Jensenin P, an antimicrobial peptide produced by P. jensenii that inhibits the growth of an organism known to cause acne.
- J. Antonio Baeza** (Ph.D., University of Louisiana at Lafayette) 226 Long Hall
Assistant Professor of Biological Sciences
Invertebrate biology. Sexual selection. Adaptive value of breeding systems.
- Lisa J. Bain** (Ph.D., North Carolina State University) 239 Long Hall
Professor of Biological Sciences
Environmental pathobiology; Cellular toxicology; Biochemical and molecular toxicology; Resistance mechanisms; and Aquatic toxicology.
- William S. Baldwin** (Ph.D., North Carolina State University) 235 Long Hall
Professor of Biological Sciences
Endocrinology/mammalian physiology; Toxicant-induced alterations in gene expression; Endocrine disruption.
- Robert E. Ballard** (Ph.D., University of Iowa) G22 Jordan Hall
Professor of Biological Sciences
Speciation of flowering plants; science outreach.
- Douglas Bielenberg** (Ph.D., Pennsylvania State University) 155 Long Hall
Associate Professor Horticulture; Biological Sciences
Genomics and gene expression for winter dormancy in trees.
- Richard W. Blob** (Ph.D., University of Chicago) 342 Long Hall
Professor of Biological Sciences, Bioengineering
Biomechanics and the evolution of animal function; animal locomotion; comparative vertebrate anatomy, physiology, and functional morphology; herpetology; vertebrate paleontology.
- Barbara Campbell** (Ph.D., Microbiology, Cornell University) 155B LSF
Associate Professor of Biological Sciences
The function and structure of microbial communities at the molecular level.
- Min Cao** (Ph.D., Cornell University) 116 Jordan Hall
Associate Professor of Biological Sciences
Identification of factors associated with bacterial virulence, especially in Listeria monocytogenes. Responses of this organism to reactive oxygen and nitrogen species.
- Susan C. Chapman** (Ph.D., King's College University of London) 340 Long Hall
Associate Professor of Biological Sciences
Embryonic development and organogenesis. Mechanisms of tissue specification, morphogenesis and patterning of specific regional identity during vertebrate head development.
- Wen Y. Chen** (Ph.D., Ohio University) Greenville Hospital
Professor of Biological Sciences Greenville, SC
Prolactin receptor antagonists for anti-human breast cancer therapy; development of protein-based therapeutics; molecular cloning of novel genes related to breast cancer formation.
- Michael J. Childress** (Ph.D., Florida State University) 105A Jordan Hall
Associate Professor of Biological Sciences
Behavioral ecology of marine invertebrates, marine ecology and population biology of lobsters, crabs and crayfish. Modeling and ecological statistics. Mechanisms of individual recognition, dominance hierarchy formation and behavioral syndromes.
- Robert S. Cohen** (Ph.D., University of Southern California) 128 Long Hall
Professor of Biological Sciences
Cell and developmental biology. Stem cell and cancer biology, Cell determination, differentiation and polarization.

- Victoria Corbin** (Ph.D. Harvard University) 153 Long Hall
Associate Professor of Biological Sciences
Signal transduction and mechanisms of development; K-12 STEM outreach; Science education and pedagogy
- John R. Cummings** (M.S., Bowling Green State University) 146 Long Hall
Senior Lecturer of Biological Sciences
Factors affecting barn owl populations, biology laboratory education, and curriculum design.
- Saara J. DeWalt** (Ph.D., Louisiana State University) 338 Long Hall
Professor of Biological Sciences
Population ecology and genetics of non-native, invasive plants in their native and introduced ranges; community ecology of tropical and temperate woody plants, primarily lianas.
- Dylan R. Dittrich-Reed** (Ph.D., University of Tennessee, Knoxville) 134 Long Hall
Assistant Professor of Biological Sciences
Introductory biology instruction. Evolutionary biology. Quantitative Biology.
- Yuqing Dong** (Ph.D., Peking University) 165 Jordan Hall
Associate Professor of Biological Sciences
Molecular mechanisms of longevity using the developmental model, C. elegans; polarization of cell growth in yeast.
- Zhicheng Dou** (Ph.D., University of Southern Mississippi) 151B LSF
Assistant Professor of Biological Sciences
Mechanisms understanding of how Toxoplasma gondii host cellular macromolecular nutrients and digest them to support its intracellular replication.
- Nora R. Espinoza** (Ph.D., University of Chicago) 348 Long Hall
Assistant Professor of Biological Sciences
Evolution of animal form and function; comparative biomechanics, animal locomotion; evolution of bone; evolution of development of the musculoskeletal system of vertebrates.
- David M. Feliciano** (Ph.D., State University of New York, Buffalo) 326 Jordan Hall
Assistant Professor of Biological Sciences
Cell and molecular biology. Neurobiology. Brain development.
- Vincent S. Gallicchio** (Ph.D., New York University) 122 Long Hall
Professor of Biological Sciences
Research interests include 1) experimental drug therapeutics for AIDS and cancer, with a focus on compounds that inhibit ribonucleotide reductase and anti-oxidants derived from natural food products and 2) the non-psychiatric clinical uses of lithium.
- John J. Hains** (Ph.D., Clemson University) 143 Long Hall/Cherry Farm Aquatics Lab
Associate Professor of Biological Sciences
Aquatic ecology and limnology. Interactions of aquatic and terrestrial systems. Modeling aquatic systems.
- Renea C. Hardwick** (M.S., University of Colorado) 148 Long Hall
Senior Lecturer of Biological Sciences
Utilize molecular markers and phylogeographic methods to examine genetic structure, genetic diversity, and geographical diversity in North American Aythya marila (greater scaup) populations.
- J. Michael Henson** (Ph.D., University of Florida) 157A LSF
Research Associate Professor of Biological Sciences
Microbial ecology of soil/root-zone of fruit/biofuel crops; conversion of plant biomass to bioproducts/biofuels; bacterial-fungal interactions.
- Xiuping Jiang** (Ph.D., University of Maryland) 228 LSF
Professor of Food Science & Human Nutrition; Biological Sciences
Development of rapid pathogen detection methods using nanotechnology and real-time PCR. Identification and characterization of antimicrobial resistant bacteria from food products, rendered animal products, and farm environment. Evaluation and improvement of composting process as a practical way for animal waste treatment. Exploration of nutraceutical products for preventing chronic human illnesses caused by human pathogens.

Tafadzwa Kaisa (Ph.D., State University of New York) Senior Lecturer of Biological Sciences <i>Nematode taxonomy and morphology; insect and nematode ultrastructure; insect-nematode interactions.</i>	322 Long Hall
Robert J. Kosinski (Ph.D., Rutgers University) Professor of Biological Sciences <i>Innovative methods in biology education, especially the use of computer simulations, mathematical modeling, and computer-based exercises in introductory biology laboratories.</i>	139 Long Hall
Harry Kurtz (Ph.D., University of Idaho) Associate Professor of Biological Sciences <i>Microbial ecosystems in the deserts of southeastern Utah; to develop management tools for use by the Bureau of Land Management and the National Park service for maintenance and care of parks and monuments. Stabilization of coastal dunes in SC.</i>	151A LSF
Tammy McNutt-Scott (Ph.D., Pennsylvania State University) Senior Lecturer of Biological Sciences <i>Physiological influence of environmental toxicants events associated with the female reproductive tract in the early stages of pregnancy. Discernment of oxidative capacity in mammalian oviduct epithelium and chemical impact of function.</i>	308 Jordan Hall
V. Christine M. Minor (M.S., Iowa State University) Senior Lecturer of Biological Sciences <i>Pedagogical innovations in science education with an emphasis on non-majors Biology Laboratory curriculum development for general biology.</i>	330C Long Hall
Andrew S. Mount (Ph.D., Clemson University) Research Associate Professor of Biological Sciences <i>Cellular biomineralization in mollusks; biofouling of marine invertebrates; invertebrate Immunology; cell biology of nanomaterials; biology of climate change.</i>	316 Jordan Hall
Christopher L. Parkinson (Ph.D., University of Louisville) Professor of Biological Sciences and Forestry and Environmental Conservation Genomics, <i>Evolution, molecular evolution, phylogenetics, systematics and taxonomy of venomous snakes and other vertebrates</i>	157B LSF
Kara E. Powder (Ph.D., Washington University in St. Louis) Assistant Professor of Biological Sciences <i>Genomic and developmental basis of craniofacial evolution in cichlid fishes</i>	055 LSF
Samantha A. Price (Ph.D., University of Virginia) Assistant Professor of Biological Sciences <i>Biodiversity and macroevolution. Evolution of vertebrate form and functional diversity. Paleontology. Phylogenetic and computational approaches.</i>	136 Long Hall
Margaret B. Ptacek (Ph.D., University of Missouri, Columbia) Professor of Biological Sciences <i>Evolutionary biology; role of sexual selection in population divergence and speciation in fish; genetic interactions between native and introduced species of trout in the intermountain West of the United States.</i>	213 Jordan Hall
Lisa G. Rapaport (Ph.D. University of New Mexico) Assistant Professor of Biological Sciences <i>Behavioral ecology and conservation biology.</i>	145 Long Hall
Charles D. Rice (Ph.D., College of William and Mary) Professor of Biological Sciences & Environmental Toxicology <i>Comparative immunobiology, disease resistance and susceptibility, marine biology, and environmental</i>	233 Long Hall
Vincent Richards (Ph.D., NOVA Southeastern University) Assistant Professor of Biological Sciences <i>Comparative genomics of pathogenic bacteria evolution and adaptation to specific hosts.</i>	111C Long Hall

- Krista Rudolph** (Ph.D., Clemson University) 330E Long Hall
Senior Lecturer of Biological Sciences
Food safety and genetic engineering of microbes.
- Simon W. Scott** (Ph.D., University of Wales) 231 Long Hall
Professor of Biological Sciences
Plant virus research specializing in viruses infecting fruit trees and other woody species.
- Michael W. Sears** (Ph.D., University of Pennsylvania) 323 Long Hall
Assistant Professor of Biological Sciences
Interface of theory and empiricism to solve problems in ecology and evolution, particularly with regard to thermal biology and climate change
- Kelly C. Smith** (Ph.D., Duke University) 208 Hardin Hall
Associate Professor of Philosophy & Religion; Biological Sciences
Ethical implications of new biotechnologies; complex systems in developmental and evolutionary biology; the origins and nature of life and philosophical issues surrounding the search for life on other planets.
- Salvatore A. Sparace** (Ph.D., University of Wyoming) 336 Long Hall
Associate Professor of Biological Sciences
Plant physiology and biochemistry; the biochemistry of higher plant lipid metabolism; the physiology and metabolic interactions in the functions of photosynthetic and non-photosynthetic plastids.
- Barbara Speziale** (Ph.D., Clemson University) 344 Watt Family Innovation Center
Professor of Biological Sciences; Associate Dean, Watt Family Innovation Center
Aquatic ecology and limnology research, education outreach, K-12 youth development.
- William M. Surver** (Ph.D., University of Notre Dame) 330A Long Hall
Professor of Biological Sciences
Development of innovative teaching strategies for Biology, integration of technology into the Biology classroom, and the development and implementation of technology degrees in higher education.
- Lesly A. Temesvari** (Ph.D., University of Windsor) 255B LSF
Professor of Biological Sciences
Molecular and cellular mechanisms that govern the biogenesis and function of endosomes and lysosomes; cellular and molecular biological approaches used to investigate the role of several small molecular weight Rab GTPases in endosomal and lysosomal membrane and protein trafficking and in pathogenicity of the protozoal parasite, Entamoeba histolytica.
- Matthew W. Turnbull** (Ph.D., University of Kentucky) 327 Jordan Hall
Associate Professor of Entomology, Soils, & Plant Sciences; Biological Sciences
Insect cell biology and immunology. Mutualistic viruses of parasitoid wasps. Role of inxins and gap junctions in insect immune systems.
- Jeremy T. Tzeng** (Ph.D., Clemson University) 149B LSF
Associate Professor of Biological Sciences
Evaluation of nanoparticle compositions for their ability to neutralize microbial pathogens. Evaluation of phytochemical compounds for antimicrobial and anti-tumor activities.
- Peter van den Hurk** (Ph.D., College of William & Mary) 237 Long Hall
Associate Professor of Biological Sciences
Toxicology of environmental pollutants in aquatic ecosystems; detoxification enzymes; fish models as pollution indicators.
- Yangzhaug Wei** (Ph.D., Ohio University) 055 LSF
Professor of Biological Sciences
Dendritic cell mediated cancer immunotherapy; cancer gene therapy; novel approaches for targeted cancer therapy
- Donna R. Weinbrenner** (Ph.D., Clemson University) 334 Long Hall
Senior Lecturer of Biological Sciences
- Christina E. Wells** (Ph.D., The Pennsylvania State University) 140 Long Hall
Associate Professor of Biological Sciences
Plant physiology; root physiology; urban trees physiology

Kristi Whitehead (Ph.D., Michigan State University)

142 Long Hall

Lecturer

How interactions between humans and their gastrointestinal tract microbes contribute to health and disease.

Xianzhong Yu (Ph.D., Ohio University)

051B LSF

Associate Professor of Biological Sciences

Tumor angiogenesis (gene therapy targeting and molecular/cellular mechanisms); tumor models/transgenic technique; tumor therapeutic agents screening.

For additional appointments to faculty and staff or office changes after July 1, 2017, check the current directory posted in Long Hall or Jordan Hall.

BIOLOGICAL SCIENCES STAFF AND FACILITIES

John Abercrombie, Microbiology Teaching Lab Manager	127 Life Science Facility
Rebecca Ackerman, Biology Teaching Lab Manager	318 Long Hall
Dixie Damrel, Herbarium Curator	201 Campbell NH Museum
Sabrina Elliott, Administrative Assistant to the Chair	132B Long Hall
Teri Elliott, Administrative Assistant	132 Long Hall
Josh Evans, Biology Lab Preparator	337 Long Hall
Ginger Foulk, Student Services Manager	226 Long Hall
Melissa Fuentes, Vertebrate Collection Curator	203 Campbell NH Museum
Terrie Jarrett, Admin. Assistant for Online Masters Program Jay Lyn Martin, Graduate Advising Coordinator	G25 Jordan Hall
Rita McConnell, Accountant/Fiscal Analyst	144 Long Hall
Londan Means, Director of Academic Advising	125 Long Hall
Mike Moore, Facilities Manager	124 Long Hall
John Smink, Aquatic Facility Manager	240 Long Hall
Jackie Van Strien, Registration Coordinator	26 P&A Building
Noelle Waggett, Advisor	127 Long Hall
Donna Weinbrenner, Biology Lab Preparator	129 Long Hall
	334 Long Hall

DESCRIPTION OF FREQUENTLY SCHEDULED CURRICULA COURSES

ANTH 3510 Biological Anthropology 3 (3) Study of humans as biological organisms. Examines human evolution, primate social behavior, human physiological variations and disease resistance, and human skeletal anatomy and forensics. Preq: ANTH 2010 or BIOL 1040 and BIOL 1060; or BIOL 1100.

ANTH 3530 Forensic Anthropology 3 (3) Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. May also be offered as BIOL 3530. Preq: Junior standing.

BCHM 3010 Molecular Biochemistry 3 (3) Introduction to the nature, production, and replication of biological structure at the molecular level and its relation to function. Preq: BIOL 1100 with a C or better. Preq or concurrent enrollment: CH 2230 with C or better.

BCHM 3050 Essential Elements of Biochemistry 3 (3) Introduction to structure, synthesis, metabolism and function of biomolecules in living organisms. Preq: BIOE 1010 or BIOL 1030 or BIOL 1100. Preq or concurrent enrollment: CH 2010 or CH 2230.

BIOL 1010 Frontiers in Biology 1 (1) Introduces Biological Sciences majors to the Biological Sciences Advising Center, curricula, pre-professional health advisors, university career services, and the department's faculty.

BIOL 1030 General Biology I 3 (3) First in a two-semester sequence. Includes an evolutionary approach to cells, cellular activities, genetics, and animal diversity emphasizing the processes of science. Credit toward a degree will be given for BIOL 1030 or 1100 only. Includes Honors sections.

BIOL 1040 General Biology II 3 (3) Continuation of BIOL 1030. Includes an evolutionary approach to human anatomy and physiology, plant diversity, morphology, and physiology and principles of ecology. Credit toward a degree will be given for BIOL 1040 or 1110 only. Includes Honors sections. Preq: BIOL 1030 and BIOL 1050; or BIOL 1100.

BIOL 1050 General Biology Laboratory I 1 (3) Laboratory to accompany BIOL 1030. Emphasizes developing laboratory techniques, becoming familiar with biological instrumentation, and performing investigations and interpreting results in the areas of biochemistry, cell biology, and molecular biology. Preq or concurrent enrollment: BIOL 1030.

BIOL 1060 General Biology Laboratory II 1 (3) Laboratory to accompany BIOL 1040. Emphasizes developing laboratory techniques, becoming familiar with biological instrumentation, and performing investigations and interpreting results in the areas of organismal structure, physiology, and ecology. Preq or concurrent enrollment: BIOL 1040.

BIOL 1100 Principles of Biology I 5 (4) Introductory course designed for students majoring in biological disciplines. Integrates lecture and laboratory and emphasizes a modern, quantitative, and experimental approach to explanations of structure, composition, dynamics, interactions, and evolution of cells and organisms. High school chemistry is recommended. Credit toward a degree will be given for BIOL 1100 or 1030 only. Includes Honors sections. Preq or concurrent enrollment: CH 1010. Coreq: BIOL 1101.

BIOL 1101 Principles of Biology I Laboratory 0 (3) Non-credit laboratory to accompany BIOL 1100. Coreq: BIOL 1100.

BIOL 1110 Principles of Biology II 5 (4) Continuation of BIOL 1100, emphasizing the study of plants and animals as functional organisms and the principles of ecology. Credit toward a degree will be given for BIOL 1110 or 1040 only. Includes Honors sections. Preq: BIOL 1100. Coreq: BIOL 1111.

BIOL 1111 Principles of Biology II Laboratory 0 (3) Non-credit laboratory to accompany BIOL 1110. Coreq: BIOL 1110.

BIOL 2000 Biology in the News 3 (3) For non-science majors. Students examine current topics of biology appearing in newspapers and other current media. Uses a problem-based learning approach, with students working as teams and individually on areas of interest identified by the class. Students are expected to have completed the General education natural science requirement prior to enrolling in this course. Preq: ENGL 1030.

BIOL 2030 Human Disease and Society 3 (3) Focuses on the basic biology underlying human disease, how disease is understood, and current methods of prevention and treatment of disease. The economics as well as the social and ethical issues surrounding human disease are a common thread throughout the course. Preq: BIOL 1040 and BIOL 1060 and BIOL 1110; and one of BIOL 1210 or BIOL 1220 or BIOL 1230

BIOL 2040 Environment, Energy and Society 3 (3) Examines power and energy production, the resultant environmental effects, and the relationship between this technology and society. Introduces historical and contemporary sources of energy and power; the economic, social, and political forces important for types and patterns

of development; and the resultant impacts to ecosystems and the environment. Students are expected to have completed the General education natural science requirement prior to enrolling in this course.

BIOL 2110 Introduction to Toxicology 3 (3) Acquaints students with the field of toxicology, integrates the science of toxicology with regulatory policy, and demonstrates its impact on our daily lives. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 2220 Human Anatomy and Physiology I 4 (3) Basic introductory course in integrated human anatomy and physiology covering cells and tissues; integumentary, skeletal, muscular, and nervous systems; sensory organs. Physiology is stressed. Structured for nursing and other health-related curricula. Preq: BIOL 1030 and BIOL 1050; or BIOL 1100; and CH 1010 or CH 1050. Coreq: BIOL 2221.

BIOL 2221 Human Anatomy and Physiology I Laboratory 0 (2) Non-credit laboratory to accompany BIOL 2220. Coreq: BIOL 2220.

BIOL 2230 Human Anatomy and Physiology II 4 (3) Continuation of BIOL 2220 covering endocrine, reproductive, cardiovascular, lymphatic, respiratory, urinary, and digestive systems; fluid and electrolyte balance. Physiology is stressed. Preq: BIOL 2220. Coreq: BIOL 2231.

BIOL 2231 Human Anatomy and Physiology II Laboratory 0 (2) Non-credit laboratory to accompany BIOL 2230. Coreq: BIOL 2230.

BIOL 2300 Emergency Medical Responder 3 (3) Students are prepared to provide emergency pre-hospital assessment and care for patients with a variety of medical conditions and traumatic injuries. Study areas include introduction to emergency medical services systems, EMR roles and responsibilities, anatomy and physiology, medical emergencies, trauma, and working in the pre-hospital setting. Preq: BIOL 1030 and BIOL 1040, and BIOL 1050 and BIOL 1060; or BIOL 1100 and BIOL 1110. Consent of instructor.

BIOL 3010 Insect Biology and Diversity 4 (3) Introduction to the study of insects, with emphasis on their structure, function, ecology, and behavior. Identification of commonly encountered species is highlighted. Relationships between insect and human populations are discussed. Control technologies are introduced, with emphasis on environmentally responsible tactics. Offered fall semester only. Coreq: BIOL 3011.

BIOL 3011 Insect Biology and Diversity Laboratory 0 (3) Non-credit laboratory to accompany BIOL 3010. Coreq: BIOL 3010.

BIOL 3020 Invertebrate Biology 3 (3) In-depth survey and comparison of free-living invertebrate animals emphasizing functional anatomy, development, and evolutionary relationships. Includes Honors sections. Preq: Introductory two-semester biology sequence with laboratory. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Preq or concurrent enrollment: BIOL 3060.

BIOL 3030 Vertebrate Biology 3 (3) Comprehensive survey of vertebrate animals, including their taxonomy, morphology, evolution, and selected aspects of the natural history and behavior. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 3040 Biology of Plants 3 (3) Survey of the major groups of plants, their biology, diversity, and evolution. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 3080.

BIOL 3060 Invertebrate Biology Laboratory 1 (3) Survey and comparison of the biology of living invertebrates, examples of which are drawn primarily from the southeastern coast of the United States. Preq: Introductory two-semester biology sequence with laboratory. Preq or concurrent enrollment: BIOL 3020.

BIOL 3070 Vertebrate Biology Laboratory 1 (3) Comparative and phylogenetic study of the gross morphology of vertebrates. Preq or concurrent enrollment: BIOL 3030.

BIOL 3080 Biology of Plants Practicum 1 (3) Laboratory exercises that explore the major groups of plants, their biology, diversity, and evolution. Coreq: BIOL 3040.

BIOL 3130 Conservation Biology 3 (3) Study of the biological bases for the conservation of flora, fauna, and habitats. Biological factors that influence the decision-making process are also addressed. Preq: BIOL 1030 and BIOL 1050 and BIOL 1040 and BIOL 1060; or BIOL 1100 and BIOL 1110.

BIOL 3150 Functional Human Anatomy 4 (3) Introduction to the anatomical structures associated with all organ systems found in the human body at both the gross and microscopic level. Basic physiology is integrated to assist with understanding the function of the anatomical systems. Preq: BIOL 1030 and BIOL 1050; or BIOL 1100; and junior standing. Coreq: BIOL 3151.

BIOL 3151 Functional Human Anatomy Laboratory 0 (3) Non-credit laboratory to accompany BIOL 3150. Coreq: BIOL 3150.

BIOL 3160 Human Physiology 4 (3) Study of the functional processes associated with the various organ systems in the human body. Students develop a basic understanding of the important and fundamental concepts in human physiology and how organ systems maintain homeostasis. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110; and CH 1020; and junior standing. Coreq: BIOL 3161.

BIOL 3161 Human Physiology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 3160. Coreq: BIOL 3160.

BIOL 3200 Field Botany 4 (2) Introductory study of the taxonomy, ecology, and evolution of plants in their natural environment with an emphasis on identification and characteristics of representative species and plant communities in the Carolinas. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 3201.

BIOL 3201 Field Botany Laboratory 0 (4) Non-credit laboratory to accompany BIOL 3200. Coreq: BIOL 3200.

BIOL 3350 Evolutionary Biology 3 (3) Introduction to basic concepts and underlying principles of modern evolutionary biology. Topics include a historical overview of evolutionary theories, elementary population genetics, principles of adaptation, speciation, systematics and phylogenetic inference, fossil record, biogeography, molecular evolution, and human evolution. Includes Honors sections. Preq: GEN 3000 or GEN 3020.

BIOL 3400 Medical Botany 3 (3) Study of use of compounds of plant and fungal origin as poisons, hallucinogens, and pharmaceuticals. May also be offered as PES 3400. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110; and CH 1020.

BIOL 3510 Biological Anthropology 3 (3) Study of humans as biological organisms. Examines human evolution, primate social behavior, human physiological variations and disease resistance, and human skeletal anatomy and forensics. May also be offered as ANTH 3510. Preq: ANTH 2010; or BIOL 1040 and BIOL 1060; or BIOL 1100.

BIOL 3530 Forensic Anthropology 3 (3) Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. May also be offered as ANTH 3530. Preq: Junior standing.

BIOL 3940 Selected Topics in Creative Inquiry I 1-3 (1-3) Disciplinary and multidisciplinary group research projects develop the student's ability to discover, analyze, and evaluate data. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. Preq: Consent of instructor.

BIOL 4000 Insect Morphology 4 (3) Study of insect structure in relation to function and of the variation of form in insects. Includes Honors sections. Preq: ENT 3010. Coreq: BIOL 4001.

BIOL 4001 Insect Morphology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4000. Coreq: BIOL 4000, 6000.

BIOL 4010 Plant Physiology 3 (3) Relations and processes pertaining to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products and liberation of energy. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110; and CH 1020. Preq or concurrent enrollment: BIOL 4020.

BIOL 4020 Plant Physiology Laboratory 1 (3) Laboratory exercises and experiments designed to indicate the relations and processes which pertain to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products, and liberation of energy. Preq or concurrent enrollment: BIOL 4010.

BIOL 4030 Introduction to Applied Genomics 3 (3) Emphasizes the practical application of bioinformatic/genomic skills to solve biological problems. The course includes an introduction to the Linux operating system, the bash command line environment, principles of next-generation sequencing, genome assembly, gene prediction, annotation, databases, gene/genome clustering, recombination detection, phylogenomics, transcriptomics, and metagenomics. Preq: GEN 3000 or GEN 3020 or MICR 4150.

BIOL 4050 Molecular Genetics of Eukaryotes 3 (3) Molecular genetic analyses of eukaryotes in relation to mutations and repair, complex phenotypes, biochemical pathways, short- and long-term regulation of gene expression, and evolution. May also be offered as GEN 4050. Preq: one of the following combinations: BCHM 3010 or BCHM 3050; or GEN 3000 and GEN 3020.

BIOL 4080 Comparative Vertebrate Morphology 3 (3) Phylogeny and diversity of vertebrates and study of their comparative morphology, leading to an understanding of the relationships and functioning of living organisms. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4090.

BIOL 4090 Comparative Vertebrate Morphology Laboratory 2 (5) Comparative anatomy of representative vertebrates; methods used in preparing specimens for study and display. Includes Honors sections. Coreq: BIOL 4080.

BIOL 4100 Limnology 3 (3) Detailed introduction to the physical, chemical, and biological interrelationships that characterize inland water environments. A fundamental approach to the interactions of components of the environment is developed at a theoretical level. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4110 Limnological Analyses 2 (1) Examines a broad range of topics covered with both standing and running fresh waters. About one-third of the laboratory exercises address the major physical components of lakes and streams. The remainder provides rationale and methods for quantitative analyses of biota, as well as some integrated analyses of whole ecosystems. Includes Honors sections. Preq or concurrent enrollment: BIOL 4100 or BIOL 4430. Coreq: BIOL 4111.

BIOL 4111 Limnological Analyses Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4110, 6110. Coreq: BIOL 4110.

BIOL 4130 Restoration Ecology 3 (3) Applies ecological principles to the restoration of disturbed terrestrial, wetland, and aquatic ecosystems. Includes the restoration of soils and waterways, of flora and fauna, and of natural ecological processes such as plant succession and nutrient cycling. May also be offered as ENR 4130. Preq: BIOL 3130 or BIOL 4410 or WFB 3130.

BIOL 4140 Basic Immunology 3 (3) Introduction to the immune system of vertebrate animals, with an emphasis on structure, function, regulation, and cellular and molecular mechanisms of immune responses. Includes Honors sections. May also be offered as AVS 4140 or MICR 4140. Preq: BIOL 4610 and MICR 3050.

BIOL 4150 Insect Taxonomy 3 (1) Identification of the principal families of the major orders of adult insects. Laboratory work consists of intensive practice of such identification. Lecture material deals with theoretical discussion of taxonomic features observed in the laboratory. Preq: BIOL 4000 or ENT 4000. Coreq: BIOL 415.

BIOL 4151 Insect Taxonomy Laboratory 0 (6) Non-credit laboratory to accompany BIOL 4150. Coreq: BIOL 4150.

BIOL 4170 Marine Biology 3 (3) Survey of the organisms that live in the sea and their adaptations to the marine environment. Emphasizes characteristics of marine habitats, organisms, and the ecosystems. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4200 Neurobiology 3 (3) Broad background in neurobiology. Topics include neuroanatomical structure-function; conduction in the neuron; neurite growth and development; neuromuscular junction; chemistry, physiology, and pharmacology of specific neurotransmitters and receptors; visual process; axoplasmic transport; hypothalamic-pituitary regulation; theories of behavior; theories of learning and memory. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110; and BIOL 4610. Preq or concurrent enrollment: PHYS 2080.

BIOL 4250 Introductory Mycology 3 (3) Introduction to the biology of all the groups of fungi and some related organisms, with considerations of the taxonomy, morphology, development, physiology, and ecology of representative forms. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Preq or concurrent enrollment: BIOL 4260 or PLPA 4260.

BIOL 4260 Mycology Practicum 2 (1) Application of the principles of mycological techniques, microscopic study of fungi. Examples from all major groups of fungi are included. Preq or concurrent enrollment: BIOL 4250 or PLPA 4250. Coreq: BIOL 4261.

BIOL 4261 Mycology Practicum Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4260, 6260. Coreq: BIOL 4260.

BIOL 4340 Biological Chemistry Laboratory Techniques 2 (1) Theory and application of some of the routine tools and techniques used in biological chemistry. Lectures introduce laboratory theory and provide additional laboratory instructions; discuss results; and conduct student evaluations. Laboratory periods are used to conduct each activity. Preq or concurrent enrollment: BCHM 3010 or BCHM 3050. Coreq: BIOL 4341.

BIOL 4341 Biological Chemistry Laboratory Techniques Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4340. Coreq: BIOL 4340.

BIOL 4360, Insect Behavior 3 (2) Fundamentals of insect behavior in an evolutionary and ecological perspective. Laboratory emphasizes generation and testing of hypotheses and observation, description, and quantification of insect behavior. May also be offered as ENT 4360. Preq: ENT 3010. Coreq: BIOL 4361

BIOL 4361 Insect Behavior Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4360. Coreq: BIOL 4360.

BIOL 4400 Developmental Animal Biology 3 (3) Events and mechanisms responsible for the development of multicellular animals. Gametogenesis, fertilization, embryonic development, cellular differentiation, morphogenesis, larval forms and metamorphosis, asexual reproduction, regeneration, malignancy, and aging are analyzed in terms of fundamental concepts and control processes. Includes Honors sections. Preq for BIOL 4400: BCHM 3010 or 3050. Preq: BCHM 3010 or 3050.

BIOL 4410 Ecology 3 (3) Study of basic ecological principles underlying the relationships between organisms and their biotic and abiotic environments. Includes physiological, population, and community ecology, with applications of each to human ecological concerns. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4430 Freshwater Ecology 3 (3) Study of basic ecological principles and concepts as they apply to freshwater environments: rivers and streams, wetlands, lakes and ponds, and reservoirs. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4440 Freshwater Ecology Laboratory (Lecture Portion) 2 (1) Laboratory-based course providing a synthesis of major components of freshwater ecosystems. Activities are hypothesis driven and relate to each other to form an overall synthesis of the field. Hands-on experience allows engagement in creative inquiry. Preq or concurrent enrollment: BIOL 4430. Coreq: BIOL 4441.

BIOL 4441 Freshwater Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4440. Coreq: BIOL 4440.

BIOL 4450 Ecology Laboratory (Lecture Portion) 2 (1) Modern and classical approaches to the study of ecological problems discussed in BIOL 4410. Students are introduced to field, laboratory and computer-based analyses of plant and animal populations and communities. Includes Honors sections. Preq or concurrent enrollment: BIOL 4410. Coreq: BIOL 4451.

BIOL 4451 Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4450. Coreq: BIOL 4450.

BIOL 4460 Plant Ecology 3 (3) Ecology of plants in relation to their biotic and abiotic environments. Individual organisms, populations, and communities are considered with an emphasis on seed plants in terrestrial environments. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4470 Plant Ecology Laboratory (Lecture Portion) 2 (1) Experimental and observational approach to addressing principles discussed in BIOL 4460. Students are introduced to field and laboratory methods involving individual organisms, populations, and communities. Includes Honors sections. Preq or concurrent enrollment: BIOL 4460. Coreq: BIOL 4471.

BIOL 4471 Plant Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4470, 6470. Coreq: BIOL 4470.

BIOL 4490 Field Ecology 4 (3). Introduces students to the practice of field ecology in terrestrial, aquatic, and/or marine habitats. Emphasis is placed on field techniques, organism adaptations, regional conservation issues, and effects of human disturbance. May be repeated for a maximum of eight credits, but only if different topics are covered. Preq: Consent of instructor. Coreq: BIOL 4491.

BIOL 4491 Field Ecology Laboratory 0 (3). Non-credit laboratory to accompany BIOL 4490. Coreq: BIOL 4490.

BIOL 4510 Biological Variation in Human Populations 3 (3) Provides an in-depth discussion of the most influential topics in human skeletal biology. Course explores the history and ethical dilemmas of the field, and examines how biological anthropologists use skeletons to reconstruct patterns of diet, disease, demography and physical activity in human populations. May be offered as ANTH 4510. Preq: ANTH 2010.

BIOL 4540 Plant Virology 4 (3) Study of plant viruses: their morphology, biochemistry, purification, and transmission; symptoms resulting from virus infection; virus vector relationships. serological and nucleic acid hybridization procedures. Diagnosis of viral diseases and the identification of causal agents. replication of plant viruses, the interaction between viral host and plant genome. Control of plant viral diseases. May also be offered as PLPA 4540. Preq: BCHM 3010 or BCHM 3050 or MICR 3050. Coreq: BIOL 4541.

BIOL 4541 Plant Virology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4540. Coreq: BIOL 4540. May also be offered as PLPA 4541.

BIOL 4560, 6560 Medical and Veterinary Parasitology 3 (3) Introduction to parasitism in the animal kingdom. Emphasizes basic and applied principles related to economically and medically important diseases. Classical and experimental approaches to the study of parasitism are examined in reference to protozoa, helminths, and arthropods. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4590 Systems Physiology 3 (3) Physiological systems of vertebrates and their homeostatic controls. Function of the major physiological systems is described in terms of anatomical structure and chemical and physical principles. *Preq:* One year each of biology, chemistry, and physics.

BIOL 4600 Systems Physiology Laboratory (Lecture Portion) 2(1) Modern and classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOL 4590. Students are introduced to computer-aided data acquisition and computer simulations of physiological function. *Preq* or concurrent enrollment: BIOL 4590. *Coreq:* BIOL 4601.

BIOL 4601 Systems Physiology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4600. *Coreq:* BIOL 4540.

BIOL 4610 Cell Biology 3 (3) In-depth analysis of how and where intracellular and extracellular molecules control general and specific cellular functions such as gene expression, secretion, motility, signaling, cell-cycle control and differentiation. Taught and graded at a level where students are expected to infer from and integrate cellular events. Includes Honors sections. *Preq:* BCHM 3010 or BCHM 3050.

BIOL 4620 Cell Biology Laboratory (Lecture Portion) 2 (1) Laboratory to accompany BIOL 4610. Focuses on molecular and microscopic analysis of eukaryotic cells. *Preq* or concurrent enrollment: BIOL 4610. *Coreq:* BIOL 4621.

BIOL 4621 Cell Biology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4620, 6620. *Coreq:* BIOL 4620.

BIOL 4640 Mammalogy 4 (3) Origin, evolution, distribution, structure, and function of mammals, with laboratory emphasis on the mammals of the southeast. Field trips are required. *Preq:* BIOL 3030. *Coreq:* BIOL 4641.

BIOL 4641 Mammalogy Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4640. *Coreq:* BIOL 4640.

BIOL 4660 Evolution of Human Behavior 3 (3) Familiarizes students with the evolutionary basis of human behavior. Examines topics such as altruism, cooperation, mating systems, parental investment, and social systems using diverse examples, from hunter-gatherer to technological societies. May also be offered as ANTH 4660. *Preq:* ANTH 3510 or BIOL 3350 or BIOL 3510 or BIOL 4700 or PSYC 2010.

BIOL 4670 Principles of Hematology 3 (3) Basic hematological principles as they relate to normal blood cell production, as well as in abnormal conditions that result in diseases of the hematological system. Clinical practice, ethics and controversies in hematology are discussed. *Preq:* BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL (WFB) 4680 Herpetology 4 (3) Physiology, functional morphology, ecology, evolution, biomechanics and current literature of amphibians and reptiles. Laboratory study examines morphology and identification of world families and United States genera, as well as southeastern species. Field trips are required. May also be offered as WFB 4680. *Preq:* BIOL 1040 and BIOL 1060; or BIOL 1110. *Coreq:* BIOL 4681.

BIOL (WFB) 4681 Herpetology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4680, 6680. *Coreq:* BIOL 4680.

BIOL 4690 Aquatic Insects 3 (1) Identification, life history, habitats, and interrelationships of aquatic insects; techniques of qualitative field collecting; important literature and research workers. Includes Honors sections. May also be offered as ENT 4690 or WFB 4690. *Preq:* ENT 3010. *Coreq:* BIOL 4691.

BIOL 4691 Aquatic Insects Laboratory 0 (6) Non-credit laboratory to accompany BIOL 4690. May also be offered as ENT 4691 or WFB 4691. *Coreq:* BIOL 4690.

BIOL 4700 Behavioral Ecology 3 (3) Historical and modern developments in animal behavior emphasizing the evolutionary and ecological determinants of behavior. A synthesis of ethology and comparative psychology. Includes Honors sections. *Preq:* BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4710 Behavioral Ecology Laboratory (Lecture Portion) 2 (1) Laboratory exercises that explore the behavior of animals. emphasizes behavioral observation and analysis and presentation of findings in a report format. Includes a semester-long independent research project. *Preq* or concurrent enrollment: BIOL 4700. *Coreq:* BIOL 4711.

BIOL 4711, Behavioral Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4710. *Coreq:* BIOL 4710.

BIOL 4740, Primatology 4 (3) Biology of nonhuman primates, including their evolution, taxonomy, physiology, life history, behavioral ecology and conservation. Three field trips are required, during which students conduct behavioral observations and later analyze their data and present it in report format. May also

be offered as ANTH 4740. Preq: ANTH 3510 or BIOL 3510; and either BIOL 1110 or both BIOL 1040 and BIOL 1060. Coreq: BIOL 4741.

BIOL 4741 Primatology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4740. May also be offered as ANTH 4741. Coreq: BIOL 4740.

BIOL 4750 Comparative Physiology 3 (3) Physiological systems of invertebrates and vertebrates emphasizing environmental adaptation. Physiological principles as they relate to metabolism, thermoregulation, osmoregulation, respiration, and neural and integrative physiology. Includes Honors sections. Preq: CH 1020; and either BIOL 1110 or both BIOL 1040 and BIOL 1060.

BIOL 4760 Comparative Physiology Laboratory (Lecture Portion) 2 (1) Modern classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOL 4750. Introduces students to computer-aided data acquisition and manipulation as well as computer simulations of physiological function. Includes Honors sections. Preq or concurrent enrollment: BIOL 4750. Coreq: BIOL 4761.

BIOL 4761 Comparative Physiology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4760. Coreq: BIOL 4760.

BIOL 4780 Exercise Physiology 3 (3) Introduction to the physiology of exercise. Focuses on the function and adaptations of body systems in response to exercise. Structured primarily for students interested in Prerehabilitation Sciences. Preq: BIOL 2220 and BIOL 2230; or BIOL 3150 and BIOL 3160.

BIOL 4800 Vertebrate Endocrinology 3 (3) Introduction to the basic principles of neuro-endocrine integration and homeostatic maintenance in vertebrates. Comparative morphology and physiology of various endocrine tissues and hormone chemistry and modes of action are considered. May also be offered as AVS 4800. Preq: BCHM 3010 or BCHM 3050.

BIOL 4820 Laboratory Techniques for Teaching Science 3 (1) Focuses on basic lab skills needed to plan, prepare, and conduct inquiry-based laboratories and to familiarize pre-service teachers with a variety of scientific equipment and their methodologies. Topics include ways to integrate technology into the classroom, lab safety, and the development of inquiry-based classroom activities. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4821. May also be offered as EDSC 4820.

BIOL 4821 Laboratory Techniques for Teaching Science 0 (6) Non-credit laboratory to accompany BIOL 4820, 6820. Coreq: BIOL 4820. May also be offered as EDSC 4821.

BIOL 4830 Stem Cell Biology 3 (3) Stem cells are the focus of intense interest because of their utility for treating human diseases. This course will provide a broad treatment of the biology of stem cells and assess their current therapeutic capacity in clinical medicine. Preq: BIOL 4610

BIOL 4840 Human and Comparative Vertebrate Embryology 3 (3) Study of human and comparative embryology with an introduction to related clinical correlations. Students develop an understanding of normal and abnormal human and comparative vertebrate embryonic development. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4850 Molecular Phylogenetics And Comparative Method 4(3). Theory and application using bioinformatic tools to develop phylogenetic trees; analysis of ecological data within a phylogenetic framework, with an emphasis on speciation and biogeography. Preq: BIOL 1100 and BIOL 1110 and BIOL 3350. Coreq: BIOL 4851.

BIOL 4851 Molecular Phylogenetics And Comparative Method Lab 0 (3). Non-credit laboratory to accompany BIOL 4850. Coreq: BIOL 4850.

BIOL 4880 Health Professions Practicum 3 (3). A study abroad opportunity for students who have decided to pursue a career in medicine, dentistry, or rehabilitation sciences. This course provides students with direct, hands-on experience working with health professionals. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: Consent of instructor.

BIOL 4890 Clinical Applications and Medical Practice 3 (2) Explores the various fields, specialties, and subspecialties in medicine. Provides students with the opportunity to shadow physicians in a hospital and/or office setting and to discuss current issues and advances in medicine with practicing physicians and other health care professionals. Preq: Consent of instructor. Coreq: BIOL 4891.

BIOL 4891 Clinical Applications and Medical Practices Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4890. Coreq: BIOL 4890.

BIOL 4910 Undergraduate Research in Biological Sciences 1-4 (3-12) Mentored research problems introduce undergraduate students to the planning and execution of research and the presentation of research findings. May be repeated for a maximum of eight credits. Honors students must take at least six credits under a single research advisor over two semesters and must write an honors thesis. Includes Honors sections. Preq: Consent of instructor.

BIOL 4920 Internship in Biological Sciences 0-4 (3-12) Preplanned internship at an advisor- approved facility to give students learning opportunities beyond their classroom experiences. Students submit a student Internship Contract and a study plan before the internship and a comprehensive report within one week of the end of the internship. May be repeated for a maximum of six credits. To be taken Pass/no Pass only. Preq: Consent of instructor.

BIOL 4930 Senior Seminar 2 (2) Capstone course engaging students in analysis and discussion of publications from the technical and non-technical literature in biological sciences and from current topics of biology appearing in other media. Emphasis is placed on ethical issues that arise as a result of biological research. Preq: Senior standing; COMM 1500 or COMM 2500 or ENGL 3140 or ENGL 3150.

BIOL 4940 Selected Topics in Creative Inquiry II 2-3 (1) Disciplinary and multidisciplinary group research projects with the goal of developing the students' ability to discover, analyze, and evaluate data. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as MICR 4940. Preq: Consent of instructor. Coreq: BIOL 4941.

BIOL 4941 Selected Topics in Creative Inquiry II Laboratory 0 (3-6) Non-credit laboratory to accompany BIOL 4940. May also be offered as MICR 4941. Coreq: BIOL 4940.

BIOL 4950 Service Learning in Biology 2-4 (1-2) Combines service and academic learning while helping pre-college or college students learn about the fundamental aspects of science. Provides lecture and laboratory experiences as students learn to prepare and participate in supervised laboratory teaching for pre-college or college students. May be repeated for a maximum of six credits. Preq: Consent of instructor. Coreq: BIOL 4951.

BIOL 4951 Service Learning in Biology Laboratory 0 (3-9) Non-credit laboratory to accompany BIOL 4950. Coreq: BIOL 4950.

BIOL 4960 Selected Topics 1-4 (1-4) Lecture coverage of selected topics in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics in the biological sciences. May be repeated for a maximum of nine credits, but only if different topics are covered. Preq: Consent of instructor.

BIOL 4970 Special Topics Laboratory 1-3 (2-9) Specialized laboratory experiences in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics of interest in the biological sciences. May be repeated for a maximum of nine credits, but only if different topics are covered. Preq: Consent of instructor.

CH 1010 General Chemistry 4 (3) Introduction to the elementary concepts of chemistry through classroom and laboratory experience. Emphasizes chemical reactions and the use of symbolic representation, the mole concept and its applications and molecular structure. Includes Honors sections. Credit toward a degree will be given for only one of CH 1010 and CH 1050. Preq: CMPT score of 60 or higher; or CH 1040 or MATH 1050; or MATH 1010 or MATH 1020 or MATH 1030 with a C or better; or preq or concurrent enrollment: MATH 1040 or MATH 1060 or MATH 1070 or MATH 1080 or MATH 2060 or MATH 2080 or STAT 2300. Coreq: CH 1011.

CH 1011 General Chemistry Laboratory 0 (3) Non-credit laboratory to accompany CH 1010. Coreq: CH 1010.

CH 1020 General Chemistry 4 (3) Continuation of CH 101 treating solutions, rates of reactions, chemical equilibrium, electrochemistry, chemistry of selected elements, and an introduction to organic chemistry. Credit toward a degree will be given for only one of CH 1020 or 1060 Includes Honors sections.. Preq: CH 1010 with a C or better. Coreq: CH 1021.

CH 1021 General Chemistry Laboratory 0 (3) Non-credit laboratory to accompany CH 1020. Coreq: CH 1020.

CH 2010 Survey of Organic Chemistry 3 (3) Introduction to organic chemistry emphasizing nomenclature, classes of organic compounds, and chemistry of functional groups. For students needing one-semester course in organic chemistry. Credit toward a degree will be given for only one of CH 2010 or 2230. Preq: CH 1020. Coreq: CH 2011.

CH 2020 Survey of Organic Chemistry Laboratory 1 (3) Laboratory emphasizing standard techniques of organic laboratory analysis with the synthesis and characterization of organic molecules discussed in CH 2010. Credit will be given for only one of CH 2020 or CH 2270. Preq: CH 1020. Preq or concurrent enrollment: CH 2010.

CH 2230 Organic Chemistry 3 (3) Introductory course in the principles of organic chemistry and the derivation of these principles from a study of the properties, preparations, and interrelationships of the important classes of organic compounds. Credit toward a degree will be given for only one of CH 2010 or 2230. Preq: CH 1020.

CH 2240 Organic Chemistry 3 (3) Continuation of CH 2230. Preq: CH 2230.

CH 2270 Organic Chemistry Laboratory 1 (3) Synthesis and properties of typical examples of the classes of organic compounds. Credit toward a degree will be given for only one of CH 2270 or 2290. Preq or concurrent enrollment: CH 2230.

CH 2280 Organic Chemistry Laboratory 1 (3) Continuation of CH 2270. Preq or concurrent enrollment: CH 2240.

CH 4130 Chemistry of Aqueous Systems 3 (3) Study of chemical equilibria in aqueous systems, especially natural waters; acids and bases, dissolved CO₂, precipitation and dissolution, oxidation-reduction, adsorption, etc. Includes Honors sections. Preq: CH1020 or 1060.

COMM 1500 Introduction to Speech Communication 3 (2) Overview of theoretical approaches to the study of communication, including the theory and practice of interpersonal/small group/intercultural/public communication. Includes a laboratory. Coreq: COMM 1501.

COMM 1501 Introduction to Human Communication Laboratory 0 (2) Non-credit laboratory to accompany COMM 1500. Coreq: COMM 1500.

COMM 2500 Public Speaking 3 (3) Practical instruction in public speaking; practice in the preparation, delivery, and criticism of short speeches. Develops an understanding and knowledge of the process of communication. Includes a laboratory. Includes Honors sections. Coreq: COMM 2501.

COMM 2501 Public Speaking Laboratory 0 (1) Non-credit laboratory to accompany COMM 2500. Coreq: COMM 2500.

ED 1050 Orientation to Education 2 (2) Introduction to teaching addresses basic program requirements, SoE Conceptual Framework, state evaluation system, the nature of the diverse and multicultural classroom, standards and practices of professional conduct and requirements in teaching. A field experience involving tutoring in a P-12 classroom is required. Coreq: ED 1051.

ED 1051 Orientation to Education Laboratory 0 (1) Non-credit laboratory to accompany ED 1050. Coreq: ED 1050.

EDF 3010 Principles of American Education 3 (3) Study of the legal basis, historical development, characteristics, and functions of educational institutions in the United States. Includes Honors sections. Preq: Sophomore standing and a 2.0 minimum grade-point average.

EDF 3020 Educational Psychology 3 (3) Introduction to classroom use of objectives, motivation theories, learning theories, tests and measurements, classroom management, and knowledge of exceptional learners. Includes Honors sections. Preq: Sophomore standing and a 2.0 minimum grade-point average.

EDF 3150 Technology Skills for Learning 1 (2) Students develop technology skills, such as creating Web pages and multimedia presentations in the context of general education class requirements. Products developed are linked within the School of Education e-portfolio. Preq: Admission to Teacher Education program and ED 1050.

EDF 3350 Adolescent Growth and Development 3 (3) Introduction to lifespan development. Emphasizes the physical, social, emotional, and cognitive characteristics of the 10 to 18-year old and the educational implications of those developmental characteristics. Includes Honors sections. Preq: Sophomore standing and a 2.0 minimum grade-point average.

EDLT 4980 Secondary Content Area Reading 3 (2) Designed for pre-service teachers who are involved with field experiences prior to student teaching full time. Prepares content area teachers to teach the reading skills necessary for effective teaching of content area material. Preq: Admission to professional level. Coreq: EDLT 4981.

EDLT 4981 Secondary Content Area Reading Laboratory 0 (2) Non-credit laboratory to accompany EDLT 4980. Coreq: EDLT 4980.

EDSC 3270 Practicum in Secondary Science 3(2) Pre-service secondary science teachers gain both content and pedagogical knowledge by observing and reflecting upon the classroom practices of selected in-service high school science teachers. Coreq: EDSC 3271.

EDSC 3271 Practicum in Secondary Science Laboratory 0 (3) Non-credit laboratory to accompany EDSC 3270. Coreq: EDSC 3270.

EDSC 4270 Teaching Secondary Science 3 (2) Development of instructional practices and materials for teaching secondary school science (biological, earth, and physical sciences); familiarization with secondary science curriculum materials; includes field experiences in local schools. Taught fall semester only. Preq: Second semester Junior standing, admission to the professional level, ED 1050 and EDF 3010 and EDF 3020 and EDF 3350; at least 18 hours of English coursework and a minimum grade-point average of 2.5. Preq or concurrent enrollment: EDLT 4980. Coreq: EDSC 4271.

EDSC 4271 Teaching Secondary Science Laboratory 0 (2) Non-credit laboratory to accompany EDSC 4270. Coreq: EDSC 4270.

EDSC 4570 Secondary Science Capstone Seminar 3 (2) Capstone seminar accompanying supervised high school science teaching internship. Satisfies part of requirement for South Carolina secondary science certification. Offered spring semester only. Preq: EDSC 4270. Coreq: EDSC 4470 and EDSC 4571.

EDSC 4571 Secondary Science Capstone Seminar Laboratory 0 (3) Non-credit laboratory to accompany EDSC 4570. Coreq: EDSC 4570.

EDSP 3700 Introduction to Special Education 3 (3) Survey of students with disabilities and with gifts/talents. Individuals with Disabilities Education Act is emphasized, including general educator's role in serving students with special needs. Characteristics, assessment, and effective instructional procedures for students of varying exceptionalities are addressed. Includes Honors sections. Students must have a minimum grade-point average of 2.0 to enroll in this course.

ENGL 1030 Accelerated Composition 3 (3) Training in composing correct and effective expository and argumentative essays, including writing documented essays. Students who have received credit for ENGL 1020 will not be allowed to enroll in or receive credit for EN GL 1030. Includes Honors sections. Coreq: ENGL 1031.

ENGL 1031 Accelerated Composition Laboratory 0 (1) Non-credit laboratory to accompany ENGL 1030. Coreq: ENGL 1030.

ENGL 3140 Technical Writing 3(3) Intensive, project-based application of principles of audience, context, purpose, and writing strategies of technical writing: proposals, reports, communication deliverables. Individual and team projects. Includes Honors sections. Preq: Junior standing.

ENGL 3150 Scientific Writing and Communication 3 (3) Study and practice of rhetorical conventions in professional scientific communication through the analysis and writing of major genres. Focuses on principles, strategies, and styles of scientific argumentation and audience adaptation in written, oral, and visual media. Intended for students majoring in the sciences. Preq: ENGL 1030; and BIOL 1030 or BIOL 1100; and Junior standing.

ENT 3000 Environmental Entomology 3 (3) Exploration of diversity and roles of insects in natural and affected environments, impact of insects and pesticides on environmental quality, and discussion of environmental ethics in entomological science. Preq: BIOL 1030 or BIOL 1040.

ENT 3010 Insect Biology and Diversity 4 (3) Introduction to the study of insects, with emphasis on their structure, function, ecology, and behavior. Identification of commonly encountered species is highlighted. Relationships between insect and human populations are discussed. Control technologies are introduced, with emphasis on environmentally responsible tactics. Offered fall semester only. Coreq: ENT 3011.

ENT 3011 Insect Biology and Diversity Laboratory 0 (3) Non-credit laboratory to accompany ENT 3010. Coreq: ENT 3010.

ENT 3080 Apiculture 3 (2) Detailed study of the honey bee and its economic importance in pollination and honey production. Attention is given to bee behavior, colony management, equipment, honey-plant identification, and honey production and processing. Preq: BIOL 1040 and BIOL 1060 and consent of instructor. Coreq: ENT 3081.

ENT 3081 Apiculture Laboratory 0 (3) Non-credit laboratory to accompany ENT 3080. Coreq: ENT 3080.

ENT 4000 Insect Morphology 4 (3) Study of insect structure in relation to function and of the variation of form in insects. Includes Honors sections. Preq: ENT 3010. Coreq: ENT 4001.

ENT 4001 Insect Morphology Laboratory 0 (3) Non-credit laboratory to accompany ENT 4000. Coreq: ENT 4000.

ENT 4040 Urban Entomology 3 (3) Study of pests common to the urban environment with emphasis on arthropod pest biology, pest importance, and management strategies. Students learn both theoretical and practical aspects of urban pest management. Includes Honors sections. Preq: BIOL 1030 and BIOL 1040; or BIOL 1100 and BIOL 1110; or ENT 3010.

ENT 4060 Diseases and Insects of Turfgrasses 2 (2) Host-parasite relationships, symptomatology, diagnosis, economics, and control of infectious diseases of turfgrasses and life histories, diagnosis, and control of important insect pests of turfgrasses. May also be offered as PLPA 4060. Preq: ENT 3010 and PLPA 3100.

ENT 4070 Applied Agricultural Entomology 4 (3) Topics include recognition, biology, damage, and control of economically important insects and mites found on major southeastern field, fruit, nut, and vegetable crops. Principles and practices of crop protection, including pesticide application, economic basis for decision-making, and development of scouting programs are introduced. Preq: ENT 3010. Coreq: ENT 4071.

ENT 4071 Applied Agricultural Entomology Laboratory 0 (3) Non-credit laboratory to accompany ENT 4070, 6070. Coreq: ENT 4070.

ENT 4150 Insect Taxonomy 3 (1) Identification of the principal families of the major orders of adult insects. Laboratory work consists of intensive practice of such identification. Lecture material deals with theoretical discussion of taxonomic features observed in the laboratory. May also be offered as BIOL 4150. Preq: BIOL 4000 or ENT 4000. Coreq: ENT 4151.

ENT 4151 Insect Taxonomy Laboratory 0 (6) Non-credit laboratory to accompany ENT 4150. May also be offered as BIOL 4151. Coreq: ENT 4150.

ENT 4360 Insect Behavior 3 (2) Fundamentals of insect behavior in an evolutionary and ecological perspective. Laboratory emphasizes generation and testing of hypotheses and observation, description, and quantification of insect behavior. May also be offered as BIOL 4360. Preq: ENT 3010. Coreq: ENT 4361.

ENT 4361 Insect Behavior Laboratory 0 (3) Non-credit laboratory to accompany ENT 4360. May also be offered as BIOL 4361. Coreq: ENT 4360.

ENT 4690 Aquatic Insects 3 (1) Identification, life history, habitats, and interrelationships of aquatic insects; techniques of qualitative field collecting; important literature and research workers. Includes Honors sections. May also be offered as BIOL 4690 or WFB 4890. Preq: ENT 3010. Coreq: ENT 4691.

ENT 4900 Practicum 1-4 (1-4) Supervised entomological learning opportunity providing highly individualized experiences to complement other programs and courses. Must be prearranged at least two months in advance. Must file written reports midway during enrollment period and at its conclusion. Must appear for oral evaluation at the end of the period. Preq: Junior standing and consent of instructor.

ETOX 4000 Wildlife Toxicology 3 (3) Assessment of impacts of toxic substances on reproduction, health, and well-being of wildlife species; acute and chronic effects of agricultural chemicals, pesticides, hazardous waste, industrial waste, and oil releases are discussed. Preq: BCHM 3010 or BCHM 3050; or both CH 2230 and CH 2270 and BIOL 1040 and BIOL 1060; or BIOL 1110 and WFB 3500.

ETOX 4210 Chemical Sources and Fate in Environmental Systems 3 (3) Discusses chemical cycles in the environment on global and microcosm scales. Examines the dependence of fate processes on physical and chemical properties and environmental conditions. Addresses breakdown, movement, and transport of selected toxicants to illustrate the mechanisms that govern chemical fate. Includes Honors sections. Preq: CH 2230 and CH 2270 and CH 3130.

ETOX 4300 Toxicology 3 (3) Basic principles of toxicology, including quantitation of toxicity, toxicokinetics, biochemical action of poisons, and environmental toxicology, are studied. Acute and chronic effects of various classes of poisons (e.g., pesticides, drugs, metals, and industrial pollutants) are discussed in relation to typical routes of exposure and regulatory testing methods. Preq: CH 2230 and CH 2270; and either BIOL 1040 and BIOL 1060; or BIOL 1110.

ETOX 4370 Ecotoxicology 3 (3) Study of the effects of stressors on the ecosystem. Explores the integrative relationships that comprise the field of ecotoxicology in a hierarchical format that focuses on the various levels of ecological organization. Preq: ETOX 4300.

GEN 3000 Fundamental Genetics 3 (3) Introductory course covering fundamental principles of genetics in prokaryotes and eukaryotes. Emphasis is given to Mendelian genetics, physical and chemical basis of heredity, and population genetics. Preq: BIOL 1030 or BIOL 1100.

GEN 3020 Molecular and General Genetics 3 (3) Rapidly-paced course covering Mendelian and molecular genetics, with introductory coverage of quantitative and population genetics. Emphasis is on the molecular basis of heredity and gene expression in prokaryotes and eukaryotes and modern genetic technology. Includes Honors sections. Preq: BIOL 1100 with C or better.

MATH 1040 Precalculus and Introductory Differential Calculus 4 (4) Relevant precalculus and algebra review, limits, continuity, and introduction to differential calculus. The combination of MATH 1040 and MATH 1070 covers the same calculus material as MATH 1060. MATH 1040 alone cannot be substituted for any calculus course. To be taken Pass/No Pass only. Not open to students who have received credit for MATH 1060. Preq: Any MATH or STAT course or a score of 65 or higher on Clemson Mathematics Placement Test.

MATH 1050 Precalculus 5 (4,) Extensive treatment of topics chosen to prepare students for the study of calculus. Special emphasis is given to polynomial, rational, exponential, logarithmic, and trigonometric functions and their graphs, as well as basic and analytic trigonometry. Students who have received credit for any other mathematical sciences course will not be allowed to enroll in or receive credit for MATH 1050. To be taken Pass/No Pass only. Coreq: MATH 1051.

MATH 1051 Precalculus Laboratory 0 (2) Non-credit laboratory to accompany MATH 1050. Coreq: MATH 1050.

MATH 1060 Calculus of One Variable I 4 (4) Topics include analytic geometry, introduction to derivatives, computation and application of derivatives, integrals, exponential and logarithm functions. Preq: MATH 1030 or MATH 1040 or MATH 1050 or a score of 80 or better on the Clemson Mathematics Placement Test.

MATH 1070 Differential and Integral Calculus 4 (4) Continuation of MATH 1040. Successful completion of MATH 1040 and MATH 1070 is equivalent to the completion of MATH 1060. Continuation of differential calculus and an introduction to integral calculus. Not open to students who have received credit for MATH 1060. Preq: MATH 1040.

MATH 1080 Calculus of One Variable II 4 (4) Topics include transcendental functions, applications of integration, integration techniques, indeterminate forms, improper integrals, parametric equations, polar coordinates, and infinite series. Includes Honors sections. Preq: MATH 1060 or MATH 1070.

MICR 3050 General Microbiology 4 (3) Morphology, physiology, classification, distribution, and cultivation of microorganisms. Preq: Introductory biology coursework, CH 1010 and CH 1020. Coreq: MICR 3051.

MICR 3051 General Microbiology Laboratory 0 (3) Non-credit laboratory to accompany MICR 3050. Coreq: MICR 3050.

MICR 3940 Selected Topics in Creative Inquiry I 1-3 (1) Disciplinary and multidisciplinary group research projects with the goal of developing the students ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of 24 credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include MICR 3940, MICR 4940 or both. Includes Honors sections. Preq: Consent of instructor.

MICR 4000 Public Health Microbiology 3 (3) Epidemiology of transmissible diseases including pathogenic characteristics of the infectious organism, modes of transmission, mechanism of infection, diagnostic aids, effective treatments, immunizing procedures, and methods of preventing infection. Includes Honors sections. Preq: MICR 3050.

MICR 4010 Microbial Diversity and Ecology 3 (3) In-depth survey of microbial morphology, ecology, and diversity. Study of the interaction and adaptation of microbes in a wide range of environmental conditions, including consideration of their metabolism, nutrition, growth and the use of microbiological assays. Includes Honors sections. Preq: CH 2010 and CH 2020 or CH 2230; and CH 2270; and MICR 3050.

MICR 4020 Environmental Microbiology 3 (3) Discussion of microorganisms in air, terrestrial, and aquatic environments and how they are used for environmental restoration activities. topics include the nature of biofilms, interactions of microbes with inorganic and organic constituents, processes to implement bioremediation in surface/subsurface environments, and treatment of solid, liquid, and gaseous waste streams. Preq: MICR 3050 and MICR 4010; and either CH 2010; or both CH 2230 and CH 2270.

MICR 4030 Marine Microbiology 3 (3) Discussion of the microbes that inhabit the marine environment, their peculiar physiological traits, and contributions to the ecology of oceans. Preq: MICR 3050; and either CH 2010 and CH 2020; or both CH 2230 and CH 2270.

MICR 4050 Advanced Microbial Ecology of Humans 3 (3) Investigation of the complex ecological relationships between microbes and their human hosts, including investigation of the normal microbial community in various body systems, factors that change the microbiota, and the role of the microbiota in normal development, health, and disease of the host. Preq: MICR 4010 with a C or better.

MICR 4070 Food and Dairy Microbiology 4 (3) Physical-chemical factors limiting survival and growth of microorganisms during processing and manufacturing of food and dairy products. Standard methods for enumerating and identifying indicator bacteria, yeasts, molds, and microbes producing food and food-borne illness. Starter cultures, fungal toxins, microbial cell injury and standards for food and dairy products. Includes Honors sections. Preq: MICR 3050; and one of BCHM 3050 or CH 2010 or CH 2230. Coreq: MICR 4071.

MICR 4071 Food and Dairy Microbiology Laboratory 0 (3) Non-credit laboratory to accompany MICR 4070. Coreq: MICR 4070.

MICR 4100 Soil Microbiology 3 (3) Role of microorganisms in the decomposition of organic substances, transformation of nitrogen and mineral substances in the soil; interrelationships between higher plants and microorganisms; importance of microorganisms in soil fertility. Includes Honors sections. Preq: MICR 3050; and MICR 4010 or PES 4900.

MICR 4110 Pathogenic Bacteriology 3 (3) Study of pathogenic bacteria and their virulence mechanisms. Emphasizes host-microbe interactions, responses to infection and treatment, and research strategies for various topics of bacterial pathogenesis. Includes Honors sections. Preq: MICR 3050 and MICR 4120 and MICR 4140.

MICR 4120 Bacterial Physiology 3 (3) Consideration of the cytology, physiology, metabolism, and genetics of bacteria. Includes studies of growth and death, reproduction and mutation, nutrition and metabolic pathways, regulatory mechanisms, and effects of environment. Includes Honors sections. Preq: CH 2240 and MICR 3050; and either BCHM 3010 or BCHM 3050.

MICR 4130 Industrial Microbiology 3 (2) Microbial aspects of large-scale processes for the production of foods, antibiotics, enzymes, fine chemicals, and beverages. Topics include strain selection, culture maintenance, biosynthetic pathways, continuous cultivation and production of single cell protein. Includes Honors sections. Coreq: MICR 4131.

MICR 4131 Industrial Microbiology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4130, 6130. Coreq: MICR 4130.

MICR 4140 Basic Immunology 3 (3) Introduction to the immune system of vertebrate animals, with an emphasis on structure, function, regulation, and cellular and molecular mechanisms of immune responses. May also be offered as AVS 4140 or BIOL 4140. Preq: BIOL 4610 and MICR 3050.

MICR 4150 Microbial Genetics 3 (3) Investigates the molecular basis of microbial lives. Topics include essential genes involved in DNA, RNA and protein metabolism; mutations and genome evolution; global gene regulation; and genetic analysis, using both forward and reverse genetics. Includes Honors sections. Preq: MICR 4120; and BCHM 3010 or BCHM 3050. Non-Microbiology majors do not have to have taken MICR 4120, but must request a registration override from the instructor to enroll in this course.

MICR 4160 Introductory Virology 3 (3) Introduction to the field of virology, including animal, bacterial, and plant viruses. topics include nomenclature and classification, biochemical and biophysical characteristics, mechanisms of replication, chemotherapy, and techniques for isolation, assay, and purification. Includes Honors sections. Preq: MICR 3050; and either BCHM 3010 or BCHM 3050.

MICR 4170 Cancer and Aging 3 (3) Discusses alterations that occur at molecular, cellular and tissue levels during cell transformation and aging. topics include the cell division cycle, signal transduction pathways, oncogenes and tumor suppressors, cell death and cell aging. Includes Honors sections. Preq: MICR 3050 and BIOL 4610; and either BCHM 3010 or 3050.

MICR 4500 Advanced Microbiology Laboratory I 2 (1) Application of knowledge and techniques learned in the Introductory Microbiology Lab with new topics on microbial ecology, diversity and physiology. Experiments in soil, marine and environmental microbiology will be conducted. Preq: MICR 4010. Coreq: MICR 4501.

MICR 4501 Advanced Microbiology Laboratory I Laboratory 0 (3) Non-credit laboratory to accompany MICR 4500. Coreq: MICR 4500.

MICR 4510 Advanced Microbiology Laboratory II 2 (1) Application of knowledge and techniques learned in the Advanced Microbiology Lab I with new topics in microbial cell biology and microbial genetics. Preq: MICR 3050, 4010, 4120 and 4500. Coreq: 4511.

MICR 4511 Advanced Microbiology Laboratory II Laboratory 0 (3) Non-credit laboratory to accompany MICR 4510. Coreq: MICR 4510.

MICR 4520 Advanced Microbiology Laboratory III 2 (1) Application of knowledge and techniques learned in the Advanced Microbiology Labs I and II with new topics on pathogenic bacteriology, parasitology, virology and immunology. Preq: MICR 4510. Coreq: MICR 4521.

MICR 4521 Advanced Microbiology Laboratory III Laboratory 0 (3) Non-credit laboratory to accompany MICR 4520 . Coreq: MICR 4520.

MICR 4910 Undergraduate Research in Microbiology 1-4 (3-12) Individually mentored research problems in various areas of microbiology that introduce undergraduate students to the planning and execution of research experimentation and the presentation of research findings. May be repeated for a maximum of eight credits with consent of instructor. Honors students must take at least six hours under a single research advisor over two semesters. Honors thesis is required. Includes Honors sections. Preq: Consent of instructor.

MICR 4920 Internship in Microbiology 0-4 (3-12) Preplanned internship at an advisor-approved facility to give students learning opportunities beyond their classroom experiences. Students submit a student Internship Contract and a study plan before the internship and a comprehensive report within one week of the end of the internship. May be repeated for a maximum of six credits. To be taken Pass/no Pass only. Preq: Consent of advisor.

MICR 4930 Senior Seminar 2 (2) Capstone course engaging students in analysis and discussion of publications from the technical and non-technical literature in biological sciences and from current topics of biology appearing in other media. Emphasis is placed on ethical issues that arise as a result of biological research. Preq: senior standing; COMM 1500 or 2500 or ENGL 3150.

MICR 4940 Selected Topics in Creative Inquiry II 2-3 (1) Disciplinary and multidisciplinary group research projects with the goal of developing the students ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as BIOL 4940. Preq: Consent of instructor. Coreq: MICR 4941.

MICR 4941 Selected Topics in Creative Inquiry II Laboratory 0 (3-6) Non-credit laboratory to accompany MICR 4940. May also be offered as BIOL 4941. Coreq: MICR 4940.

MICR 4950 Service Learning in Biology 2-4 (1) Combines service and academic learning while helping pre-college or college students learn about the fundamental aspects of science. Provides lecture and laboratory experiences as students learn to prepare and participate in supervised laboratory teaching for pre-college or college students. May be repeated for a maximum of six credits. Preq: Consent of instructor. Coreq: MICR 4951.

MICR 4951 Service Learning in Biology Laboratory 0 (3-9) Non-credit laboratory to accompany MICR 4950. Coreq: MICR 4950.

PHYS 1220 Physics with Calculus I 3 (3) First of three courses in a calculus-based physics sequence. Topics include vectors, laws of motion, conservation principles, rotational motion, oscillations, and gravitation. Credit for a degree will be given for only one of PHYS 1220, 2000, or 2070. Includes Honors sections. Preq or concurrent enrollment: MATH 1060 or MATH 1070.

PHYS 1240 Physics Laboratory I 1 (3) Introduction to physical experimentation with emphasis on mechanical systems, including oscillatory motion and resonance. Computers are used in the experimental measurements and in the statistical treatment of data. Credit for a degree will be given for only one of PHYS 1240 or 2090. Preq or concurrent enrollment: PHYS 1220.

PHYS 2070 General Physics I 3 (3) Introductory course for students who are not majoring in physical science or engineering. Covers such topics as mechanics, waves, fluids, and thermal physics. Credit for a degree will be given for only one of PHYS 1220, 2000, or 2070. Preq: MATH 1020 or MATH 1040 or MATH 1050 or MATH 1060 or MATH 1070 or score of 60 or higher on the CMPT.

PHYS 2080 General Physics II 3 (3) Continuation of PHYS 2070. Covers such topics as electricity, magnetism, electromagnetic waves, optics, and modern physics. Credit for a degree will be given for only one of PHYS 2080 or 2210. Preq: PHYS 2070.

PHYS 2090 General Physics I Laboratory 1 (2) Introductory laboratory course for students who are not majoring in physical science or engineering. Covers such topics as mechanics, waves, fluids, and heat. Credit for a degree will be given for only one of PHYS 1240 or 2090. Preq or concurrent enrollment: PHYS 2070.

PHYS 2100 General Physics II Laboratory 1 (2) Covers such topics as electricity, magnetism, electromagnetic waves, optics, and modern physics. Credit for a degree will be given for only one of PHYS 2230 or 2100. Preq: PHYS 2070, 2090. Preq or concurrent enrollment: PHYS 2080.

PHYS 2210 Physics with Calculus II 3 (3) Continuation of PHYS 1220. Topics include thermodynamics, kinetic theory of gases, electric and magnetic fields, electric currents and circuits, and motions of charged particles in fields. Credit for a degree will be given for only one of PHYS 2080 or 2210. Includes Honors sections. Preq or concurrent enrollment: MATH 1080 or MATH 1110.

PHYS 2230 Physics Laboratory II 1 (3) Experiments in heat and thermodynamics, electrostatics, circuits, and magnetism. Computers are used in statistical treatment of data. Credit for a degree will be given for only one of PHYS 2230 or 2100. Preq or concurrent enrollment: MATH 1080 or MATH 1110.

PSYC 2010 Introduction to Psychology 3 (3) Introduction to the study of behavior. Analysis of the biological bases of behavior, learning, thinking, motivation, perception, human development, social behavior, and the application of basic principles to more complex phenomena such as education, personal adjustment, and interpersonal relations. Includes Honors sections.

PSYC 3400 Lifespan Developmental Psychology 3(3) Survey of current theory and research concerned with the psychological aspects of human growth and development across the entire lifespan. Major topics include developmental methods, physical maturation, cognition, socialization, personality, psycholinguistics, intelligence, learning, behavior problems, and exceptionality. Includes Honors sections. Preq: PSYC 2010.

PSYC 3830 Abnormal Psychology 3 (3) Introduction to the diagnosis and treatment of mental illnesses. Uses current diagnostic standards for mental disorders as a framework for understanding the symptoms, causes, and treatments of the most commonly observed maladaptive behaviors. Includes Honors sections. Preq: PSYC 2010.

STAT 2300 Statistical Methods I 3 (2) Basic concepts and methods of statistical inference; organization and presentation of data, elementary probability, measures of central tendency and variation, tests of significance, sampling, simple linear regression and correlation. Stresses the role of statistics in interpreting research and the general application of the methods. Statistical microcomputer software is used. Not open to students who have received credit for MATH 3020 or STAT 3090. Includes Honors sections. Preq: Any MATH course or STAT 2220 or a 65 or better on the Clemson Mathematics Placement Test. Coreq: STAT 2301.

STAT 2301 Statistical Methods I Laboratory 0 (2) Non-credit laboratory to accompany STAT 2300. Coreq: STAT 2300.

WFB 4720 Ornithology 4 (3) Biology of birds: their origin and diversification, adaptations, phylogeny, classification, structure and function, behavior, ecology, and biogeography. Field identification is emphasized, and field trips are required. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: WFB 4721.

WFB 4721 Ornithology Laboratory 0 (3) Non-credit laboratory to accompany WFB 4720. Coreq: WFB 4720.

WFB 4770 Ichthyology 3 (2) Systematics, life history, distribution, ecology, and current literature of fish. Laboratory study of morphology and identification of U.S. genera, as well as all southeastern species. Field trips are required. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: WFB 4771.

WFB 4771 Ichthyology Laboratory 0 (3) Non-credit laboratory to accompany WFB 4770. Coreq: WFB 4770.

TENTATIVE SCHEDULE OF COURSE OFFERINGS

We reserve the right to change course offerings as required by staff changes, demand, and budgetary considerations.

	<i>Fall</i>		<i>Spring</i>		<i>Summer</i>	
					1 st	2 nd
Biochemistry	3050		3050 4320		3050†††	
Biological Sciences	1010	4620	1040	4670	1030	1040
	1030	*4750	1060	*4690†	1050	1060
¹ Summer Minimester A	1050	*4840	1110	*4700	2000†††	2000†††
² Summer Minimester B	1100	4890/4891	2000	4710	2220	2230
³ Summer Minimester C	2000	*4910	2040	4780†	3350††††	4170
⁴ Summer Minimester D	2040	4920	2230	4800†	4430 ⁵	*4410 ³
⁵ Long Summer	2110	4930	2300	4830	4440 ⁵	4880 ^{3,4}
	2220	*4940	*3020	4890/4891	4610	*4910
	3010	*4950	*3040	*4910	4880 ^{1,2}	4920 ⁵
	*3030	4960	3060	4920	*4910	4940 ⁵
	*3040	4970	3080	4930	4920 ⁵	
	3070		3130	*4940	*4940	
	3080		3160	*4950	4940 ⁵	
	3150		*3350	4960	4970	
	3200		3510	4970		
	3350		3530			
	3510		*3940			
	3530		*4010			
*Honors section also available	*3940		4020			
	*4000††		4100			
	4030		*4110			
†odd years only	*4140		*4140			
	*4200		4150†			
††even years only	4250		4340			
	4260		*4400			
†††Online & On-campus	4340		*4460			
	4360†		*4470			
††††Online only	*4410		4540			
	4430		*4610			
	4440		4620			
	*4450		4640/4641††			
	*4560		4660			
	*4610					
Genetics	3000		3000		3000††††	
Microbiology	3050	*4950	3050	4920	3050	*4910
	*3940		*3940	4930	*4910	
	*4010		*4000	*4940	4920 ⁴	
	4050		4020††	*4950		
	*4100		4030†			
	*4140		*4070			
	*4150		*4110			
	*4160		*4120			
	4510		*4130			
	4560		*4140			
	*4910		*4170			
	4920		4500			
	4930		4520			
	*4940		*4910			