

DEPARTMENT OF BIOLOGICAL SCIENCES

# Undergraduate Handbook

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# Department of Biological Sciences

## Undergraduate Handbook

### 2020-2021

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## CONTACT INFORMATION

TITLE	NAME	OFFICE	E-MAIL (@clemsun.edu)	TELEPHONE (864)
<b>Biological Sciences</b>	Main Office	132 Long Hall	BiolSci	656-2328
Department Chair	S. DeWalt	132C Long Hall	saarad	656-1112
Administrative	A. Simpson	132B Long Hall	asimps	656-3057
Administrative Assistant	T. Elliott	132 Long Hall	telltt	656-2328
<b>Advising Center</b>				
Director	L. Charley	124 Long Hall	londanm	656-3604
Registration Coordinator	C. Brewer	127 Long Hall	cjdunca	656-0854
Advisor	R. Ballard	G22 Jordan Hall	ballard	656-3579
Advisor	A. Hubbard	125 Long Hall	ahubba2	656-3830
Advisor	D. Jones	151 Long Hall	djones1	656-1300
Advisor	L. Love	129 Long Hall	lslove	656-5074
Advisor	A. Masters	143 Long Hall	acmaste	656-2416
Advisor	M. Metcalf	145 Long Hall	mrmetc	656-0838
<b>Special Programs</b>				
Pre-Professional School: Medical, Dental, Pharmacy, Rehabilitation Sciences	H. Williams	102 Long Hall	harolyw	656-4154
Pre-Pharmacy – Undeclared Major	A. Hunter	105 Long Hall	hunter3	656-3288
MUSC Accelerated Pathways	A. Hunter	105 Long Hall	hunter3	656-3288
Pre-Vet. Med.	G. Birrenkott	134 P&A	gbrnkt	656-4019
	J. Jones	140 P&A	jerylj	656-2142

**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.** Professional School advisors 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 ensure that all Clemson requirements for graduation are met.

<b>Environmental Toxicology</b>	L. Bain	239 Long Hall	lbain	656-5050
<b>Double Major – EDSEC</b>	M. Cook	418E Tillman Hall	mcook	656-2037
<b>Study Abroad Liaison</b>	A. Hunter	105 Long Hall	hunter3	656-3288
<b>Honors College Liaison</b>	R. Hardwick	148 Long Hall	rhardwi	
<b>Campbell Museum of Natural History Curator</b>	M. Fuentes	201 Herbarium 203 Vert. Collection	fuentes	656-7234 656-2328
<b>CU Records/Registration</b> Enrolled Student Services		104 Sikes Hall	esstranscripts	656-2174 656-0440
<b>Center for Career and Professional Development</b>		Hendrix Student Center, 3 <sup>rd</sup> floor	carrer-L	656-6000
<b>Scholar Development:</b> Summer experiences, international opportunities, fellowships and scholarships, grad/professional school, and employment opportunities.	J. LaMonte	109 Long Hall	jlamont	656-9855

### Major Codes

BA-BIOS-G BA Biological Sciences	BS-MICR-G	BS Microbiology
E076 Pre-Rehabilitation Sciences Emphasis Area	BS-MICR-BIOM	Biomedicine Concentration
BS-BIOS-G BS Biological Sciences	UD-PRPH-G	UD Pre-pharmacy – Non-degree
E078 Pre-Pharmacy Emphasis Area		
E080 Toxicology Emphasis Area		

**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 2020-2021, ([Undergraduate Announcements 2020-2021](#))

## FACULTY DIRECTORY

<u>Faculty</u>	<u>Office</u>	<u>E-mail (@clemsn.edu)</u>	<u>Phone (864)</u>
<b>John Abercrombie</b>	127 LSF	JA	656-5431
<b>Virginia Abernathy</b>	350 Long Hall	VABERNA	656-3588
<b>Antonio Baeza</b>	226 Long Hall	JBAEZAM	656-2157
<b>Lisa Bain</b>	239 Long Hall	LBAIN	656-5050
<b>William Baldwin</b>	235 Long Hall	BALDWIN	656-9957
<b>Robert Ballard</b>	G22 Jordan Hall	BALLARD	656-3579
<b>Sharon Bewick</b>	142 Long Hall	SBEWICK	656-3492
<b>Richard Blob</b>	342 Long Hall	RBLOB	656-2328
<b>Barbara Campbell</b>	155B LSF	BCAMPB7	656-0559
<b>Min Cao</b>	116 Jordan Hall	MCAO	507-7270
<b>Susan Chapman</b>	340 Long Hall	SCHAPM2	656-2328
<b>Michael Childress</b>	105A Jordan Hall	MCHILDR	656-2328
<b>John Cummings</b>	146 Long Hall	CUMMINJ	656-3601
<b>Saara DeWalt</b>	132C Long Hall	SAARAD	656-1112
<b>Sourabh Dhingra</b>	51B LSF	SDHINGR	656-9998
<b>Zhicheng Dou</b>	151-B LSF	ZDOU	656-2460
<b>Nora Espinoza</b>	348 Long Hall	NESPINO	656-3589
<b>David Feliciano</b>	326 Jordan Hall	DFELICI	656-2328
<b>Vincent Gallicchio</b>	122 Long Hall	VSGALL	650-6702
<b>Julia George</b>	231 Long Hall	JGEORG4	656-2328
<b>Renea Hardwick</b>	148 Long Hall	RHARDWI	656-2328
<b>Tafadzwa Kaisa</b>	322 Long Hall	TKAISA	656-6963
<b>Matt Koski</b>	134 Long Hall	MKOSKI	656-3163
<b>Harry Kurtz, Jr.</b>	151A LSF	HKURTZ	656-6915
<b>Cassandra May</b>	100C Jordan Hall	CMAY3	656-2328
<b>Tamara McNutt-Scott</b>	308 Jordan Hall	TMCNUTT	656-2328
<b>Christine Minor</b>	330A Long Hall	MMINOR	656-2328
<b>Christopher Parkinson</b>	157B LSF	VIPER	656-3058
<b>Kara Powder</b>	055A LSF	KPOWDER	656-3196
<b>Sam Price</b>	136 Long Hall	SPRICE6	656-3961
<b>Margaret Ptacek</b>	213 Jordan Hall	MPTACEK	656-6964
<b>Kaustubha Qanungo</b>	165 Jordan Hall	KQAUNG	656-9916
<b>Nathan Redding</b>	330C Long Hall	NWREDDI	656-3456
<b>Charles Rice</b>	233 Long Hall	CDRICE	656-0449
<b>Vincent Richards</b>	111C Jordan Hall	VPRICHA	656-2207
<b>Emily Rosowski</b>	155A LSF	EROSOWS	656-5433
<b>Krista Rudolph</b>	330E Long Hall	KRUDOLP	656-3838
<b>Michael Sears</b>	323 Long Hall	SEARS3	656-2328
<b>Anna Seekatz</b>	157A LSF	ASEEKAT	656-9921
<b>Salvatore Sparace</b>	336 Long Hall	SMSPRC	314-5400
<b>Lesly Temesvari</b>	255B LSF	LTEMESV	656-6387
<b>Matthew Turnbull</b>	327 Jordan Hall	TURNBUL	656-2328
<b>Jeremy Tzeng</b>	149A LSF	TZUENRT	986-0825
<b>Peter van den Hurk</b>	237 Long Hall	PVDHURK	656-3594
<b>Lisa Ruggiero Wagner</b>	231 Long Hall	LRWAGNE	656-5745
<b>Yanzhang Wei</b>	055B LSF	YWEI	656-7393
<b>Donna Weinbrenner</b>	330B Long Hall	DONNAW	656-2328
<b>Kristi Whitehead</b>	150 Long Hall	KWHITEH	656-4146
<b>Xianzhong Yu</b>	207 Jordan Hall	XYU	656-0718

## INTRODUCTION TO THE CURRICULA

Biology encompasses the broad spectrum of the modern life sciences, including the study of all aspects of life from the structure and function of the whole organism down to the subcellular levels and up through the interactions of organisms to the integrated existence of life on the entire planet. Descriptive, structural, functional, and evolutionary questions are explored through the hierarchy of the organization of life. Applications of current advances to the health and well-being of man and society, to nature and the continuation of earth as a balanced ecosystem, and to an appreciation of the place of natural science in our cultural heritage receive emphasis. Majors in Biological Sciences receive classroom, laboratory, and field training in biology with an emphasis on chemistry, mathematics, and physics as necessary tools.

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 Bachelor of Science in Biological Sciences curriculum prepares students for graduate study in any of the life science areas (such as agricultural sciences, biochemistry, botany, cell and molecular biology, conservation, ecology and environmental science, entomology, forestry, genetics, industrial and regulatory biology, microbiology, morphology, physiology, wildlife biology, and zoology; for the health professions (medicine, dentistry, etc.), veterinary medicine; and for science teaching.

The Bachelor of Arts in Biological Sciences provides a strong foundation in biology and is ideal for students desiring a liberal education emphasizing an interdisciplinary approach to a thorough understanding of the life sciences.

The Bachelor of Science and the Bachelor of Arts in Biological Sciences are excellent courses of study for those who wish to enter professional school as both require coursework in calculus, physics, chemistry, organic chemistry, biochemistry, genetics, evolutionary biology, and organismal diversity. 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 modern language and a minor. See page 34 for a comparison of the B.S. and B.A. degrees.

**Pre-Pharmacy 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 Pre-Pharmacy 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, organic chemistry, and economics are required.

**Pre-Rehabilitation 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. Pre-rehabilitation 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 Pre-Rehabilitation sciences emphasis area is distinct from the standard B.A. in Biological Sciences in that specific courses in human anatomy and physiology are required. Other recommendations include particular courses in exercise physiology, modern languages, health sciences, mathematics, and microbiology.

**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.

**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. To be recommended for licensure, students must earn a grade of C or higher in all required science content and education courses.

**B.S. Microbiology.** Microbiology deals with the study of bacteria, viruses, yeasts, filamentous fungi, protozoa, and unicellular algae. Microbiologists seek to describe these organisms in terms of their structures, functions, and processes of reproduction, growth, and death at both the cellular and molecular levels. They are also concerned with their ecology, particularly in regard to their pathological effects on man, and with their economic importance.

The Microbiology major provides a thorough training in the basic microbiological skills. Further, students receive instruction in mathematics, physics, chemistry, and biochemistry, all essential to the training of a modern microbiologist. Students can prepare for a variety of careers through a wide choice of electives. Microbiology graduates may enter graduate school in microbiology, biochemistry, bioengineering, or related disciplines; they may enter medical or dental schools or pursue careers in one of the many industries or public service departments dependent upon microbiology. Some of these are the fermentation and drug industries, medical and public health microbiology, various food industries, and agriculture.

**B.S. Microbiology - Biomedicine Concentration.** The Microbiology curriculum with a Biomedicine Concentration is recommended for students planning postgraduate programs. It is especially suited for students interested in the study of infectious disease. This concentration allows students to take more courses related to human health and disease and includes courses in genetics, cell biology, immunology and virology.

Both the standard MICR and the Biomedicine Concentration curricula are excellent courses of study for graduate or professional school. Both require courses in genetics, cell biology, 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.

## 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. Many Biological Sciences and Microbiology majors are employed by industry, environmental engineering and consulting firms, or city, state, and federal agencies. For biologists and microbiologists 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.

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, U.S. 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 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 majors 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.

**Worksheets** for pre-medicine, pre-dental, pre-rehabilitation sciences, and veterinary medicine programs are on pages 10, 11, 12, and 13, respectively. **Worksheets do not represent a degree granting program.** The worksheets list commonly required and recommended courses for each professional school's program. Please note that entrance requirements for professional schools vary by institution and should be verified individually.

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](#)**

**Links to Sites with General Career Information – [Links to Many Specific Career Descriptions](#)**

**Careers in the Biological Sciences – [American Institute of Biological Sciences](#)**

**What to Do With a Biology Degree – [Careers](#)**

**Careers in Microbiology – [Microbe World](#)**

**Careers in Microbiology – [American Society for Microbiology](#)**

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

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

**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](#)**

## B. S. BIOLOGICAL SCIENCES 2020-2021

### FRESHMAN YEAR

#### First Semester

BIOL 1010 Frontiers in Biol. I.....	1(1,0)
BIOL 1100 Prin. of Biol. I <sup>1</sup> .....	4(3,3)
CH 1010 General Chemistry .....	4(3,3)
MATH 1060 Calculus of One Var. I .....	4(4,0)
Oral Communication Requirement <sup>2</sup> .....	<u>3</u>
	16

#### Second Semester

BIOL 1110 Prin. of Biol. II <sup>1</sup> .....	4(3,3)
CH 1020 General Chemistry .....	4(3,3)
ENGL 1030 Composition and Rhetoric .....	3(3,1)
Mathematical Sciences Requirement <sup>3</sup> .....	<u>3</u>
	14

### SOPHOMORE YEAR

CH 2230 Organic Chemistry <sup>4,5</sup> .....	3(3,0)
CH 2270 Organic Chemistry Lab <sup>4,5</sup> .....	1(0,3)
GEN 3000 Fundamental Genetics <sup>6</sup> .....	3(3,0)
Arts and Humanities (Literature) Req. <sup>2</sup> .....	3
Organismal Diversity Requirement <sup>7</sup> .....	4
Elective.....	<u>2</u>
	16

BCHM 3050 Essential Elements of Bioch <sup>8</sup> .....	3(3,0)
Major Requirement <sup>4,9</sup> .....	4
Social Science Requirement <sup>10</sup> .....	3
Electives.....	<u>6</u>
	16

### JUNIOR YEAR

BIOL 3350 Evolutionary Biology.....	3(3,0)
BIOL 4610 Cell Biology.....	3(3,0)
BIOL 4620 Cell Biology Lab.....	2(1,2)
PHYS 2070 General Physics I <sup>11</sup> .....	3(3,0)
PHYS 2090 General Physics Lab I <sup>11</sup> .....	1(0,3)
Ecology Requirement <sup>12</sup> .....	<u>3</u>
	15

ENGL 3150 Scientific Writing and Comm. <sup>13</sup> ....	3(3,0)
PHYS 2080 General Physics II <sup>14</sup> .....	3(3,0)
PHYS 2100 General Physics II Lab <sup>14</sup> .....	1(0,2)
Arts and Humanities (Non-Lit) Req. <sup>10</sup> .....	3
Functional Biol. Requirement <sup>15</sup> .....	3
Major Requirement <sup>9</sup> .....	<u>2</u>
	15

### SENIOR YEAR

BIOL 4930 Senior Seminar or MICR 4930 Senior Seminar .....	2(2,0)
Major Requirement <sup>9</sup> .....	6
Social Science Requirement <sup>10</sup> .....	3
Elective.....	<u>4</u>
	15

Major Requirement <sup>9</sup> .....	9
Elective .....	<u>4</u>
	13

**Total Semester Hours = 120**

- <sup>1</sup> 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.
- <sup>2</sup> See General Education Requirements.
- <sup>3</sup> MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements. Statistics will be useful in either graduate study or professional school.
- <sup>4</sup> Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.
- <sup>5</sup> CH 2010 and CH 2020 may be substituted.
- <sup>6</sup> GEN 3020 may be substituted.
- <sup>7</sup> At least one lecture and associated laboratory selected from BIOL 3010/BIOL 3011, BIOL 3020/BIOL 3060, BIOL 3030/BIOL 3070, BIOL 3040/BIOL 3080, BIOL 3200/BIOL 3201, BIOL 4060/BIOL 4070, BIOL 4250/BIOL 4260.
- <sup>8</sup> BCHM 3010 may be substituted.
- <sup>9</sup> Twenty-one credit hours from 3000-level or higher BIOL or MICR courses (except MICR 3000) or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include at least three laboratory courses. Any combination of BIOL 3940, BIOL 4910, BIOL 4920, BIOL 4940, BIOL 4950, MICR 3940, MICR 4910, MICR 4920, MICR 4940, and MICR 4950 may not exceed eight credits.
- <sup>10</sup> 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.
- <sup>11</sup> PHYS 1220/1240 may be substituted.
- <sup>12</sup> At least one course selected from BIOL 4100, BIOL 4410, BIOL 4420, BIOL 4430, BIOL 4460, BIOL 4480, BIOL 4700, MICR 4010, or MICR 4030.
- <sup>13</sup> ENGL 3140 may be substituted.
- <sup>14</sup> PHYS 2210/2230 may be substituted.
- <sup>15</sup> At least one course selected from selected from BIOL 4010, BIOL 4080, BIOL 4200, BIOL 4400, BIOL 4530, BIOL 4590, BIOL 4750, BIOL 4800, BIOL 4830, BIOL 4840, MICR 4140 or MICR 4170.



# 2020/2021 B.S. BIOLOGICAL SCIENCES CURRICULUM PRE-MEDICINE WORKSHEET

Required†† and Strongly Recommended† Courses. Worksheets are not for a degree-granting program

<b>BIOL Core Requirement: (29 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0)	_____
<b>BIOL 1100/1101†† Biology I</b>	<b>4(3,3)</b> <sup>1</sup>	_____
<b>BIOL 1110/1111†† Biology II</b>	<b>4(3,3)</b> <sup>1</sup>	_____
BIOL 3350	3(3,0)	_____
<b>BIOL 4610† Cell Biology</b>	<b>3(3,0)</b>	_____
<b>BIOL 4620/4621† Cell Biology Lab</b>	<b>2(1,2)</b>	_____
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 4100, 4410, 4420, 4430, 4460, 4480, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (3 cr.)</i>		
BIOL 4010, 4080, 4200, 4400, 4530, 4590, 4750, 4800, 4830, 4840, OR MICR 4140	_____	_____
<b>Major Requirement: (21 cr.)</b> <sup>2,3</sup>		
Laboratory Course req. <b>BIOL 3151</b>	0(3)	_____
Laboratory Course req. <b>BIOL 3161</b>	0(3)	_____
Laboratory Course req. <b>MICR 3051</b>	0(3)	_____
<b>BIOL 3150/3151† Human Anatomy</b>	<b>4(3,3)</b>	_____
<b>BIOL 3160/3161† Human Physiology</b>	<b>4(3,3)</b>	_____
<b>CH 2240, 2280†† Org. CH II 3(3,0) &amp; 1(0,3)</b>	_____	_____
<b>MICR 3050† Microbiology</b>	<b>4(3,3)</b>	_____
_____	_____	_____
_____	_____	_____
<b>Required Science Courses (33 cr.)</b>		
<b>BCHM 3050†† Biochemistry</b>	<b>3(3,0)</b>	_____
<b>CH 1010/1011†† General Chemistry I</b>	<b>4(3,3)</b>	_____
<b>CH 1020/1021†† General Chemistry II</b>	<b>4(3,3)</b>	_____
<b>CH 2230, 2270†† Org. Chem I 3(3,0) &amp; 1(0,3)</b> <sup>4</sup>	_____	_____
<b>GEN 3000† Genetics</b>	<b>3(3,0)</b>	_____
<b>MATH 1060† Calculus I</b>	4(4,0)	_____
<b>MATH 1080 OR</b>	4(4,0) <sup>5</sup>	_____
<b>STAT 2300/2301† Statistics</b>	<b>3(3,0)</b> <sup>5</sup>	_____
<b>PHYS 2070, 2090†† Physics I 3(3,0) &amp; 1(0,2)</b> <sup>6</sup>	_____	_____
<b>PHYS 2080, 2100†† Physics II 3(3,0) &amp; 1(0,2)</b> <sup>6</sup>	_____	_____
<b>Required Non-Science Courses (21 cr.)</b>		
<b>ENGL 1030/1031 Accel. Composition</b>	3(3,1)	_____
<b>ENGL 3150 OR 3140</b>	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) <sup>7</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>7,8</sup>	_____
Oral Communication Requirement	3(3,0) <sup>7</sup>	_____
Social Sciences		
<b>PSYC 2010†† Intro to Psychology</b>	<b>3(3,0)</b>	_____
<b>SOC 2010†† Sociology</b>	<b>3(3,0)</b>	_____
<b>Electives (16 cr.)</b> <sup>3,9</sup>		
<b>BCHM 4900† Medical Terminology</b>	<b>2(2,0)</b>	_____
<b>PHIL 1030† Introduction to Ethics</b>	<b>3(3,0)</b>	_____
<b>PSYC 3400† Lifespan Development</b>	<b>3(3,0)</b>	_____
<b>PSYC 3830† Abnormal Psychology</b>	<b>3(3,0)</b>	_____
_____	_____	_____
_____	_____	_____
<b>Total Semester Hours = 120</b>	10	

<sup>1</sup> 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.

<sup>2</sup> Twenty-one credit hours from 3000-level or higher BIOL or MICR courses (except MICR 3000) or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.

<sup>3</sup> Medical schools utilize a holistic review process on applicants that allows for the assessment of an applicant's capabilities while balancing experience, attributes, and academic metrics. Therefore, students must prepare for medical school in multiple ways beyond academics. Competitive applicants will often have experience volunteering or working in a healthcare setting, participating in laboratory research, job shadowing, holding leadership positions, tutoring or studying abroad.

<sup>4</sup> Most medical schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280, rather than a one semester survey of organic chemistry (CH 2010/2020)

<sup>5</sup> Calculus is not a prerequisite for the MCAT, but it is sometimes required for specific medical schools, so check with your prospective schools for their required coursework. Most pre-medicine students take STAT 2300/2301 instead of MATH 1080.

<sup>6</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).

<sup>7</sup> See General Education Requirements.

<sup>8</sup> These credit hours may be used to satisfy the Cross-Cultural Awareness (CCA) and/or Science and Technology in Society Requirements (STS).

<sup>9</sup> These credit hours should be used to satisfy the Cross-Cultural Awareness (CCA) and/or Science and Technology in Society Requirements (STS).

★Note. Entrance requirements vary by institution and should be verified individually.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

**Electives Cont'd**

_____	_____	_____
_____	_____	_____
_____	_____	_____

# 2020/2021 B.S. BIOLOGICAL SCIENCES CURRICULUM PRE-DENTAL WORKSHEET

Required<sup>††</sup> and Strongly Recommended<sup>†</sup> Courses. Worksheets are not for a degree-granting program

	<b>SEM/Yr</b>	<b>Grade</b>
<b>BIOL Core Requirement: (29 cr.)</b>		
BIOL 1010	1(1,0)	_____
<b>BIOL 1100/1101<sup>††</sup> Biology I</b>	<b>4(3,3)</b> <sup>1</sup>	_____
<b>BIOL 1110/1111<sup>††</sup> Biology II</b>	<b>4(3,3)</b> <sup>1</sup>	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 <b>OR</b> 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, <b>OR</b> 4250/4260	_____	_____
<i>Ecology (3 cr.)</i>		
BIOL 4100, 4410, 4420, 4430, 4460, 4480, 4700, MICR 4010, <b>OR</b> 4030	_____	_____
<i>Functional Biology Requirement (3 cr.)</i>		
BIOL 4010, 4080, 4200, 4400, 4530, 4590, 4750, 4800, 4830, 4840, <b>OR</b> MICR 4140	_____	_____
<b>Major Requirement: (21 cr.)</b> <sup>2,3</sup>		
<i>Laboratory Course req.</i> BIOL 3151	<b>0(3)</b>	_____
<i>Laboratory Course req.</i> BIOL 3161	<b>0(3)</b>	_____
<i>Laboratory Course req.</i> MICR 3051	<b>0(3)</b>	_____
<b>BIOL 3150/3151<sup>†</sup> Human Anatomy</b>	<b>4(3,3)</b>	_____
<b>BIOL 3160/3161<sup>†</sup> Human Physiology</b>	<b>4(3,3)</b>	_____
<b>CH 2240, 2280<sup>††</sup> Org. CH II 3(3,0) &amp; 1(0,3)</b>	_____	_____
<b>MICR 3050<sup>†</sup> Microbiology</b>	<b>4(3,3)</b>	_____
_____	_____	_____
_____	_____	_____
<b>Required Science Courses (33 cr.)</b>		
<b>BCHM 3050<sup>†</sup> Biochemistry</b>	<b>3(3,0)</b>	_____
<b>CH 1010/1011<sup>††</sup> General Chemistry I</b>	<b>4(3,3)</b>	_____
<b>CH 1020/1021<sup>††</sup> General Chemistry II</b>	<b>4(3,3)</b>	_____
<b>CH 2230, 2270<sup>††</sup> Org. Chem I 3(3,0) &amp; 1(0,3)</b> <sup>4</sup>	_____	_____
<b>GEN 3000<sup>†</sup> Genetics</b>	<b>3(3,0)</b>	_____
<b>MATH 1060 Calculus I</b>	<b>4(4,0)</b>	_____
<b>STAT 2300<sup>†</sup> Statistics</b>	<b>3(3,0)</b> <sup>4</sup>	_____
<b>PHYS 2070, 2090<sup>††</sup> Physics I 3(3,0) &amp; 1(0,2)</b> <sup>6</sup>	_____	_____
<b>PHYS 2080, 2100<sup>††</sup> Physics II 3(3,0) &amp; 1(0,2)</b> <sup>6</sup>	_____	_____
<b>Required Non-Science Courses (21 cr.)</b>		
<b>ENGL 1030/1031<sup>††</sup></b>	<b>3(3,1)</b>	_____
<b>ENGL 3150 <b>OR</b> 3140</b>	3(3,0)	_____
<b>Arts &amp; Humanities – Literature<sup>††</sup></b>	<b>3(3,0)</b> <sup>7</sup>	_____
<b>Arts &amp; Humanities – Non-Literature</b>	3(3,0) <sup>7,8</sup>	_____
<b>Oral Communication Requirement</b>	3(3,0) <sup>6</sup>	_____
<b>Social Sciences</b>		
<b>PSYC 2010<sup>††</sup> Psychology</b>	<b>3(3,0)</b>	_____
<b>SOC 2010<sup>††</sup> Sociology</b>	<b>3(3,0)</b>	_____
<b>Electives (16 cr.)</b> <sup>3,8,9</sup>		
<b>BCHM 4900<sup>†</sup> Medical Terminology</b>	<b>2(2,0)</b>	_____
<b>PHIL 1030<sup>†</sup> Introduction to Ethics</b>	<b>3(3,0)</b>	_____
<b>PSYC 3400<sup>†</sup> Lifespan Development</b>	<b>3(3,0)</b>	_____
<b>PSYC 3830<sup>†</sup> Abnormal Psychology</b>	<b>3(3,0)</b>	_____
_____	_____	_____
_____	_____	_____

- <sup>1</sup> 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.
- <sup>2</sup> Twenty-one credit hours from 3000-level or higher BIOL or MICR courses or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.
- <sup>3</sup> **In addition to challenging coursework, applicants should look for opportunities to demonstrate a range of competencies.** Applicants are encouraged to complete experiences providing clinical exposure to inform their decision to enter dentistry. These experiences, ideally, should be attained through participation in a formal Clemson internship (or similar) supervised course and independent student planning. The latter would demonstrate a personal commitment to explore this career path.
- <sup>4</sup> Most dental schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280, rather than a one semester survey of organic chemistry (CH 2010/2020).
- <sup>5</sup> **The Dental Admission Test (DAT) mathematics topics include** algebra (equations and expressions, inequalities, exponential notation, absolute value, ratios and proportions, and graphical analysis); data analysis, interpretation, and sufficiency; quantitative comparison; and probability and statistics.
- <sup>6</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230. (MATH 1080 pre-req).
- <sup>7</sup> See General Education Requirements.
- <sup>8</sup> These credit hours should be used to satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- <sup>9</sup> **Basic business courses are recommended** due to the fact that many dentists choose to pursue private practice.

★**Note.** Entrance requirements vary by institution and should be verified individually.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

**Electives Cont'd**

_____	_____	_____
_____	_____	_____

**2020/2021 B.S. BIOLOGICAL PRE-REHABILITATION SCIENCES WORKSHEET**  
**Occupational Therapy (OT), Physical Therapy (PT), Speech Disorders, and Physician Assistant (PA)**  
**Required†† and Strongly Recommended† Courses. Worksheets are not a for degree-granting program**

<b>BIOL Core Requirement: (31 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0)	_____
<b>BIOL 1100/1101†† Biology I</b>	<b>4(3,3)</b> <sup>1</sup>	_____
<b>BIOL 1110/1111†† Biology II</b>	<b>4(3,3)</b> <sup>1</sup>	_____
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 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030		_____
<i>Functional Biology Requirement (3 cr.)</i>		
BIOL 4010, 4080, 4200, 4400, 4530*, 4590, 4750, 4800, 4830, 4840, OR MICR 4140		_____
<b>Major Requirement: (21 cr.)</b> <sup>2</sup>		
Laboratory Course req. BIOL 3151	0(3)	_____
Laboratory Course req. BIOL 3161	0(3)	_____
Laboratory Course req.		_____
<b>BIOL 3150†† Human Anatomy</b>	<b>4(3,3)</b>	_____
<b>BIOL 3160†† Human Physiology</b>	<b>4(3,3)</b>	_____
<b>CH 2240†† Org. Chem II (PA)</b>	<b>4(3,3)</b>	_____
<b>MICR 3050† Microbiology (PA)</b>	<b>4(3,3)</b>	_____
<hr/>		
<b>Required Science Courses (33 cr.)</b>		
BCHM 3050 Biochemistry†(PA)	3(3,0)	_____
CH 1010/1011†† General CH I	4(3,3)	_____
CH 1020/1021†† General CH II	4(3,3)	_____
CH 2230, 2270 OR CH 2010, CH 2020	3(3,0) & 1(0,3) <sup>3</sup>	_____
GEN 3000 Genetics† (PA)	3(3,0)	_____
MATH 1060 Calculus†† (PA)	4(4,0) <sup>4</sup>	_____
PHYS 2070, 2090†† Physics I	3(3,0) & 1(0,2) <sup>5</sup>	_____
PHYS 2080, 2100†† Physics II	3(3,0) & 1(0,2) <sup>5</sup>	_____
STAT 2300†† Statistics	3(3,0) <sup>4</sup>	_____
<b>Required Non-Science Courses (21 cr.)</b>		
ENGL 1030/1031††	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature††	3(3,0) <sup>6</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>6,7</sup>	_____
<b>Oral Communication Requirement††</b>	<b>3(3,0)</b> <sup>6</sup>	_____
Social Sciences		
PSYC 2010†† Psychology	3(3,0)	_____
SOC 2010†† Sociology (PA)	3(3,0)	_____

**Total Semester Hours = 120**

\* Request Substitution for Academic Requirement.

<sup>1</sup> 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.

<sup>2</sup> Twenty-one credit hours from 3000-level or higher BIOL or MICR courses (except MICR 3000) or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include at least three laboratory courses. **MICR 3050 and CH 2240/2280 are required for most PA programs.** Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.

★Students applying to professional schools that require BIOL 4780 Exercise Physiology should note this course is offered spring semester, odd numbered years only and has prerequisites of both anatomy & physiology.

<sup>3</sup> Most PA programs require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.

<sup>4</sup> The GRE Math section only tests basic math. The math content includes algebra, geometry, statistics, exponents, probability, fractions, ratios, and data interpretation.

<sup>5</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).

<sup>6</sup> See General Education Requirements.

<sup>7</sup> These credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).

<sup>8</sup> 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, sociology, abnormal psychology, and/or lifespan development courses. **ECON 2000 or 2110 or 2120 is recommended for PA programs.**

Many PA programs require or recommend direct patient care hours and a course in Medical Terminology

★Note. Entrance requirements vary by institution and should be verified individually.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

**Electives (16 cr.)**<sup>7,8</sup>

**PSYC 3400† Lifespan Development 3(3,0)**  
**PSYC 3830† Abnormal Psychology 3(3,0)**  
**BCHM 4900† Medical Terminology 2(2,0)**  
**PHIL 1030† Introduction to Ethics 3(3,0)**

_____	_____	_____
_____	_____	_____
_____	_____	_____

# 2020/2021 B.S. BIOLOGICAL SCIENCES CURRICULUM PRE-VETERINARY MEDICINE WORKSHEET

Required†† and Strongly Recommended† Courses. Worksheets are not for a degree-granting program

	SEM/Yr	Grade
<b>BIOL Core Requirement: (31 cr.)</b>		
BIOL 1010	1(1,0)	_____
<b>BIOL 1100/1101†† Biology I</b>	<b>4(3,3)</b> <sup>1</sup>	_____
<b>BIOL 1110/1111†† Biology II</b>	<b>4(3,3)</b> <sup>1</sup>	_____
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, 4530, 4590, 4750, 4800, 4830, 4840, OR MICR 4140		_____
<b>Major Requirement: (21 cr.)</b> <sup>2,3</sup>		
Laboratory Course req. MICR 3051	0(3)	_____
Laboratory Course req. CH 2280	1(0,3)	_____
Laboratory Course req. _____		_____
<b>CH 2240†† Org. Chem II</b>	<b>4(3,3)</b>	_____
<b>MICR 3050† Microbiology</b>	<b>4(3,3)</b>	_____
<hr/>		
<b>Required Science Courses (33 cr.)</b>		
<b>BCHM 3050†† Biochemistry</b>	<b>3(3,0)</b>	_____
<b>CH 1010/1011†† General Chemistry I</b>	<b>4(3,3)</b>	_____
<b>CH 1020/1021†† General Chemistry II</b>	<b>4(3,3)</b>	_____
<b>CH 2230, 2270 †† Org. Chem I</b>	<b>3(3,0) &amp; 1(0,3)</b>	_____
<b>GEN 3000† Genetics</b>	<b>3(3,0)</b>	_____
<b>MATH 1060†† Calculus I</b>	<b>4(4,0)</b>	_____
<b>STAT 2300†† Statistics</b>	<b>3(3,0)</b> <sup>5</sup>	_____
<b>PHYS 2070, 2090†† Physics I</b>	<b>3(3,0) &amp; 1(0,2)</b> <sup>6</sup>	_____
<b>PHYS 2080, 2100†† Physics II</b>	<b>3(3,0) &amp; 1(0,2)</b> <sup>6</sup>	_____
<b>Required Non-Science Courses (21 cr.)</b>		
<b>ENGL 1030/1031††</b>	<b>3(3,1)</b>	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature††	3(3,0) <sup>7</sup>	_____
<b>Arts &amp; Humanities – Non-Literature</b>	<b>3(3,0)</b> <sup>7,8,9</sup>	_____
<b>Oral Communication Requirement†</b>	<b>3(3,0)</b> <sup>7</sup>	_____
<b>Social Sciences</b>		
<b>PSYC 2010† Intro to Psychology</b>	<b>3(3,0)</b>	_____
_____	3(3,0) <sup>8,9</sup>	_____
<b>Electives (16 cr.)</b> <sup>3,8,9</sup>		
<b>AVS 3010†† Anatomy &amp; Physiology</b>	<b>4(3,3)</b>	_____
<b>AVS 3700†† Animal Nutrition</b>	<b>3(3,0)</b>	_____
<b>BCHM 4900† Medical Terminology</b>	<b>2(2,0)</b>	_____
<b>PHIL 1030† Introduction to Ethics</b>	<b>3(3,0)</b>	_____

- <sup>1</sup> 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.
- <sup>2</sup> Twenty-one credit hours from 3000-level or higher BIOL or MICR courses (except MICR 3000) or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include at least three laboratory courses. Any combination of BIOL or MICR 3940, 4910, 4920, 4940, and 4950 may not exceed eight credits.
- <sup>3</sup> In addition to challenging coursework, applicants should look for opportunities to demonstrate a range of competencies. To gain experience, applicants should consider interning or volunteering at a veterinary hospital or clinic to gain practical experience in the veterinary medicine. 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.
- <sup>4</sup> Most veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280, rather than a one semester survey of organic chemistry (CH 2010/2020).
- <sup>5</sup> The GRE Math section only tests basic math. The math content includes algebra, geometry, statistics, exponents, probability, fractions, ratios, and data interpretation.
- <sup>6</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).
- <sup>7</sup> See General Education Requirements.
- <sup>8</sup> Six of these credit hours may also satisfy the Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- <sup>9</sup> Total of 15 semester hours of any combination of the humanities, social/behavioral sciences and fine arts courses.
- ★**Note.** Entrance requirements vary by institution and should be verified individually.

Other Courses	SEM/Yr	Grade
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____
<b>Electives Cont'd</b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____

\* Request Substitution for Academic Requirement.

**B. S. BIOLOGICAL SCIENCES 2020-2021  
PRE-PHARMACY EMPHASIS**

**FRESHMAN YEAR**

First Semester

Second Semester

BIOL 1010 Frontiers in Biol. I.....	1(1,0)
BIOL 1100 Prin. of Biol. I <sup>1</sup> .....	4(3,3)
CH 1010 General Chemistry .....	4(3,3)
MATH 1060 Calculus of One Var. I .....	4(4,0)
Oral Communication Requirement <sup>2</sup> .....	<u>3</u>
	16

BIOL 1110 Prin. of Biol. II <sup>1</sup> .....	4(3,3)
CH 1020 General Chemistry .....	4(3,3)
ENGL 1030 Composition and Rhetoric.....	3(3,1)
Statistics Requirement <sup>3</sup> .....	<u>3</u>
	14

**SOPHOMORE YEAR**

CH 2230 Organic Chemistry.....	3(3,0)
CH 2270 Organic Chemistry Lab.....	1(0,3)
GEN 3000 Fundamental Genetics <sup>4</sup> .....	3(3,0)
Arts and Humanities (Literature) Req. <sup>2</sup> .....	3
Organismal Diversity Requirement <sup>5</sup> .....	4
Elective.....	<u>2</u>
	16

BCHM 3050 Essential Elements of Bioch. <sup>6</sup> .....	3(3,0)
BIOL 3350 Evolutionary Biology .....	3(3,0)
CH 2240 Organic Chemistry.....	3(3,0)
CH 2280 Organic Chemistry Lab .....	1(0,3)
Social Science Requirement <sup>7</sup> .....	3
Elective.....	<u>3</u>
	16

**JUNIOR YEAR**

BIOL 3150 Functional Human Anatomy.....	4(3,3)
BIOL 4610 Cell Biology .....	3(3,0)
BIOL 4620 Cell Biology Laboratory .....	2(1,2)
PHYS 2070 General Physics I <sup>8</sup> .....	3(3,0)
PHYS 2090 General Physics Lab I <sup>8</sup> .....	1(0,3)
PSYC 2010 Introduction to Psychology .....	<u>3</u>
	16

BIOL 3160 Human Physiology.....	4(3,3)
ENGL 3150 Scientific Writing and Comm. <sup>9</sup> .....	3(3,0)
PHYS 2080 General Physics II <sup>10</sup> .....	3(3,0)
PHYS 2100 General Physics II Lab <sup>10</sup> .....	1(0,2)
Arts and Humanities (Non-Lit) Req. <sup>7</sup> .....	3
Economics Requirement <sup>11</sup> .....	<u>3</u>
	17

**SENIOR YEAR**

BIOL 4930 Senior Seminar <b>or</b>	
MICR 4930 Senior Seminar .....	2(2,0)
Ecology Requirement <sup>12</sup> .....	3
Major Requirement <sup>13</sup> .....	3
Elective.....	<u>5</u>
	13

MICR 3050 General Microbiology .....	4(3,3)
Major Requirement <sup>13</sup> .....	3
Elective .....	<u>5</u>
	12

**Total Semester Hours = 120**

<sup>1</sup> 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.

<sup>2</sup> See General Education Requirements.

<sup>3</sup> STAT 2300 or STAT 3090. See advisor. Professional schools have different mathematics requirements.

<sup>4</sup> GEN 3020 may be substituted.

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

<sup>6</sup> BCHM 3010 may be substituted.

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

<sup>8</sup> PHYS 1220/1240 may be substituted.

<sup>9</sup> ENGL 3140 may be substituted.

<sup>10</sup> PHYS 2210/2230 may be substituted.

<sup>11</sup> ECON 2000, ECON 2110, or ECON 2120

<sup>12</sup> At least one course selected from BIOL 4100, BIOL 4410, BIOL 4420, BIOL 4430, BIOL 4460, BIOL 4480, BIOL 4700, MICR 4010, or MICR 4030.

<sup>13</sup> Six credit hours must be selected from BIOL or MICR courses at the 3000-level or above (except MICR 3000), ETOX 4300, ETOX 4370, WFB 4720 or WFB 4770

**2020/2021 B.S. BIOLOGICAL SCIENCES CURRICULUM PRE-PHARMACY EMPHASIS**

	<b>SEM/Yr</b>	<b>Grade</b>
<b>BIOL Core Requirement: (30 cr.)</b>		
BIOL 1010	1(1,0)	_____
<b>BIOL 1100/1101†† Biology I</b>	<b>4(3,3)</b> <sup>1</sup>	_____
<b>BIOL 1110/1111†† Biology II</b>	<b>4(3,3)</b> <sup>1</sup>	_____
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 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, OR 4030	_____	_____
<i>Functional Biology Requirement (4 cr.)</i>		
<b>BIOL 3160/3161†† Human Physiology</b>	_____	_____
<b>Major Requirement: (18 cr.)</b> <sup>2</sup>		
<b>BIOL 3150/3151†† Human Anatomy</b>	<b>4(3,3)</b>	_____
<b>CH 2240, 2280†† Org. CH II</b>	<b>3(3,0) &amp; 1(0,3)</b>	_____
<b>MICR 3050/3051†† Microbiology</b>	<b>4(3,3)</b>	_____
_____	_____	_____
_____	_____	_____
<b>Required Science Courses (33 cr.)</b>		
BCHM 3050	3(3,0)	_____
<b>CH 1010/1011†† General Chemistry I</b>	<b>4(3,3)</b>	_____
<b>CH 1020/1021†† General Chemistry II</b>	<b>4(3,3)</b>	_____
<b>CH 2230, 2270†† Org. Chem I</b>	<b>3(3,0) &amp; 1(0,3)</b>	_____
GEN 3000	3(3,0)	_____
<b>MATH 1060†† Calculus I</b>	<b>4(4,0)</b>	_____
<b>STAT 2300†† Statistics</b>	3(3,0) <sup>3</sup>	_____
<b>PHYS 2070, 2090†† Physics I</b>	<b>3(3,0) &amp; 1(0,2)</b> <sup>4</sup>	_____
<b>PHYS 2080, 2100†† Physics II</b>	<b>3(3,0) &amp; 1(0,2)</b> <sup>4</sup>	_____
<b>Required Non-Science Courses (24 cr.)</b>		
<b>ECON 2000 OR 2110 OR 2120</b>	<b>3(3,0)</b>	_____
<b>ENGL 1030/1031† Accel. Composition</b>	<b>3(3,1)</b>	_____
ENGL 3150 OR 3140	3(3,0)	_____
<b>Arts &amp; Humanities – Literature†</b>	<b>3(3,0)</b> <sup>5</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>5</sup>	_____
<b>Oral Communication Requirement†</b>	<b>3(3,0)</b> <sup>5</sup>	_____
Social Sciences <sup>6</sup>		
<b>PSYC 2010†† Intro to Psychology</b>	<b>3(3,0)</b>	_____
<b>SOC 2010†† Sociology</b>	<b>3(3,0)</b>	_____
<b>Electives (15 cr.)</b> <sup>6</sup>		
_____	_____	_____
_____	_____	_____
_____	_____	_____

<sup>1</sup> 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.

<sup>2</sup> Eighteen credit hours must come from BIOL or MICR courses (except MICR 3000) at the 3000-level or above or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include at least three laboratory courses. Also, all applicants are encouraged, but not required, to complete experiences providing clinical exposure to inform their decision to enter pharmacy. These experiences, ideally, should be attained through participation in a Clemson course and/or independent planning. The latter would demonstrate a personal commitment to explore this career path.

<sup>3</sup> Pharmacy schools have specific prerequisite MATH course requirements. The Pharmacy College Admission Test (PCAT) mathematics topics include basic math, algebra, probability & statistics, pre-calculus, and calculus.

<sup>4</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).

<sup>5</sup> See General Education Requirements.

<sup>6</sup> Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).

★**Note.** Entrance requirements vary by institution and should be verified individually. The PCAT is required or highly recommended by most pharmacy schools.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____

**Electives Cont'd**

_____	_____	_____
_____	_____	_____
_____	_____	_____

**Total Semester Hours = 120**

## B. S. BIOLOGICAL SCIENCES 2020-2021 TOXICOLOGY EMPHASIS

### 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 <sup>1</sup> ..... 4(3,3)
BIOL 1100 Prin. of Biol. I <sup>1</sup> ..... 4(3,3)	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 <sup>3</sup> ..... <u>3</u>
Oral Communication Requirement <sup>2</sup> ..... <u>3</u>	14
16	

### SOPHOMORE YEAR

BIOL 2110 Introduction to Toxicology ..... 3(3,0)	BCHM 3050 Essential Elements of Bioch <sup>8</sup> ..... 3(3,0)
CH 2230 Organic Chemistry <sup>4,5</sup> ..... 3(3,0)	BIOL 3350 Evolutionary Biology..... 3(3,0)
CH 2270 Organic Chemistry Lab <sup>4,5</sup> ..... 1(0,3)	Major Requirement <sup>4,9</sup> ..... 4
GEN 3000 Fundamental Genetics <sup>6</sup> ..... 3(3,0)	Organismal Diversity Requirement <sup>10</sup> ..... 4
Social Science Requirement <sup>7</sup> ..... 3	Elective..... <u>3</u>
Elective..... <u>2</u>	17
15	

### JUNIOR YEAR

BIOL 4610 Cell Biology ..... 3(3,0)	ENGL 3150 Scientific Writing and Comm. <sup>13</sup> .... 3(3,0)
BIOL 4620 Cell Biology Laboratory ..... 2(1,2)	PHYS 2080 General Physics II <sup>14</sup> ..... 3(3,0)
ETOX 4300 Toxicology..... 3(3,0)	PHYS 2100 General Physics II Lab <sup>14</sup> ..... 1(0,2)
PHYS 2070 General Physics I <sup>11</sup> ..... 3(3,0)	Arts and Humanities (Literature) Req. <sup>2</sup> ..... 3
PHYS 2090 General Physics I Lab <sup>11</sup> ..... 1(0,3)	Functional Biol. Requirement <sup>15</sup> ..... 3
Ecology Requirement <sup>12</sup> ..... <u>3</u>	Elective..... <u>2</u>
15	15

### SENIOR YEAR

BIOL 4930 Senior Seminar <b>or</b>	CH 4130 Chemistry of Aqueous Systems <b>or</b>
MICR 4930 Senior Seminar ..... 2(2,0)	ETOX 4210 Chemical Fate in Environ. .... 3(3,0)
CH 3130 Quantitative Analysis..... 3(3,0)	Arts and Humanities (Non-Lit) Req. <sup>7</sup> ..... 3
CH 3150 Quantitative Analysis Lab ..... 2(0,6)	Toxicology Requirement <sup>16</sup> ..... 3
Social Science Requirement <sup>7</sup> ..... 3	Elective ..... <u>4</u>
Elective..... <u>5</u>	13
15	

**Total Semester Hours = 120**

<sup>1</sup> 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.

<sup>2</sup> See General Education Requirements.

<sup>3</sup> MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements. Statistics will be useful in either graduate study or professional school.

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

<sup>5</sup> CH 2010 and CH 2020 may be substituted.

<sup>6</sup> GEN 3020 may be substituted.

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

<sup>8</sup> BCHM 3010 may be substituted.

<sup>9</sup> Four credit hours must be selected from BIOL or MICR courses at the 3000-level or above (except MICR 3000) or CH 2240/2280, WFB 4720, or WFB 4770.

<sup>10</sup> At least one lecture and associated laboratory selected from BIOL 3010/BIOL 3011, BIOL 3020/BIOL3060, BIOL 3030/BIOL 3070, BIOL 3040/BIOL 3080, BIOL 3200/BIOL 3201, BIOL 4060/BIOL 4070, BIOL 4250/BIOL 4260.

<sup>11</sup> PHYS 1220/1240 may be substituted.

<sup>12</sup> At least one course selected from BIOL 4100, BIOL 4410, BIOL 4420, BIOL 4430, BIOL 4460, BIOL 4480, BIOL 4700, MICR 4010, or MICR 4030.

<sup>13</sup> ENGL 3140 may be substituted.

<sup>14</sup> PHYS 2210/2230 may be substituted.

<sup>15</sup> At least one course selected from selected from BIOL 3160, BIOL 4010, BIOL 4080, BIOL 4200, BIOL 4400, BIOL 4530, BIOL 4590, BIOL 4750, BIOL 4800, BIOL 4830, BIOL 4840, MICR 4140 or MICR 4170.

<sup>16</sup> Any 4000-level ETOX course.

**2020/2021 B.S. BIOLOGICAL SCIENCES CURRICULUM – TOXICOLOGY EMPHASIS**

	<b>SEM/Yr</b>	<b>Grade</b>
<b>BIOL Core Requirement: (32 cr.)</b>		
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	<b>4(3,3)</b> <sup>1</sup>	_____
BIOL 1110/1111	<b>4(3,3)</b> <sup>1</sup>	_____
BIOL 2110	3(3,0)	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 <b>OR</b> MICR 4930	2(2,0)	_____
<b>Organismal Diversity Requirement (4 cr.)</b>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, <b>OR</b> 4250/4260		_____
<b>Ecology (3 cr.)</b>		
BIOL 4100, 4410, 4420, 4430, 4460, 4700, MICR 4010, <b>OR</b> 4030		_____
<b>Functional Biology Requirement (3 cr.)</b> <sup>2</sup>		
BIOL 3160, 4010, 4080, 4200, 4400, 4530, 4590, 4750, 4800, 4830, 4840, MICR 4140 <b>OR</b> MICR 4170		_____
<b>Major Requirement: (4 cr.)</b> <sup>3</sup>		
_____		_____
_____		_____
_____		_____
<b>Toxicology Requirement (6 cr.)</b> <sup>4</sup>		
ETOX 4300	3(3,0)	_____
_____	3(3,0)	_____
<b>Required Science Courses (41 cr.)</b>		
BCHM 3050	3(3,0)	_____
CH 1010/1011	4(3,3)	_____
CH 1020/1021	4(3,3)	_____
CH 2230, 2270 <b>OR</b> CH 2010, CH 2020	3(3,0) & 1(0,3)	_____
CH 3130 & 3150	3(3,0) & 2(0,6)	_____
CH 4130 <b>OR</b> ETOX 4210	3(3,0)	_____
GEN 3000	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080 <b>OR</b> STAT 2300	4(4,0) 3(3,0) <sup>5</sup>	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) <sup>6</sup>	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) <sup>6</sup>	_____
<b>Required Non-Science Courses (21 cr.)</b>		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 <b>OR</b> 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) <sup>7</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>7,8</sup>	_____
Oral Communication Requirement	3(3,0) <sup>7</sup>	_____
Social Sciences		
_____	3(3,0) <sup>7,8</sup>	_____
_____	3(3,0) <sup>7,8</sup>	_____

- <sup>1</sup> 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.
- <sup>2</sup> Credit hours above 3 will be used for Major Requirement credits.
- <sup>3</sup> Four credit hours from 3000-level or higher BIOL or MICR courses (except MICR 3000) or from CH 2240/2280, WFB 4720, or WFB 4770.
- <sup>4</sup> Any 4000-level ETOX course.
- <sup>5</sup> Statistics will be useful in both graduate school and professional school.
- <sup>6</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).
- <sup>7</sup> See General Education Requirements.
- <sup>8</sup> Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____

<b>Electives (16 cr.)</b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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

BIOL Undergraduate Advisor: Londa Means Charley, [londanm@clemson.edu](mailto:londanm@clemson.edu), 656-3604

BIOE Graduate Advisor: Patricia Nigro, [pnigro@clemson.edu](mailto:pnigro@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 Londa Means Charley 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; Preq or concurrent enrollment: and BIOE 3100 and 3200. 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 3100; 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 or ENGR 1410; 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 perspective. 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. 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: MTHS 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 or ENGR 1410; 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 (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 2020-2021

### FRESHMAN YEAR

#### First Semester

BIOL 1010 Frontiers in Biol. I.....	1(1,0)
BIOL 1100 Prin. of Biol. I <sup>1</sup> .....	4(3,3)
CH 1010 General Chemistry .....	4(3,3)
MATH 1060 Calculus of One Var. I .....	4(4,0)
Oral Communication Requirement <sup>2</sup> .....	<u>3</u>
	16

#### Second Semester

BIOL 1110 Prin. of Biol. II <sup>1</sup> .....	4(3,3)
CH 1020 General Chemistry .....	4(3,3)
ENGL 1030 Composition and Rhetoric .....	3(3,1)
MATH 1080 Calculus of One Var. II .....	<u>4</u>
	16

### SOPHOMORE YEAR

CH 2230 Organic Chemistry <b>and</b> .....	3(3,0)
CH 2270 Organic Chemistry Lab <sup>3,4</sup> .....	1(0,3)
GEN 3000 Fundamental Genetics <sup>5</sup> .....	3(3,0)
MATH 2060 Calculus of Several Var. ....	4(4,0)
Organismal Diversity Requirement <sup>6</sup> .....	<u>4</u>
	15

BCHM 3050 Essential Elements of Bioch <sup>7</sup> .....	3(3,0)
BIOL 3350 Evolutionary Biology.....	3(3,0)
MATH 2080 Intro. Ordin. Differ. Equ.....	4(4,0)
Social Science Requirement <sup>8</sup> .....	3
Major Requirement <sup>9</sup> .....	<u>3</u>
	16

### JUNIOR YEAR

BIOL 4610 Cell Biology .....	3(3,0)
BIOL 4620 Cell Biology Laboratory .....	2(1,2)
CE 2010 Statics .....	3(3,0)
MSE 2100 Intro. Material Science <sup>10</sup> <b>or</b> .....	3(3,0)
ECE 2070 Basic Elect Engineer <sup>11</sup> <b>and</b> .....	2(2,0)
ECE 2080 Elect Engineering Lab I .....	1(0,2)
PHYS 1220 Physics with Calculus I <b>and</b> .....	3(3,0)
PHYS 1240 Physics Laboratory I .....	<u>1(0,3)</u>
	15

BIOE 3200 Biomechanics <sup>10</sup> <b>or</b> .....	3(3,0)
BIOE 3700 Bioinstr. and Bioimaging <sup>11</sup> .....	3(2,3)
ENGL 3150 Scientific Writing and Comm. <sup>12</sup> ....	3(3,0)
PHYS 2210 Physics with Calculus II and.....	3(3,0)
PHYS 2230 Physics Laboratory II .....	1(0,3)
Arts and Humanities (Literature) Req. <sup>2</sup> .....	3
Functional Biol. Requirement <sup>13</sup> .....	<u>3</u>
	16

### SENIOR YEAR

BIOE 6400 Biopharmaceutical Engineer.....	3(3,0)
BIOL 3150 Functional Human Anatomy.....	4(3,3)
BIOL 4930 Senior Seminar or	
MICR 4930 Senior Seminar .....	2(2,0)
Major Requirement <sup>9</sup> .....	3
Social Science Requirement <sup>8</sup> .....	<u>3</u>
	15

Arts and Humanities (Non-Lit) Req. <sup>8</sup> .....	3
BIOE, BIOL OR BCHM 6xxx .....	3
Ecology Requirement <sup>14</sup> .....	3
Major Requirement <sup>9, 15</sup> .....	<u>3</u>
	12

**Total Semester Hours = 120**

<sup>1</sup> 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.

<sup>2</sup> See General Education Requirements.

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

<sup>4</sup> CH 2010 and CH 2020 may substitute.

<sup>5</sup> GEN 3020 may substitute.

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

<sup>7</sup> BCHM 3010 may substitute.

<sup>8</sup> 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.

<sup>9</sup> 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.

<sup>10</sup> Biomaterials track

<sup>11</sup> Bioinstrumentation track

<sup>12</sup> ENGL 3140 may substitute.

<sup>13</sup> At least one course selected from selected from BIOL 4010, 4080, 4200, 4400, 4530, 4590, 4750, 4800, 4830, 4840, MICR 4140, or 4170

<sup>14</sup> At least one course selected from BIOL 4100, 4410, 4420, 4430, 4460, 4480, 4700, MICR 4010, or 4030.

<sup>15</sup> Students may take additional graduate courses during this semester. Total graduate courses completed as an undergraduate may not exceed twelve credit hours. See advisor.

**2020/2021 B.S. BIOLOGICAL SCIENCES/M.S. BIOENGINEERING WORKSHEET**

<b>BIOL Core Requirement: (29 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	4(3,3) <sup>1</sup>	_____
BIOL 1110/1111	4(3,3) <sup>1</sup>	_____
BIOL 3350	3(3,0)	_____
BIOL 4610	3(3,0)	_____
BIOL 4620/4621	2(1,2)	_____
BIOL 4930 OR MICR 4930	2(2,0)	_____
<b>Organismal Diversity Requirement (4 cr.)</b>		
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070, OR 4250/4260	_____	_____
<b>Ecology (3 cr.)</b>		
BIOL 4100, 4410, 4420, 4430, 4460, 4480, 4700, MICR 4010, OR 4030	_____	_____
<b>Functional Biology Requirement (3 cr.)</b>		
BIOL 4010, 4080, 4200, 4400, 4530, 4590, 4750, 4800, 4830, 4840, MICR 4140 OR 4170	_____	_____
<b>Major Requirement: (21 cr.)</b> <sup>2</sup>		
Laboratory course req. BIOL 3151 (0)	_____	_____
Laboratory Course req.	_____	_____
Laboratory Course req.	_____	_____
BIOL 3150 (4)	_____	_____
MATH 2060 (4) <sup>3</sup>	_____	_____
MATH 2080 (4) <sup>3</sup>	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
<b>Required Science Courses (34 cr.)</b>		
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) <sup>4</sup>	_____
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)	_____
<b>Required Non-Science Courses (21 cr.)</b>		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) <sup>5</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>5,6</sup>	_____
Oral Communication Requirement	3(3,0) <sup>5</sup>	_____
Social Sciences	_____	_____
_____	3(3,0) <sup>5,6</sup>	_____
_____	3(3,0) <sup>5,6</sup>	_____

- <sup>1</sup> 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.
- <sup>2</sup> Twenty-one credit hours from 3000-level or higher BIOL or MICR courses (except MICR 3000) or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Selections must include 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.
- <sup>3</sup> Requires course substitution.
- <sup>4</sup> Most medical and dental schools require two semesters of organic chemistry with laboratory (CH 2230, 2270 and 2240, 2280), rather than a one semester survey of organic chemistry (CH 2010/2020)
- <sup>5</sup> See General Education Requirements.
- <sup>6</sup> Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- <sup>7</sup> Biomaterials track. See advisor if this course is not available.
- <sup>8</sup> Bioinstrumentation track
- <sup>9</sup> Used to satisfy both the BS and MS requirements (6 credits total).
- <sup>10</sup> Requires prerequisite override from Civil Engineering

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

<b>Electives (15 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOE 3200 <sup>7</sup> (3) OR BIOE 3700 <sup>8</sup> (3)	_____	_____
BIOE 6400 <sup>9</sup> (3)	_____	_____
CE 2010 (3) <sup>10</sup>	_____	_____
MSE 2100 (3) <sup>7</sup> OR ECE 2070 (2) <sup>8</sup> and ECE 2080 (1)	_____	_____
BIOE, BIOL OR BCHM 6xxx <sup>9</sup> (3)	_____	_____

## B.A. BIOLOGICAL SCIENCES 2020-2021

### FRESHMAN YEAR

<u>First Semester</u>	<u>Second Semester</u>
BIOL 1010 Frontiers in Biol. I <sup>1</sup> ..... 1(1,0)	BIOL 1110 Prin. of Biol. II <sup>2</sup> ..... 4(3,3)
BIOL 1100 Prin. of Biol. I <sup>2</sup> ..... 4(3,3)	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 <sup>4</sup> ..... 3
Oral Communication Requirement <sup>3</sup> ..... 3	14
16	

### SOPHOMORE YEAR

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

### JUNIOR YEAR

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

### SENIOR YEAR

BIOL 4930 Senior Seminar <sup>16</sup> or ..... 2(2,0)	PHYS 2080 General Physics II <sup>19</sup> ..... 3(3,0)
MICR 4930 Senior Seminar <sup>16</sup> ..... 2(2,0)	PHYS 2100 General Physics II Lab <sup>19</sup> ..... 1(0,2)
PHYS 2070 General Physics I <sup>17</sup> ..... 3(3,0)	Minor Requirement <sup>14</sup> ..... 6
PHYS 2090 General Physics I Lab <sup>17</sup> ..... 1(0,2)	Elective ..... 4
Functional Biology Requirement <sup>18</sup> ..... 3	14
Social Science Requirement <sup>9</sup> ..... 3	
12	

**Total Semester Hours = 120**

<sup>1</sup> Students seeking a double major in Science Teaching/Biological Sciences should substitute ED 1050 for BIOL 1010.

<sup>2</sup> 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.

<sup>3</sup> See General Education Requirements.

<sup>4</sup> MATH 1080, STAT 2300, or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements. Statistics will be useful in either graduate study or professional school.

<sup>5</sup> Most professional health sciences schools require the second semester of organic chemistry with laboratory, CH 2240/2280.

<sup>6</sup> CH 2010 and CH 2020 may be substituted.

<sup>7</sup> GEN 3020 may be substituted.

<sup>8</sup> Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement in Academic Regulations.

<sup>9</sup> 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.

<sup>10</sup> BCHM 3010 may be substituted.

<sup>11</sup> Four credit hours must be selected from BIOL or MICR courses at the 3000-level or above (except MICR 3000) or from CH 2240/2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Students seeking a double major in Science Teaching/Biological Sciences should substitute EDSC 4470 for the Major Requirement.

<sup>12</sup> At least one lecture and associated laboratory selected from BIOL 3010/BIOL 3011, BIOL 3020/BIOL 3060, BIOL 3030/BIOL 3070, BIOL 3040/BIOL 3080, BIOL 3200/BIOL 3201, BIOL 4060/BIOL 4070, BIOL 4250/BIOL 4260.

<sup>13</sup> ENGL 3140 may be substituted.

<sup>14</sup> See Minors.

<sup>15</sup> At least one course selected from BIOL 4100, BIOL 4410, BIOL 4420, BIOL 4430, BIOL 4460, BIOL 4480, BIOL 4700, MICR 4010, or MICR 4030.

<sup>16</sup> Students seeking a double major in Science Teaching/Biological Sciences should substitute EDSC 4570 for BIOL 4930 or MICR 4930.

<sup>17</sup> PHYS 1220/1240 may be substituted.

<sup>18</sup> At least one course selected from selected from BIOL 3160, BIOL 4010, BIOL 4080, BIOL 4200, BIOL 4400, BIOL 4530, BIOL 4590, BIOL 4750, BIOL 4800, BIOL 4830, BIOL 4840, MICR 4140 or MICR 4170.

<sup>19</sup> PHYS 2210/2230 may be substituted.

**2020/2021 B.A. BIOLOGICAL SCIENCES CURRICULUM**

<b>BIOL Core Requirement: (29 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0) <sup>1</sup>	_____
BIOL 1100/1101	4(3,3) <sup>2</sup>	_____
BIOL 1110/1111	4(3,3) <sup>2</sup>	_____
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 4100, 4410, 4420, 4430, 4460, 4480, 4700, MICR 4010, OR 4030		_____
<i>Functional Biology Requirement (3 cr.)</i> <sup>3</sup>		
BIOL 3160/3161, 4010, 4080, 4200, 4400, 4530, 4590, 4750, 4800, 4830, 4840, MICR 4140 OR MICR 4170		_____
<b>Major Requirement: (4 cr.)</b> <sup>4</sup>		
_____	_____	_____
<b>Required Science Courses (33 cr.)</b>		
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) <sup>5</sup>	_____
GEN 3000 (OR 3020)	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080 OR STAT 2300	4(4,0) 3(3,0) <sup>6</sup>	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) <sup>7</sup>	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) <sup>7</sup>	_____
<b>Required Non-Science Courses (35 cr.)</b>		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) <sup>8</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>8,9</sup>	_____
Modern Language	4(3,1) <sup>10</sup>	_____
Modern Language	4(3,1) <sup>10</sup>	_____
Modern Language	3(3,0) <sup>10</sup>	_____
Modern Language	3(3,0) <sup>10</sup>	_____
Oral Communication Requirement	3(3,0) <sup>8</sup>	_____
Social Sciences		_____
_____	3(3,0) <sup>8,9,11</sup>	_____
_____	3(3,0) <sup>8,9,11</sup>	_____
<b>Minor Courses (15 cr.)</b> <sup>12</sup>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

- <sup>1</sup> Students seeking a double major in Science Teaching and Biological Sciences should substitute ED 1050 for BIOL 1010.
- <sup>2</sup> 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.
- <sup>3</sup> Credit hours above 3 will be used for Major Requirement credits.
- <sup>4</sup> Four credit hours must be selected from BIOL or MICR courses at the 3000 level or above (except MICR 3000) or CH 2240/CH 2280, ETOX 4300, ETOX 4370, WFB 4720, or WFB 4770. Students seeking a double major in Science Teaching/Biological Sciences should substitute EDSC 4470 for the Major Requirement.
- <sup>5</sup> Most medical, dental, and veterinary medicine schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- <sup>6</sup> Statistics will be useful in both graduate school and professional school.
- <sup>7</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).
- <sup>8</sup> See General Education Requirements.
- <sup>9</sup> Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- <sup>10</sup> Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement in Academic Regulations.
- <sup>11</sup> The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.
- <sup>12</sup> Minors as listed 2020-2021 Undergraduate Catalog.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

<b>Electives (4 cr.)</b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**B. A. BIOLOGICAL SCIENCES 2020-2021  
PRE-REHABILITATION SCIENCES EMPHASIS**

**FRESHMAN YEAR**

First Semester

Second Semester

BIOL 1010 Frontiers in Biol. I..... 1(1,0)	BIOL 1110 Prin. of Biol. II <sup>1</sup> ..... 4(3,3)
BIOL 1100 Prin. of Biol. I <sup>1</sup> ..... 4(3,3)	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)	Statistics Requirement <sup>3</sup> ..... <u>3</u>
Oral Communication Requirement <sup>2</sup> ..... <u>3</u>	14
16	

**SOPHOMORE YEAR— See Footnote 11**

CH 2230 Organic Chemistry <sup>4,5</sup> ..... 3(3,0)	BCHM 3050 Essential Elements of Bioch. <sup>9</sup> ..... 3(3,0)
CH 2270 Organic Chemistry Lab <sup>4,5</sup> ..... 1(0,3)	PSYC 2010 Introduction to Psychology ..... 3(3,0)
GEN 3000 Fundamental Genetics <sup>6</sup> ..... 3(3,0)	Arts and Humanities (Literature) Req. <sup>2</sup> ..... 3
Modern Language Requirement <sup>7</sup> ..... 4	Modern Language Requirement <sup>7</sup> ..... 4
Organismal Diversity Requirement <sup>8</sup> ..... <u>4</u>	Social Science Requirement <sup>10</sup> ..... <u>3</u>
15	16

**JUNIOR YEAR**

BIOL 3150 Functional Human Anatomy <sup>11</sup> ... 4(3,3)	BIOL 3160 Human Physiology <sup>11</sup> ..... 4(3,3)
BIOL 3350 Evolutionary Biology ..... 3(3,0)	Arts and Humanities (Non-Lit) Req. <sup>10</sup> ..... 3
BIOL 4610 Cell Biology ..... 3(3,0)	Modern Language Requirement <sup>7</sup> ..... 3
BIOL 4620 Cell Biology Laboratory ..... 2(1,2)	Minor Requirement <sup>12</sup> ..... <u>6</u>
Modern Language Requirement <sup>7</sup> ..... <u>3</u>	16
15	

**SENIOR YEAR**

BIOL 4930 Senior Seminar <b>or</b>	PHYS 2080 General Physics II <sup>16</sup> ..... 3(3,0)
MICR 4930 Senior Seminar ..... 2(2,0)	PHYS 2100 General Physics II Lab <sup>16</sup> ..... 1(0,2)
ENGL 3150 Scientific Writing and Comm <sup>13</sup> 3(3,0)	Minor Requirement <sup>12</sup> ..... 6
PHYS 2070 General Physics I <sup>14</sup> ..... 3(3,0)	Elective <sup>17</sup> ..... <u>3</u>
PHYS 2090 General Physics I Lab <sup>14</sup> ..... 1(0,2)	13
Ecology Requirement <sup>15</sup> ..... 3	
Minor Requirement <sup>12</sup> ..... <u>3</u>	
15	

**Total Semester Hours = 120**

- <sup>1</sup> 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.
- <sup>2</sup> See General Education Requirements.
- <sup>3</sup> STAT 2300 or STAT 3090
- <sup>4</sup> CH 2010 and CH 2020 may be substituted.
- <sup>5</sup> Most professional health sciences schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- <sup>6</sup> GEN 3020 may be substituted.
- <sup>7</sup> Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement in Academic Regulations.
- <sup>8</sup> At least one lecture and associated laboratory selected from BIOL 3010/BIOL 3011, BIOL 3020/BIOL 3060, BIOL 3030/BIOL 3070, BIOL 3040/BIOL 3080, BIOL 3200/BIOL 3201, BIOL 4060/BIOL 4070, BIOL 4250/BIOL 4260.
- <sup>9</sup> BCHM 3010 may be substituted.
- <sup>10</sup> See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and the Science and Technology in Society Requirements.
- <sup>11</sup> Students applying to professional schools that require a course in exercise physiology may substitute BIOL 2220 and BIOL 2230 for BIOL 3150 and BIOL 3160 during their sophomore year.
- <sup>12</sup> See Minors. Psychology is recommended. The Medical University of South Carolina and other Rehabilitation Sciences programs require PSYC 2010 and PSYC 3830.
- <sup>13</sup> ENGL 3140 may be substituted.
- <sup>14</sup> PHYS 1220/1240 may be substituted.
- <sup>15</sup> At least one course selected from BIOL 4100, BIOL 4410, BIOL 4420, BIOL 4430, BIOL 4460, BIOL 4480, BIOL 4700, MICR 4010, or MICR 4030.
- <sup>16</sup> PHYS 2210/2230 may be substituted.
- <sup>17</sup> Students should select courses that 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 or lifespan development courses. MICR 3050 is recommended for those applying to Physician Assistant programs.

**2020/2021 B.A. BIOLOGICAL SCIENCES CURRICULUM – PRE-REHABILITATION SCIENCES EMPHASIS**  
**Occupational Therapy (OT), Physical Therapy (PT), Speech Disorders, and Physician Assistant (PA)**

<b>BIOL Core Requirement: (34 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	4(3,3) <sup>1</sup>	_____
BIOL 1110/1111	4(3,3) <sup>1</sup>	_____
BIOL 3150/3151	4(3,3) <sup>2</sup>	_____
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 4100, 4410, 4420, 4430, 4460, 4480, 4700, MICR 4010, OR 4030		_____
<i>Functional Biology Requirement (4 cr.)</i> <sup>2</sup>		
BIOL 3160/3161		_____
<b>Required Science Courses (33 cr.)</b>		
BCHM 3050	3(3,0) <sup>3</sup>	_____
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) <sup>4,5</sup>	_____
GEN 3000	3(3,0) <sup>6</sup>	_____
MATH 1060	4(4,0)	_____
PHYS 2070, 2090	3(3,0) & 1(0,2) <sup>7</sup>	_____
PHYS 2080, 2100	3(3,0) & 1(0,2) <sup>7</sup>	_____
STAT 2300	3(3,0) <sup>8</sup>	_____
<b>Required Non-Science Courses (35 cr.)</b>		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	3(3,0)	_____
Arts & Humanities – Literature	3(3,0) <sup>9</sup>	_____
Arts & Humanities – Non-Literature	3(3,0) <sup>9,10</sup>	_____
Modern Language	4(3,1) <sup>11</sup>	_____
Modern Language	4(3,1) <sup>11</sup>	_____
Modern Language	3(3,0) <sup>11</sup>	_____
Modern Language	3(3,0) <sup>11</sup>	_____
Oral Communication Requirement	3(3,0) <sup>8</sup>	_____
Social Sciences		_____
PSYC 2010	3(3,0)	_____
	3(3,0) <sup>9,10,12</sup>	_____

<b>Minor Courses (15 cr.)</b> <sup>13</sup>	<b>SEM/Yr</b>	<b>Grade</b>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

- <sup>1</sup> 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.
- <sup>2</sup> 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 BIOL 2230 for BIOL 3150 and BIOL 3160 during their sophomore year **if BIOL 4780 Exercise Physiology is not offered during their senior year.**
- <sup>3</sup> BCHM 3010 may be substituted.
- <sup>4</sup> Most professional health science schools require two semesters of organic chemistry with laboratory, CH 2230/2270 and 2240/2280.
- <sup>5</sup> CH 2010 and CH 2020 may be substituted.
- <sup>6</sup> GEN 3020 may be substituted.
- <sup>7</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).
- <sup>8</sup> STAT 2300 or STAT 3090
- <sup>9</sup> See General Education Requirements.
- <sup>10</sup> Six of these credit hours may also satisfy the Cross-Cultural Awareness (CCA) and Science and Technology in Society Requirements (STS).
- <sup>11</sup> Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement in Academic Regulations.
- <sup>12</sup> The Medical Colleges Admissions Test (MCAT) includes questions on psychology and sociology.
- <sup>13</sup> Minors as listed 2020-2021 Undergraduate Catalog.
- <sup>14</sup> **Students should select courses that 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 and ECON 2000 or 2110 or 2120 are recommended for Physician Assistant programs.**
- ★**Note.** Entrance requirements vary by institution and should be verified individually.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000 _____	_____	_____
CCA _____	_____	_____
STS _____	_____	_____
<b>Electives (3 cr.)</b> <sup>14</sup>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

# B.A. BIOLOGICAL SCIENCES & B.A. SCIENCE TEACHING: BIOLOGICAL SCIENCES 2020-2021

## FRESHMAN YEAR

### First Semester

BIOL 1030 General Biology I <b>and</b> .....	3(3,0)
BIOL 1050 General Biology Laboratory I <b>or</b> .....	1(0,3)
BIOL 1100 Principles of Biology I .....	4(3,3)
CH 1010 General Chemistry.....	4(3,3)
ENGL 1030 Composition and Rhetoric.....	3(3,0)
MATH 1060 Calculus of One Variable I.....	4(4,0)
Modern Language Requirement <sup>1</sup> .....	<u>3(3,0)</u>
	18

### Second Semester

BIOL 1040 General Biology II <b>and</b> .....	3(3,0)
BIOL 1060 General Biology Laboratory II <b>or</b> .....	1(0,3)
BIOL 1110 Principles of Biology II .....	4(3,3)
CH 1020 General Chemistry.....	4(3,3)
ED 1050 Orientation to Education.....	2(2,0)
Modern Language Requirement <sup>1</sup> .....	3(3,0)
Statistics Requirement <sup>2</sup> .....	<u>3(3,0)</u>
	16

## SOPHOMORE YEAR

CH 2010 Survey of Organic Chemistry <b>and</b> .....	3(3,0)
CH 2020 Survey of Organic Chem. Lab.....	1(0,3)
HIST 1220 History, Technology and Society <b>or</b>	
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 <sup>3</sup> .....	3
Biochemistry or Genetics Requirement <sup>4</sup> .....	<u>3</u>
	17

ED 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 <sup>4</sup> .....	3
Organismal Diversity Requirement <sup>5</sup> .....	<u>4</u>
	17

## JUNIOR YEAR

ANTH 2010 Introduction to Anthropology <b>or</b>	
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 <sup>6</sup> .....	<u>3</u>
	17

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 <sup>7</sup> .....	<u>3</u>
	15

## SENIOR YEAR

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

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

**Total Semester Hours = 127**

<sup>1</sup> Students must complete through 2020 in a modern language. See Modern Languages Requirement at Clemson University statement in [Academic Regulations](#).

<sup>2</sup> STAT 2300 or 3090

<sup>3</sup> See General Education Requirements

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

<sup>5</sup> 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.

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

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

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

<sup>9</sup> EDSC 4470 and EDSC 4570 must be taken concurrently. Students completing the coursework for the Teacher Certification Emphasis Area must complete the above coursework and meet all requirements for enrollment in professional courses, apply for directed teaching/teaching internship, and meet all requirements for recommendation for initial licensure as stated in the Undergraduate Catalog under Teacher Education Programs. Must be taken the spring semester of the senior year.

**2020/2021 B.A. BIOLOGICAL SCIENCES & SCIENCE TEACHING: BIOLOGICAL SCIENCES**

		<b>SEM/Yr</b>	<b>Grade</b>		
<b>BIOL Core Requirement: (29 cr.)</b>					
BIOL 1030/1050 <b>OR</b>	3(3,0) & 1(0,3)	_____	_____	<sup>1</sup> 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.	
BIOL 1100/1101	4(3,3)	_____	_____		
BIOL 1040/1060 <b>OR</b>	3(3,0) & 1(0,3)	_____	_____		
BIOL 1110/1111	4(3,3)	_____	_____		
BIOL 3350	3(3,0)	_____	_____		
BIOL 4610	3(3,0)	_____	_____		
BIOL 4620/4621	2(1,2)	_____	_____		
BIOL 4820	3(1,6)	_____	_____		
<b>Organismal Diversity Requirement (4 cr.)</b>					<sup>2</sup> Students may choose to take physics with calculus, PHYS 1220, 1240 & PHYS 2210, 2230 (MATH 1080 pre-req).
BIOL 3010/3011, 3020/3060, 3030/3070, 3040/3080, 3200/3201, 4060/4070 <b>OR</b> 4250/4260		_____	_____		
<b>Ecology (3 cr.)</b>				<sup>3</sup> Two semesters (through 2020) in any modern language. See Modern Languages Requirement at Clemson University statement in <a href="#">Academic Regulations</a> .	
BIOL 4410, 4420, 4430, 4460, 4700 <b>OR</b> MICR 4010		_____	_____		
<b>Functional Biology Requirement (3 cr.)</b>				<sup>4</sup> See General Education Requirements.	
BIOL 3160, 4010, 4080, 4530, 4590, 4750, <b>OR</b> 4800		_____	_____		
<b>Required Science Courses (33 cr.)</b>				<sup>5</sup> To be taken the semester prior to EDSC 4470 and 4570. EDSC 4270 and EDLT 4980 must be taken concurrently.	
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) <sup>1</sup>	_____	_____		
GEN 3000	3(3,0)	_____	_____		
MATH 1060	4(4,0)	_____	_____		
STAT 2300 <b>OR</b> 3090	3(3,0)	_____	_____		
PHYS 2070, 2090	3(3,0) & 1(0,2) <sup>2</sup>	_____	_____		
PHYS 2080, 2100	3(3,0) & 1(0,2) <sup>2</sup>	_____	_____		
<b>Req. Non-Science Courses (27 cr.)</b>				<sup>6</sup> EDSC 4470 and EDSC 4570 must be taken concurrently. Offered spring semester only.	
ENGL 1030/1031	3(3,1)	_____	_____		
ENGL 3150	3(3,0)	_____	_____		
ENGL 2120, 2130, 2140, <b>OR</b> 2150 (Modern Language)	3(3,0)	_____	_____		
(Modern Language)	4(3,1) <sup>3</sup>	_____	_____		
(Modern Language)	4(3,1) <sup>3</sup>	_____	_____		
Modern Language	3(3,0) <sup>3</sup>	_____	_____		
Modern Language	3(3,0) <sup>3</sup>	_____	_____		
ANTH 2010 <b>OR</b> GEOG 1030 - CCA	3(3,0)	_____	_____		
HIST 1220 <b>OR</b> HIST 1240 – STS	3(3,0)	_____	_____		
Arts & Humanities – Non-Literature Oral Communication Requirement	3(3,0) <sup>4</sup>	_____	_____		
<b>Education Courses (38 cr.)</b>					
ED 1050	2(2,0)	_____	_____		
ED 3010	3(3,0)	_____	_____		
EDF 3020	3(3,0)	_____	_____		
EDF 3350	3(3,0)	_____	_____		
EDLT 4800	3(3,0)	_____	_____		
EDLT 4980	3(2,2) <sup>5</sup>	_____	_____		
EDSC 3270	3(3,0)	_____	_____		
EDSC 4270	3(2,2) <sup>5</sup>	_____	_____		
EDSC 4470	9(0,27) <sup>6</sup>	_____	_____		
EDSC 4570	3(2,3) <sup>6</sup>	_____	_____		
EDSP 3700	3(3,0)	_____	_____		

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU1000	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## B. S. MICROBIOLOGY 2020-2021<sup>a</sup>

### FRESHMAN YEAR

#### First Semester

BIOL 1010 Frontiers in Biol. I.....	1(1,0)
BIOL 1100 Prin. of Biol. I <sup>1</sup> .....	4(3,3)
CH 1010 General Chemistry .....	4(3,3)
MATH 1060 Calculus of One Var. I .....	4(4,0)
Oral Communication Requirement <sup>2</sup> .....	<u>3</u>

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#### Second Semester

BIOL 1110 Prin. of Biol. II <sup>1</sup> .....	4(3,3)
CH 1020 General Chemistry .....	4(3,3)
ENGL 1030 Composition and Rhetoric .....	3(3,1)
Mathematical Sciences Requirement <sup>3</sup> .....	<u>3</u>

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### SOPHOMORE YEAR

CH 2230 Organic Chemistry .....	3(3,0)
CH 2270 Organic Chemistry Lab .....	1(0,3)
<b>MICR 3050 (MICR Majors)<sup>4</sup></b> .....	4(3,3)
Arts and Humanities (Literature) Req. <sup>2</sup> .....	3
Social Science Requirement <sup>5</sup> .....	<u>3</u>

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BCHM 3050 Essential Elements of Bioch <sup>6</sup> .....	3(3,0)
CH 2240 Organic Chemistry .....	3(3,0)
CH 2280 Organic Chemistry Lab.....	1(0,3)
GEN 3000 Fundamental Genetics <sup>7</sup> .....	3(3,0)
<b>MICR 3070 Microbial Diversity</b> .....	<b>4(3,3)</b>
Arts and Humanities (Non-Lit) Req. <sup>5</sup> .....	<u>3</u>

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### JUNIOR YEAR

ENGL 3150 Scientific Writing and Comm <sup>8</sup> .....	3(3,0)
<b>MICR 4010 Microbial Diversity and Ecol</b> ....	<b>3(3,0)</b>
PHYS 2070 General Physics I <sup>9</sup> .....	3(3,0)
PHYS 2090 General Physics Lab I <sup>9</sup> .....	1(0,3)
Microbiology Requirement <sup>10</sup> .....	<u>6</u>

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<b>MICR 4120 Bacterial Physiology</b> .....	<b>3(3,0)</b>
<b>MICR 4500 Advanced Micro Lab I</b> .....	<b>2(1,2)</b>
Microbiology Requirement <sup>10</sup> .....	3 (3,0)
Social Science Requirement <sup>5</sup> .....	3
Elective <sup>11,12</sup> .....	<u>3</u>

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### SENIOR YEAR

BIOL 4340 Bio. Chem. Lab Techniques <sup>13</sup> .....	2(1,2)
BIOL 4610 Cell Biology .....	3(3,0)
<b>MICR 4150 Microbial Genetics</b> .....	<b>3(3,0)</b>
<b>MICR 4510 Advanced Micro Lab II</b> .....	<b>2(1,2)</b>
Virology Requirement <sup>14</sup> .....	3
Elective <sup>11</sup> .....	<u>3</u>

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BIOL 4930 Senior Seminar <b>or</b>	
MICR 4930 Senior Seminar.....	2(2,0)
<b>MICR 4520 Advanced Micro Lab III</b> .....	<b>2(1,2)</b>
Microbiology Requirement <sup>10</sup> .....	3
Elective <sup>5</sup> .....	<u>6</u>

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**Total Semester Hours = 120**

<sup>a</sup> **Bolded courses must be taken in the sequence listed above to ensure a punctual graduation.**

<sup>1</sup> 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.

<sup>2</sup> See General Education Requirements.

<sup>3</sup> MATH 1080 or STAT 2300 or other approved coursework. See advisor. Medical and dental schools have different mathematics requirements. Statistics will be useful in either graduate study or professional school.

<sup>4</sup> Enroll in the section of this course specifically for microbiology majors.

<sup>5</sup> 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.

<sup>6</sup> BCHM 3010 may be substituted.

<sup>7</sup> GEN 3020 may be substituted.

<sup>8</sup> ENGL 3140 may be substituted.

<sup>9</sup> PHYS 1220/1240 may be substituted.

<sup>10</sup> See advisor. Minimum of 12 credits is required. At least one course must be selected from each of the following fields:

*Biomedicine*—BIOL 4200, BIOL 4560, BIOL 4670, BIOL 4840, BIOL 4890, HLTH 3800, MICR 4000, MICR 4050, MICR 4110, MICR 4140, MICR 4170, MICR 4180, MICR 4190, MICR 4240

*Environmental*—BIOL 4250, MICR 4020, MICR 4030, MICR 4100

*Food Safety, Industrial, and Technology*—BCHM 4400, BIOL 4030, BIOL 4870, MICR 4070, MICR 4130

Remaining credits can be satisfied by any 4000 MICR course, any of the above listed courses or any of the following: BIOL 3150, BIOL 3160, BIOL 3940, BIOL 4910, BIOL 4940, MICR 3940

<sup>11</sup> Elective hours may be used toward satisfying the requirements of a minor.

<sup>12</sup> Students planning on applying to medical/dental schools should take PHYS 2080 and 2100 during the second semester junior year.

<sup>13</sup> BIOL 4620 may be substituted..

<sup>14</sup> BIOL 4540 or MICR 4160.

**2020/2021 B.S. MICROBIOLOGY CURRICULUM**

<b>MICR Core Requirement: (34 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	4(3,3) <sup>1</sup>	_____
BIOL 1110/1111	4(3,3) <sup>1</sup>	_____
MICR 3050/3051 (Fall, SO)	4(3,3)	_____
MICR 3070 (Sp., SO)	4(3,3)	_____
MICR 4010 (Fall., JR)	3(3,0)	_____
MICR 4120 (Sp., JR)	3(3,0)	_____
MICR 4150 (Fall, 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)	_____
<b>MICR Requirement: (12 cr.)<sup>2</sup></b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

<b>Virology Requirement (3 cr.)<sup>3</sup></b>		
_____	_____	_____

<b>Required Science Courses (38 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BCHM 3050 OR 3010	3(3,0)	_____
BIOL 4340/4341 OR BIOL 4620	2(1,2)	_____
BIOL 4610	3(3,0)	_____
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 OR 3020	3(3,0)	_____
MATH 1060	4(4,0)	_____
MATH 1080	4(4,0)	_____
OR STAT 2300	3(3,0) <sup>4</sup>	_____
PHYS 2070, 2090	3(3,0), 1(0,2) <sup>5,6</sup>	_____

<b>Required Non-Science Courses (21 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 OR 3140	(3 cr.)	_____
Arts & Humanities – Literature	3(3,0) <sup>7</sup>	_____
Arts & Humanities – Non-Lit	3(3,0) <sup>7,8</sup>	_____
Oral Communication Req.	3(3,0) <sup>7</sup>	_____
Social Sciences		
_____	3(3,0) <sup>7,8</sup>	_____
_____	3(3,0) <sup>7,8</sup>	_____

- <sup>1</sup> 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.
- <sup>2</sup> 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, HLTH 3800, MICR 4000, 4050, 4110, 4140, 4170, 4180, 4190, 4240  
*Environmental:* BIOL 4250, MICR 4020, 4030, 4100  
*Food Safety, Industrial, and Technology:* BCHM 4400, BIOL 4030, 4870, MICR 4070, 4130.
- Remaining credits can be satisfied by any 4000-level MICR course, any of the above listed courses, or any of the following: BIOL 3150, 3160, 3940, 4910, 4940, MICR3940
- <sup>3</sup> BIOL 4540 OR MICR 4160
- <sup>4</sup> Statistics will be useful in both graduate school and professional school.
- <sup>5</sup> PHYS 1220, 1240 may be substituted.
- <sup>6</sup> Students planning on applying to medical/dental schools should take PHYS 2080/2100 or 2210/2230 (MATH 1080 pre-req). during the second semester junior year.
- <sup>7</sup> See General Education Requirements.
- <sup>8</sup> 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.
- <sup>9</sup> Elective hours may be used toward satisfying the requirements of a minor.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____
<b>Electives (12 cr.)<sup>9</sup></b>		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**B. S. MICROBIOLOGY 2020-2021  
BIOMEDICINE CONCENTRATION <sup>a</sup>**

**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 <sup>1</sup> ..... 4(3,3)
BIOL 1100 Prin. of Biol. I <sup>1</sup> ..... 4(3,3)	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 <sup>3</sup> ..... <u>3</u>
Oral Communication Requirement <sup>2</sup> ..... <u>3</u>	14
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**SOPHOMORE YEAR**

CH 2230 Organic Chemistry ..... 3(3,0)	BCHM 3050 Essential Elements of Bioch <sup>6</sup> ..... 3(3,0)
CH 2270 Organic Chemistry Lab ..... 1(0,3)	CH 2240 Organic Chemistry ..... 3(3,0)
<b>MICR 3050 (MICR Majors) <sup>4</sup></b> ..... <b>4(3,3)</b>	CH 2280 Organic Chemistry Lab ..... 1(0,3)
Arts and Humanities (Literature) Req. <sup>2</sup> ..... 3	GEN 3000 Fundamental Genetics <sup>7</sup> ..... 3(3,0)
Social Science Requirement <sup>5</sup> ..... <u>3</u>	<b>MICR 3070 Microbial Diversity</b> ..... <b>4(3,3)</b>
14	Arts and Humanities (Non-Lit) Req. <sup>5</sup> ..... <u>3</u>
	17

**JUNIOR YEAR**

BIOL 4610 Cell Biology ..... 3(3,0)	ENGL 3150 Scientific Writing and Comm <sup>10</sup> ..... 3(3,0)
BIOL 4620 Cell Biology Lab ..... 2(1,2)	<b>MICR 4120 Bacterial Physiology</b> ..... <b>3(3,0)</b>
<b>MICR 4010 Microbial Ecology &amp; Diver</b> ... 3(3,0)	<b>MICR 4500 Advanced Micro Lab I</b> ..... <b>2(1,2)</b>
PHYS 2070 General Physics I <sup>8</sup> ..... 3(3,0)	PHYS 2080 General Physics II <sup>11</sup> ..... 3(3,0)
PHYS 2090 General Physics Lab I <sup>8</sup> ..... 1(0,3)	PHYS 2100 General Physics II Lab <sup>11</sup> ..... 1(0,2)
Biomedicine Requirement <sup>9</sup> ..... <u>3</u>	Social Science Requirement <sup>5</sup> ..... <u>3</u>
15	15

**SENIOR YEAR**

<b>MICR 4140 Basic Immunology</b> ..... <b>3(3,0)</b>	BIOL 4930 Senior Seminar <b>or</b>
<b>MICR 4150 Microbial Genetics</b> ..... <b>3(3,0)</b>	MICR (BIOL) 4930 Senior Seminar ..... 2(2,0)
<b>MICR 4160 Introductory Virology</b> ..... <b>3(3,0)</b>	<b>MICR 4520 Advanced Micro Lab III</b> ..... <b>2(1,2)</b>
<b>MICR 4510 Advanced Micro Lab II</b> ..... <b>2(1,2)</b>	Biomedicine Requirement <sup>9</sup> ..... 3
Biomedicine Requirement <sup>9</sup> ..... <u>3</u>	<b>Pathogenic Requirement<sup>12</sup></b> ..... 3
14	Elective..... <u>5</u>
	15

**Total Semester Hours = 120**

<sup>a</sup> **Bolded courses must be taken in the sequence listed above to ensure a punctual graduation.**

<sup>1</sup> 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.

<sup>2</sup> See General Education Requirements.

<sup>3</sup> MATH 1080 or STAT 2300 or other approved coursework. See advisor. Medical/dental schools have different mathematics requirements. Statistics will be useful in either graduate study or professional school.

<sup>4</sup> Enroll in section for microbiology majors.

<sup>5</sup> 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.

<sup>6</sup> BCHM 3010 may be substituted.

<sup>7</sup> GEN 3020 may be substituted.

<sup>8</sup> PHYS 1220/1240 may be substituted.

<sup>9</sup> See advisor. A minimum of 9 hours is required, selected from BCHM 4320, BCHM 4400, BIOL 3150, BIOL 3160, BIOL 3940, BIOL 4030, BIOL 4200, BIOL 4250, BIOL 4340, BIOL 4560, BIOL 4670, BIOL 4840, BIOL 4890, BIOL 4910, BIOL 4940, BIOL 4950, HLTH 3800, MICR 3940, MICR 4000, MICR 4050, MICR 4170, MICR 4190, MICR 4910, MICR 4940, MICR 4950.

<sup>10</sup> ENGL 3140 may substitute.

<sup>11</sup> PHYS 2210/2230 may be substituted.

<sup>12</sup> MICR 4110 or MICR 4180.

**2020/2021 B.S. MICROBIOLOGY - BIOMEDICINE CONCENTRATION CURRICULUM**

<b>MICR Core Requirement: (40 cr.)</b>	<b>SEM/Yr</b>	<b>Grade</b>
BIOL 1010	1(1,0)	_____
BIOL 1100/1101	4(3,3) <sup>1</sup>	_____
BIOL 1110/1111	4(3,3) <sup>1</sup>	_____
MICR 3050/3051 (Fall, SO)	4(3,3)	_____
MICR 3070 (Sp., SO)	4(3,3)	_____
MICR 4010 (Fall, JR)	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, SR)	3(3,0)	_____
MICR 4500/4501 (Sp., JR)	2(1,2)	_____
MICR 4510/4511 (Fall, SR)	2(1,2)	_____
MICR 4520/4511 (Fall, SR)	2(1,2)	_____
MICR 4930 (or BIOL 4930)	2(2,0)	_____
<b>Biomedicine Requirement (9 cr.)<sup>2</sup></b>		
_____		
_____		
_____		

<b>Pathogenic Requirement (3 cr.)<sup>3</sup></b>		
_____		
_____		
_____		
<b>Required Science Courses (42 cr.)</b>		
BCHM 3050 OR 3010	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) <sup>4</sup>	_____
MATH 1060	4(4,0)	_____
MATH 1080	4(4,0)	_____
OR STAT 2300	3(3,0) <sup>5</sup>	_____
PHYS 2070, 2090	3(3,0), 1(0,2) <sup>6</sup>	_____
PHYS 2080, 2100	3(3,0), 1(0,2) <sup>7</sup>	_____

<b>Required Non-Science Courses (21 cr.)</b>		
ENGL 1030/1031	3(3,1)	_____
ENGL 3150 or 3140	3(3,1)	_____
Arts & Humanities – Literature	3(3,0) <sup>8</sup>	_____
Arts & Humanities – Non-Lit	3(3,0) <sup>8,9</sup>	_____
Oral Communication Req.	3(3,0) <sup>8</sup>	_____
Social Sciences		_____
_____	3(3,0) <sup>8,9</sup>	_____
_____	3(3,0) <sup>8,9</sup>	_____

<b>Electives (5 cr.)<sup>9</sup></b>		
_____		
_____		
_____		
_____		
_____		
_____		
_____		

- <sup>1</sup> 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.
- <sup>2</sup> See advisor. Minimum 9 hours required. BCHM 4320, 4400, BIOL 3150, 3160, 3940, 4030, 4200, 4250, 4340, 4560, 4670, 4840, 4890, 4910, 4940, 4950, HLTH 3800, MICR 3940, 4000, 4050, 4170, 4190, 4910, 4940 or 4950
- <sup>3</sup> MICR 4110
- <sup>4</sup> GEN 3020 may be substituted
- <sup>5</sup> Statistics will be useful in both graduate school and professional school.
- <sup>6</sup> PHYS 1220, 1240 may be substituted.
- <sup>7</sup> PHYS 2210, 2230 (MATH 1080 pre-req) may be substituted.
- <sup>8</sup> See General Education Requirements.
- <sup>9</sup> 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.

<b>Other Courses</b>	<b>SEM/Yr</b>	<b>Grade</b>
CU 1000	_____	_____
CCA	_____	_____
STS	_____	_____

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

### B.S. BIOLOGICAL SCIENCES

#### **BIOL Core Requirement: (29 cr.)**

BIOL 1010 (1 cr.)  
BIOL 1100/1101 (4 cr.)  
BIOL 1110/1111 (4 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 (16 cr.)**

**Total Semester Hours = 120**

### B.A. BIOLOGICAL SCIENCES

#### **BIOL Core Requirement: (29 cr.)**

BIOL 1010 (1 cr.)  
BIOL 1100/1101 (4 cr.)  
BIOL 1110/1111 (4 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 (3 cr.)  
Modern Language (3 cr.)  
Oral Communication Requirement (3 cr.)  
Social Sciences (6 cr.)

#### **Minor Courses (15 cr.)**

#### **Electives (4 cr.)**

**Total Semester Hours = 120**

## B.S. MICR and B.S. MICR - BIOMEDICINE Degrees Compared

### B.S. MICROBIOLOGY

#### MICR Core Requirement (34 cr.)

BIOL 1010 (1 cr.)  
BIOL 1100 (4 cr.)  
BIOL 1110 (4 cr.)  
MICR 3050 (4 cr.)  
MICR 3070 (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 42 cr.

BCHM 3050 (3 cr.)  
BIOL 4340/4341 or BIOL 4620 (2 cr.)  
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 OR 3140 (3 cr.)  
Arts & Humanities – Literature (3 cr.)  
Arts & Humanities – Non-Literature (3 cr.)  
Oral Communication (3 cr.)  
Social Sciences (6 cr.)

#### Electives (12 cr.)

**Total Semester Hours = 120**

### B.S. MICROBIOLOGY - BIOMEDICINE

#### MICR Core Requirement (40 cr.)

BIOL 1010 (1 cr.)  
BIOL 1100 (4 cr.)  
BIOL 1110 (4 cr.)  
MICR 3050 (4 cr.)  
MICR 3070 (4 cr.)  
MICR 4010 (3 cr.)  
MICR 4120 (3 cr.)  
MICR 4140 (3 cr.)  
MICR 4150 (3 cr.)  
MICR 4160 (3 cr.)  
MICR 4500 (2 cr.)  
MICR 4510 (2 cr.)  
MICR 4520 (2 cr.)  
MICR (BIOL) 4930 (2 cr.)

#### Biomedicine Requirement (9 cr.)

#### Pathogenic Requirement (3 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 OR 3140 (3 cr.)  
Arts & Humanities – Literature (3 cr.)  
Arts & Humanities – Non-Literature (3 cr.)  
Oral Communication (3 cr.)  
Social Sciences (6 cr.)

#### Electives (5 cr.)

**Total Semester Hours = 120**

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

**Honors College Director of Advising and Recruitment:** Katie Maxwell [bower2@clemson.edu](mailto:bower2@clemson.edu)

**Honors Student [Handbook](#)**

**Departmental Liaison to the Honors College:** Renea Hardwick [rhardwi@clemson.edu](mailto:rhardwi@clemson.edu)

**Honors College - Advising Form:** Page 36.

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 ([Honors College](#)).

Current Clemson University non-honors students can apply to join the 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 Honors Program are required to take and complete at least one honors course (HON) each fall and spring semester.** 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 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,

**Note: The following list is not a comprehensive list of all Honors courses offered, but examples of courses that have been offered in the past. For a full list of Honors course offerings, please check the iROAR registration system or contact an Honors [Advisor](#)**

**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, 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; REL 1020; 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, 3900; SOC 2010

Group E. Cross Cultural Awareness: AAH 1020; 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; MGT 2010; MKT 3010; PRTM 2010, 2700

Note: This is not a comprehensive list of all Honors courses offered, but examples of courses that have been offered in the past. For a full list of Honors course offerings, please check the iROAR registration system. Students are advised to contact an Honors advisor if they are unclear with which group a course will satisfy.

**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 Honors College) who have demonstrated outstanding ability in the biological sciences.

**To graduate with Senior Departmental Honors in Biological Sciences or Departmental Honors in Microbiology ([Link](#)), 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.

**Honors Graduation Forms: *Honors Candidacy Form and Honors Distinction Verification Form***

The Honors College **requires all** graduating honors students (active or presently inactive), who have *successfully* completed honors requirements for the distinctions below, to fill out the Honors Candidacy Form and the Honors Distinction Verification Form. The Honors distinctions are:

- General Honors
- Departmental honors
- Interdisciplinary Honors
- General Honors and Departmental Honors
- General Honors and Interdisciplinary Honors

Do not be late in submitting your **two** forms. Failure to do so may result in your not receiving your certificate (and medallion if you have completed (at the minimum) Departmental Honors or Interdisciplinary Honors) before graduation. It may also prevent your diploma/transcript from reflecting your honors credit as well.

**If you are graduating with General Honors ONLY.** You need to complete the following forms:

[Distinction Verification Form- General Honors ONLY](#)

[Honors Candidacy Form- General Honors ONLY](#)

**If you are graduating with General and Departmental (or Interdisciplinary) Honors OR just graduating with Departmental (or Interdisciplinary) Honors.** You need to complete the following forms:

[Distinction Verification Form- Departmental or Interdisciplinary Honors \(with or without General Honors\)](#)

[Honors Candidacy Form- Departmental or Interdisciplinary Honors \(with or without General Honors\)](#)

## Honors College - Advising Forms

### 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 Arts and Humanities

Group B Science, Mathematics & Engineering Group C  
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 ([Link](#)), 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](mailto:rise@clemsun.edu)

RISE exists to support **first-year** STEM students. At this time, RISE supports majors in the College of Engineering, Computing and Applied Sciences and well as the College of Science, and students who have selected Pre-professional Health as a chosen discipline. Eligible majors/disciplines include – General Engineering, Bioengineering, Biosystems Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering; Computer Science, and Computer Information Systems; Geology; Biological Sciences, Microbiology, Biochemistry, Chemistry, Genetics, Mathematical Sciences, and Physics; Preprofessional Health Studies, Prepharmacy, and Pre-rehabilitation Sciences, and Geology. If you have a specific question about a major/discipline, please email [clemsunrise@clemsun.edu](mailto:clemsunrise@clemsun.edu)

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 94 minors ([Minors](#)). Minors popular with BIOL and MICR majors last year 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.

#### **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. Please note that ECON 2120 requires ECON 2110 as a prerequisite. Also, FIN 3060 has prerequisites of ACCT 2010 and a statistics course. See FIN 3060 course description for courses that currently fulfill the statistics requirement. Additionally, these statistics courses may have prerequisites of their own. MKT 3010 requires one of ECON 2000, ECON 2110, ECON 2120 or any 2000-level AGRB class as a prerequisite.

#### **Spanish Studies (29 credits)**

A minor in Spanish Studies requires 15 credits of 3000- and 4000-level SPAN courses, including at least one 4000-level literature course (select from SPAN 4010, SPAN 4030, SPAN 4040, SPAN 4050, SPAN 4060, SPAN 4070, SPAN 4220, and SPAN 4990). SPAN 4380 and SPAN 4390 may not be used to satisfy requirements for the Spanish Studies minor.

#### **Microbiology (16 credits minimum) – For Biological Sciences majors**

A minor in Microbiology requires at least 16 credits as follows: Required courses: MICR 3050; and either BCHM 3010 or BCHM 3050. At least three credits from each of the following three sections:

Section I: MICR 3070, MICR 4000, MICR 4010, MICR 4120, MICR 4160. Section II: BIOL 4250, MICR 4020, MICR 4030, MICR 4050, MICR 4560. Section III: MICR 4070, MICR 4130, MICR 4910, MICR 4930, MICR 4940, MICR 4950

#### **Biological Sciences (20 credits minimum) – For 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 or 3050, GEN 3000 or GEN 3020, or MICR 3050. Only four credits of BCHM 3010, BCHM 3050, BIOL 3940, BIOL 4910, BIOL 4930, BIOL 4940, GEN 3000, GEN 3020, and/or MICR 3050 may count toward the minor.

## 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 by promoting reasoning and critical thinking skills, ethical judgement, 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) Disciplinary and multidisciplinary group research projects develop the student's ability to discover, analyze, and evaluate data. Departmental honors students must take at least six credits over a two-semester period with the same research advisor, write an honors thesis, and make a public presentation of their research. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May be repeated for a maximum of 24 credits. Preq: Consent of instructor.

*BIOL (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. Departmental honors students must take at least six credits over a two-semester period with the same research advisor, write an honors thesis, and make a public presentation of their research. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as MICR 4940. May be repeated for a maximum of 24 credits. 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. Departmental honors students must take at least six credits over a two-semester period with the same research advisor, write an honors thesis, and make a public presentation of their research. These credits may include MICR 3940, MICR 4940 or both. Includes Honors sections. May also be offered as BIOL 4940. May be repeated for a maximum of 24 credits. 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. Departmental honors students must take at least six credits under a single research advisor over two semesters, must write an honors thesis, and must make a public presentation of their research. Includes Honors sections. May be repeated for a maximum of 24 credits. 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. Departmental honors students must take at least six hours under a single research advisor over two semesters, must write an honors thesis, and must make a public

presentation of their research. Includes Honors sections. May be repeated for a maximum of 24 credits with consent of instructor. 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 instructor.

Student Internship Contracts are available from Dr. DeWalt ([saarad@clemsun.edu](mailto:saarad@clemsun.edu))

**Internship Instructor: Dr. Saara DeWalt.**

#### **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. Have the Student Internship Contract approved by Dr. DeWalt
5. Return contract to Ms. Carla Brewer, 127 Long Hall, 656-0854, [cjduca@clemsun.edu](mailto:cjduca@clemsun.edu)
6. Complete the internship;
7. File a final report and submit to Ms. Carla Brewer; [cjduca@clemsun.edu](mailto:cjduca@clemsun.edu)
8. Have the mentor send a letter or e-mail to Ms. Brewer evaluating the student;
9. Dr. DeWalt 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:

[Registration](#)

**BIOL 4880 Health Professions Practicum 3 (3)** A summer 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. For more information contact Dr. Vincent Gallicchio at [vsgall@clemsun.edu](mailto:vsgall@clemsun.edu).

Dental Missions in Panama is offered during Summer Minimester A and Health Missions to Costa Rica is offered during Summer Minimesters B, C, and D.

**BIOL 4890 Clinical Applications & Medical Practice 3 (2,1)** 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. 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 Ms. Carla Brewer, 127 Long Hall, 656-0854, [cjdunca@clemsun.edu](mailto:cjdunca@clemsun.edu). For more information contact Dr. Vincent Gallicchio at [vsgall@clemsun.edu](mailto:vsgall@clemsun.edu)**

## ACADEMIC FORGIVENESS POLICY

The Academic Forgiveness Policy, or AFP, (revised 2019) allows a student with first term enrollment of fall 2013 through *spring* 2019 to eliminate from the GPA calculation up to three courses in which a D or F was earned. Students with first term enrollment of *summer 2019* or later can eliminate a maximum of two courses. Detailed information is available at [Academic Forgiveness](#)

### The following conditions apply:

- The AFP shall apply only to courses taken at Clemson University.
- The AFP may not be applied to a course taken on a Pass/No Pass basis.
- Courses taken prior to fall semester 2003 may not be considered for academic forgiveness.
- ***Students with a first term of enrollment beginning summer 2019 may apply academic forgiveness to a particular course only once.***
- The AFP may not be applied to any course in which the student was previously found in violation of the academic integrity policy.
- Once applied, academic forgiveness cannot be reversed.
- D or F grades in required courses may be eliminated from the GPA before the course is repeated.
- A forgiven course cannot be used to satisfy any prerequisite.
- Course substitutions are not permitted in situations where Academic Forgiveness has been previously applied.
- Any course used to meet a graduation requirement must be repeated satisfactorily at Clemson University. Both grades will remain on the transcript, degree progress report and other official documents.

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.

## FINANCIAL AID INFORMATION

The Financial Aid Office at Clemson University administers and/or coordinates various types of undergraduate financial aid, which includes scholarships, loans, grants, and student 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 in G-01 Sikes Hall, (864) 656-1831 or visit their web site at [Financial Aid](#).

### STATE OF SOUTH CAROLINA SCHOLARSHIPS PROGRAMS [SC Scholarships](#)

- **PALMETTO FELLOWS Scholarship Program.** [Palmetto Fellows](#).
- **LIFE (Legislative Incentives for Future Excellence) Scholarships.** ([LIFE Scholarship](#))
- **HOPE Scholarship Program.** [HOPE Scholarship Program](#).
- **Enhanced LIFE Scholarship and Palmetto Fellows Scholarships.** ([Enhanced Scholarships](#))
- **Summer Disbursements of State Scholarships.** [Summer Disbursements](#)
- **Scholarships and Academic Forgiveness Policy** [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. If you have scholarships or loans, go to Financial Aid in G-01 Sikes, (864) 656-1831, [finaid@clemson.edu](mailto:finaid@clemson.edu)
  - 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 GPA (keeping vs. dropping the class)

- Academic forgiveness policy
- 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

### 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 PI") [Academic Regulations](#)

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. Courses used for this purpose cannot be counted later towards an advanced degree. However, if a student is taking graduate level courses and are subsequently admitted to the graduate school, they may request that the graduate level courses be included as a part of their graduate program. 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](#)).

### 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 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, 864-656-3022.

### CLUBS AND SOCIETIES [Tiger Quest](#)

#### **Alpha Epsilon Delta: Students with medical and health-care interests** [Alpha Epsilon Delta](#)

Alpha Epsilon Delta (AED) is a premedical honor society dedicated to preparing and exposing interested students to medicine and other health-care disciplines. The mission of the Society is to encourage and recognize excellence in premedical scholarship; to stimulate an appreciation of the importance of premedical education; to promote communication between medical and premedical students and educators; to provide a forum for students with common interests; and to use its resources to benefit health organizations, charities and the community. The Clemson Chapter of AED hosts meetings throughout the year with physicians and dentists, Kaplan Test Drives, trips to Medical, Dental, Optometry, and other Professional Schools, and is committed to serving the community through various service projects. Contact Information: [ardilla@g.clemson.edu](mailto:ardilla@g.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

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. Contact Information: [clemsonamsa@gmail.com](mailto:clemsonamsa@gmail.com)

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

Beta Beta Beta is an honorary society for undergraduate and graduate students who are interested in improving the understanding and appreciation of study in biological sciences. In addition, the organization is committed to service and to increasing knowledge through scientific research opportunities. The application to join this organization goes out in the spring semester and is open to those with junior standing based on credit hours. In our chapter, Beta Beta Beta members are involved in tutoring local elementary schools, Relay for Life, and being ambassadors to future Clemson students interested in fields of science. Contact Information: [tribetaclemson@gmail.com](mailto:tribetaclemson@gmail.com). Faculty Advisor, Dr. Tamara McNutt-Scott ([tmcnutt@clemson.edu](mailto:tmcnutt@clemson.edu))

**Clemson PrePharmacy Club: [PrePharmacy Club](#)**

Clemson PrePharmacy 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 PrePharmacy Club hosts monthly meetings with quest speakers. Contact information: [smoak7@g.clemson.edu](mailto:smoak7@g.clemson.edu)

**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. Contact Information: Dr. Harry Kurtz [hkurtz@clemson.edu](mailto:hkurtz@clemson.edu)

**Clemson University Pre-Veterinary Club [Pre-Veterinary Club](#)**

Pre-Vet Club is a professional undergraduate club. Students who aspire to go to Veterinary school after Clemson are provided with knowledge about various vet schools, different veterinary careers, and a group of individuals he/she can relate to! Through fun and informational meetings all your Veterinary related questions will be met!

**Paws for PA [Physician Assistant](#)**

Paws for PA is a resource for undergraduate students pursuing a career as a physician assistant. This club will provide opportunities for networking with other students. Students will be able to expand their knowledge on opportunities available in the medical field as a physician assistant. This club will provide information on prerequisite and patient care hour requirements for various graduate programs. We hope to build a community of students that is eager to become the next generation of health care professionals. Contact Information: [cupaws4pa@gmail.com](mailto:cupaws4pa@gmail.com)

**Pre-Dental Club of Clemson University: [Pre-dentistry](#)**

The Pre-Dental Club serves as an outlet for undergraduate students interested in pursuing a career in dental medicine. It 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. The purpose of the organization shall be to establish a community of students interested in the field of Dentistry that will facilitate relationships and provide a support network. We also hope to promote dental health within the university and community at large. We provide a way for pre-dental students to access help with dental school applications, testing, and general knowledge.

**Tigers for Turtles [Tigers for Turtles](#)**

We are a group of chill people who are all passionate about conserving the ocean. Our goal is to provide Clemson students with more opportunities to both learn more about and participate in a more eco-friendly way of living. We are focusing on using less plastic in everyday activities as well as recycling properly and cleaning up the environments around us. We also have educational opportunities about how to get more involved with ocean conservation and how to make an impact. Contact Information: [tigersforturtles@gmail.com](mailto:tigersforturtles@gmail.com)

## GRADUATE AND PROFESSIONAL SCHOOLS

### I. 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, 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 School](#)

**II. 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. Professional school advisors 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 ensure that all Clemson requirements for graduation are met.

Most **Medical and Dental Schools** have identical basic course requirements ([Admission Requirements](#)); however, entrance requirements vary by institution and should be verified individually. These basic course requirements may be included in the Biological Science B.S. and B.A. 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 1030/1050 & 1040/1060	BIOL 1100 & 1110 (recommended) or BIOL
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 3000/3020
General Biochemistry	BCHM 3050/3010
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
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](#)

**Pre-Pharmacy Declared major.** For students who want to receive a baccalaureate degree before applying to a college of pharmacy, the Biological Sciences B.S. Pre-pharmacy Emphasis degree fulfills the requirements for pharmacy school. Frequently Asked Questions regarding requirements of, preparation for, and admission into pharmacy school is at: [Health Professions Advising](#)

**Pre-Pharmacy Undeclared major.** Advisor: Adam Hunter ([hunter3@clemson.edu](mailto:hunter3@clemson.edu)), 105 Long Hall, 656-3288. The three-year Pre-pharmacy 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 Pre-professional 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 Pre-pharmacy 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](#)

**Pre-Rehabilitation Sciences.** Pre-rehabilitation 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.** Clemson undergraduate students may apply for admission into one of the nine-health related graduate programs at the Medical University of South Carolina (MUSC). These programs include medicine, dentistry, pharmacy, physical therapy, and public health. Students would matriculate to MUSC after 3 or 4 years at Clemson and earn a Bachelor of Science degree in Pre-Professional Studies from Clemson after completing their first year at MUSC. Advisor: Adam Hunter ([hunter3@clemson.edu](mailto:hunter3@clemson.edu)).

**Accelerated Pathways to MUSC Professional Health Degrees (3 years at CU + 4 years at MUSC) Program** purpose and description: Clemson and MUSC have developed the *Accelerated Pathway to Medical School, Dental School, Pharmacy* programs aimed at reducing students' overall educational cost from undergraduate education through professional school while retaining the most talented students in South Carolina. Clemson students, meeting all program requirements, may apply for admittance to MUSC's doctorate in medicine (MD), dental medicine (DMD), Pharmacy (PharmD), or Physical Therapy (DPT) degree after completing 90 semester hours of undergraduate education at Clemson. Admission to the MD, DMD, PharmD, or DPT program is not guaranteed; admissions decisions will be made solely by MUSC. If admitted into the MD, DMD, PharmD or

DPT program, Clemson accelerated students are held to the standards and progress guidelines as all other students in the MD, DMD, PharmD, or DPT program. After successful completion of the first year of medical, dental, pharmacy, or physical therapy school (as defined by MUSC's academic standards), Clemson University will award the student an earned baccalaureate degree subject to students satisfying all applicable requirements outlined in the Clemson University Undergraduate Announcements and completion of the formal application for graduation.

**Medical School Student Eligibility Requirements (3 years at CU + 4 years at MUSC):**

- a. Clemson students must take the Medical College Admissions Test (MCAT) prior to June 30 following completion of the sophomore year (for Early Decision applicants) or prior to July 30 following their sophomore year (for Regular Admission applicants).
- b. The current minimum score accepted by MUSC on the MCAT is 508 (which may change annually, but the standard is that the score falls in the top quartile).
- c. Student's unadjusted GPA at the time of application to medical school must be  $\geq 3.5$
- d. Students must complete a minimum of 90 semester credit hours at Clemson (not including any AP credits, IB credits or transfer credits) prior to matriculating at MUSC.
- e. All Clemson general education requirements must be completed prior to matriculating at MUSC.
- f. It is recommended, but not required, that students complete two semesters of the following courses prior to applying to MUSC: general biology, general chemistry, organic chemistry, and physics.
- g. Other suggested courses that are valuable in preparing for the MD curriculum are anatomy, biochemistry, cell biology, embryology, genetics and physiology. The following courses are also suggested to support preparation for the MCAT: two semesters of introductory biology, introductory physics, general chemistry, organic chemistry, biochemistry, sociology and psychology.
- h. All applicants are expected to complete significant experiences providing clinical exposure to inform their decision to enter medicine. These experiences, ideally, should be attained through participation in a formal Clemson internship (or similar) supervised course and independent student planning. The latter would demonstrate a personal commitment to explore this career path.

**Dental School Student Eligibility Requirements (3 years at CU + 4 years at MUSC):**

- a. Clemson students must take the Dental Admissions Test (DAT) following completion of the sophomore year.
- b. The current MUSC recommended score accepted on the DAT is 20/20. Students are encouraged to repeat the DAT if their initial score is less than 20/20. MUSC's DMD admissions committee will consider the highest total DAT score submitted. There is no penalty or negative connotation associated with multiple DAT attempts.
- c. Student's unadjusted GPA at the time of application to medical school must be  $\geq 3.5$
- d. Students must complete a minimum of 90 semester credit hours at Clemson (not including any AP credits, IB credits or transfer credits) prior to matriculating at MUSC.
- e. All Clemson general education requirements must be completed prior to matriculating at MUSC. In addition, the College of Dental Medicine requires two semesters of the following courses: General Chemistry, Organic Chemistry, Physics, Biology, English, Mathematics, and Science Electives. These courses may concurrently meet Clemson's General Education requirements as set forth in the applicable Clemson University Undergraduate Announcements. It is the student's responsibility to verify that he/she has met Clemson general education requirements and College of Dental Medicine course requirements.
- f. *Suggested courses:* Courses that are valuable in preparing for the DMD curriculum are anatomy, biochemistry, cell biology, embryology, microbiology, genetics and physiology. Courses in the following areas are also suggested to support preparation: finance and accounting, sociology and psychology.
- g. All applicants are encouraged by the College of Dental Medicine to complete experiences providing clinical exposure to inform their decision to enter dentistry. These experiences, ideally, should be attained through participation in a formal Clemson internship (or similar) supervised course and independent student planning. The latter would demonstrate a personal commitment to explore this career path.

**Physical Therapy Student Eligibility Requirements (3 years at CU + 3 years at MUSC):**

- a. Clemson students must take the Graduate Record Examination (GRE) following completion of their sophomore year.
- b. There is no minimum score on the GRE, but competitive scores on each section are the 60th percentile. Students are encouraged to repeat the GRE if a section score is below the 60th percentile. MUSC's DPT admissions committee will consider the highest GRE score submitted for each section. There is no penalty or negative connotation associated with multiple GRE attempts.

- c. Student's unadjusted GPA at the time of application, and until matriculation if accepted into the DPT program, must be  $\geq 3.0$ . The average GPA for students accepted into the program is 3.6 on a 4.0 scale.
- d. Students must complete a minimum of 90 semester credit hours at Clemson (not including any AP credits, IB credits or transfer credits) prior to matriculating at MUSC.
- e. *Required courses:* All General Education requirements must be completed prior to matriculating at MUSC. In addition, students should complete two semesters of the following courses: Chemistry for science majors, Physics for science majors, and Biology for science majors. Also, a minimum of one semester course each of Human Anatomy, Human Physiology, General Psychology, Abnormal Psychology, and Statistics is required.
- f. The DPT program requires a minimum of 40 hours of observation with a licensed physical therapist. These experiences may be attained through participation in a formal Clemson internship (or similar), volunteer, or work experience.

**Pre-Veterinary Medicine Requirements for Biological Sciences Majors.** Pre-Veterinary Medicine Advisor: Dr. Jeryl Jones, [jerly@clemson.edu](mailto:jerly@clemson.edu), 140 P&A, 656-2142 and Dr. Glenn Birrenkott, [gbrnkt@clemson.edu](mailto:gbrnkt@clemson.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 links to the minimum requirements for a South Carolina resident to be accepted to the three veterinary schools with contract seats.

**University of Georgia (Course Requirements)**

**Mississippi State University (Entrance Requirements)**

**Tuskegee University (Course Requirements)**

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

**BIOLOGICAL SCIENCES FACULTY / RESEARCH EMPHASIS / OFFICE**  
**(Telephone number and email address are on page 3)**

<b>John G. Abercrombie</b> (M.S., Clemson University) Senior Lecturer of Biological Sciences <i>The biology of bacteriocin Jensenin P, an antimicrobial peptide produced by P. jensenii that inhibits the growth of an organism known to cause acne.</i>	127 LSF
<b>Virginia Abernathy</b> (PhD, Australian National University) Lecturer of Biological Sciences <i>Study of the coevolutionary interactions between avian brood parasites and their hosts.</i>	350 Long Hall
<b>J. Antonio Baeza</b> (Ph.D., University of Louisiana at Lafayette) Associate Professor of Biological Sciences <i>Invertebrate biology. Sexual selection. Adaptive value of breeding systems.</i>	226 Long Hall
<b>Lisa J. Bain</b> (Ph.D., North Carolina State University) Professor of Biological Sciences <i>Environmental pathobiology; Cellular toxicology; Biochemical and molecular toxicology; Resistance mechanisms; Aquatic toxicology.</i>	239 Long Hall
<b>William S. Baldwin</b> (Ph.D., North Carolina State University) Professor of Biological Sciences <i>Endocrinology/mammalian physiology; Toxicant-induced alterations in gene expression; Endocrine disruption.</i>	235 Long Hall
<b>Robert E. Ballard</b> (Ph.D., University of Iowa) Visiting Professor of Biological Sciences <i>Speciation of flowering plants; science outreach.</i>	G22 Jordan Hall
<b>Sharon Bewick</b> (Ph.D., Princeton University) Assistant Professor of Biological Sciences <i>Theoretical population, community and disease ecology of systems ranging from tropical forests to vector-borne pathogens and the human microbiome.</i>	142 Long Hall
<b>Richard W. Blob</b> (Ph.D., University of Chicago) Professor of Biological Sciences, Bioengineering <i>Biomechanics and the evolution of animal function; animal locomotion; comparative vertebrate anatomy, physiology, and functional morphology; herpetology; vertebrate paleontology.</i>	342 Long Hall
<b>Barbara Campbell</b> (Ph.D., Cornell University) Associate Professor of Biological Sciences <i>The function and structure of microbial communities at the molecular level.</i>	155B LSF
<b>Min Cao</b> (Ph.D., Cornell University) Associate Professor of Biological Sciences <i>Bacteria, host, and inter-kingdom communication.</i>	116 Jordan Hall
<b>Susan C. Chapman</b> (Ph.D., King's College University of London) Associate Professor of Biological Sciences <i>Embryonic development and organogenesis. Mechanisms of tissue specification, morphogenesis and patterning of specific regional identity during vertebrate head development.</i>	340 Long Hall
<b>Michael J. Childress</b> (Ph.D., Florida State University) Associate Professor of Biological Sciences <i>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.</i>	105A Jordan Hall
<b>John R. Cummings</b> (M.S., Bowling Green State University) Senior Lecturer of Biological Sciences <i>Factors affecting barn owl populations, biology laboratory education, and curriculum design.</i>	146 Long Hall
<b>Saara J. DeWalt</b> (Ph.D., Louisiana State University) Chair, Professor of Biological Sciences <i>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.</i>	132C Long Hall

<b>Sourabh Dhingra</b> (Ph.D. Northern Illinois University) Assistant Professor of Biological Sciences Molecular mechanisms governing drug response and pathogenesis in eukaryotic pathogenic mold <i>Aspergillus fumigatus</i> ; role of non-coding RNAs (ncRNAs) in pathobiology of <i>Aspergillus fumigatus</i> .	051B LSF
<b>Zhicheng Dou</b> (Ph.D., University of Southern Mississippi) Assistant Professor of Biological Sciences <i>Mechanisms understanding of how Toxoplasma gondii host cellular macromolecular nutrients and digest them to support its intracellular replication.</i>	151B LSF
<b>Nora R. Espinoza</b> (Ph.D., University of Chicago) Assistant Professor of Biological Sciences <i>Evolution of animal form and function; comparative biomechanics, animal locomotion; evolution of bone; evolution of development of the musculoskeletal system of vertebrates.</i>	348 Long Hall
<b>David M. Feliciano</b> (Ph.D., State University of New York, Buffalo) Associate Professor of Biological Sciences <i>Cell and molecular biology. Neurobiology. Brain development.</i>	326 Jordan Hall
<b>Vincent S. Gallicchio</b> (Ph.D., New York University) Professor of Biological Sciences <i>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.</i>	122 Long Hall
<b>Julia George</b> (Ph.D., Rockefeller University) Associate Professor of Biological Sciences <i>Neurobiology and neurogenomics in songbirds, modeling effects of prenatal experience on development and cognition</i>	231 Long Hall
<b>Renea C. Hardwick</b> (M.S., University of Colorado) Senior Lecturer of Biological Sciences <i>Utilize molecular markers and phylogeographic methods to examine genetic structure, genetic diversity, and geographical diversity in North American Aythya marila (greater scaup) populations.</i>	148 Long Hall
<b>Xiuping Jiang</b> (Ph.D., University of Maryland) Professor of Food Science & Human Nutrition; Biological Sciences <i>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.</i>	228 LSF
<b>Tafadzwa Kaisa</b> (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
<b>Matt Koski</b> (Ph.D., University of Pittsburgh) Assistant Professor of Biological Sciences <i>Evolutionary ecology of plants with a focus on floral coloration and mating systems; abiotic drivers of floral diversity; plant-pollinator interactions; responses to global change; influence of biogeography and evolutionary history on reproductive diversity.</i>	134 Long Hall
<b>Harry Kurtz</b> (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

<b>Cassandra May</b> (Ph.D., The Ohio State University) Lecturer of Biological Sciences <i>Innovative teaching strategies for biology education. Mechanisms regulating fish population dynamics.</i>	100C Jordan Hall
<b>Tamara McNutt-Scott</b> (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
<b>V. Christine M. Minor</b> (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>	330A Long Hall
<b>Christopher L. Parkinson</b> (Ph.D., University of Louisville) Professor of Biological Sciences; Forestry and Environmental Conservation <i>Evolution, molecular evolution, phylogenetics, systematics and taxonomy of venomous snakes and other vertebrates</i>	157B LSF
<b>Kara E. Powder</b> (Ph.D., Washington University in St. Louis) Assistant Professor of Biological Sciences <i>Genomic and developmental basis of craniofacial evolution in cichlid fishes</i>	055A LSF
<b>Samantha A. Price</b> (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
<b>Margaret B. Ptacek</b> (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
<b>Kaustubha Qanungo</b> (Ph.D., Indian Institute of Technology, Kharagpur) Lecturer of Biological Sciences <i>RNA virus Molecular Biology and Bioinformatics, Evidence based pedagogy development</i>	165 Jordan Hall
<b>Nathan Redding</b> (Ph.D., Clemson University) Lecturer of Biological Sciences <i>Molecular and structural responses of host plants during infection with plant parasitic</i>	330C Long Hall
<b>Charles D. Rice</b> (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
<b>Vincent Richards</b> (Ph.D., NOVA Southeastern University) Assistant Professor of Biological Sciences <i>Comparative genomics of pathogenic bacteria evolution and adaptation to specific hosts.</i>	111C Jordan Hall
<b>Emily Rosowski</b> (Ph.D., Massachusetts Institute of Technology) Assistant Professor of Biological Sciences <i>Host-pathogen interactions in larval zebrafish; Identification of innate immune mechanisms that target fungal pathogens.</i>	155A LSF
<b>Krista Rudolph</b> (Ph.D., Clemson University) Senior Lecturer of Biological Sciences <i>Food safety and genetic engineering of microbes.</i>	330E Long Hall
<b>Michael W. Sears</b> (Ph.D., University of Pennsylvania) Assistant Professor of Biological Sciences <i>Interface of theory and empiricism to solve problems in ecology and evolution, particularly with regard to thermal biology and climate change.</i>	323 Long Hall

<b>Anna Seekatz</b> (Ph.D. University of Maryland School of Medicine) <i>Interactions between infectious diseases and the gut microbiome; fecal microbiota transplantation; Clostridioides (Clostridium) difficile; beneficial microbes of the gut; 16S rRNA gene-based assays, metagenomics, genomics.</i>	157A LSF
<b>Salvatore A. Sparace</b> (Ph.D., University of Wyoming) Professor of Biological Sciences <i>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.</i>	336 Long Hall
<b>Barbara Speziale</b> (Ph.D., Clemson University) Professor of Biological Sciences; Associate Dean, Watt Family Innovation Center <i>Aquatic ecology and limnology research, education outreach, K-12 youth development.</i>	344 Watt Innovation Center
<b>Lesly A. Temesvari</b> (Ph.D., University of Windsor) Professor of Biological Sciences <i>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.</i>	255B LSF
<b>Matthew W. Turnbull</b> (Ph.D., University of Kentucky) Associate Professor of Plant and Environmental Sciences; Biological Sciences <i>Insect cell biology and immunology. Mutualistic viruses of parasitoid wasps. Role of inxins and gap junctions in insect immune systems.</i>	327 Jordan Hall
<b>Jeremy T. Tzeng</b> (Ph.D., Clemson University) Associate Professor of Biological Sciences <i>Evaluation of nanoparticle compositions for their ability to neutralize microbial pathogens. Evaluation of phytochemical compounds for antimicrobial and anti-tumor activities.</i>	149A LSF
<b>Peter van den Hurk</b> (Ph.D., College of William & Mary) Associate Professor of Biological Sciences <i>Toxicology of environmental pollutants in aquatic ecosystems; detoxification enzymes; fish models as pollution indicators.</i>	237 Long Hall
<b>Yanzhang Wei</b> (Ph.D., Ohio University) Professor of Biological Sciences <i>Dendritic cell mediated cancer immunotherapy; cancer gene therapy; novel approaches for targeted cancer therapy</i>	055B LSF
<b>Lisa Ruggiero Wagner</b> (M.A., Temple University) Lecturer of Biological Sciences <i>Pedagogy and curriculum design in anatomy and physiology for teaching and learning excellence; interdisciplinary approaches to health, disease and health disparities.</i>	231 Long Hall
<b>Donna R. Weinbrenner</b> (Ph.D., Clemson University) Senior Lecturer of Biological Sciences	330B Long Hall
<b>Kristi Whitehead</b> (Ph.D., Michigan State University) Senior Lecturer of Biological Sciences <i>How interactions between humans and their gastrointestinal tract microbes contribute to health and disease.</i>	140 Long Hall
<b>Xianzhong Yu</b> (Ph.D., Ohio University) Associate Professor of Biological Sciences <i>Tumor angiogenesis (gene therapy targeting and molecular/cellular mechanisms); tumor models/transgenic technique; tumor therapeutic agents screening.</i>	207 Jordan Hall

## DESCRIPTION OF FREQUENTLY SCHEDULED CURRICULA COURSES

**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. Credit toward a degree will be given for only one of BCHM 3010 or BCHM 3050. Preq: BIOE 1010 or BIOL 1030 or BIOL 1100. Preq or concurrent enrollment: CH 2010 or CH 2230.

**BCHM 4320 Biochemistry of Metabolism 3 (3)** Study of the central pathway of carbohydrate, lipid, and nucleotide metabolism. Emphasizes bioenergetics, limiting reactions, and the regulation and integration of the metabolic pathways. Includes Honors sections. Preq: BCHM 3010 with a grade of C or higher. (Satisfies Biomedicine Requirement)

**BCHM 4400 Bioinformatics 3 (3)** Theory and application of computational technology to analysis of the genome, transcriptome, and proteome. Includes Honors sections. May also be offered as GEN 4400. Preq: BCHM 3010 or BCHM 3050 or GEN 3000 or GEN 3020, with C or better. (Satisfies Biomedicine Requirement) (Satisfies MICR B.S. Food Safety, Industrial, & Technology Requirement)

**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. Preq or concurrent enrollment: BIOL 1030 and BIOL 1050; or BIOL 1100.

**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 4 (3)** 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. 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 4 (3)** 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 2210 Therapeutic Applications of Human Anatomy and Physiology3 (3).** A survey of human anatomy and physiology (systems approach), incorporating foundational human anatomy and physiology principles and language, including organ systems, anatomical features, and integration of the concept of maintaining homeostasis and failures of homeostasis: the basic mechanisms of disease/pathologies. Preq: BIOL 1030 and BIOL 1050; or BIOL 1100; and CH 1010 or CH 1050.

**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 (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: BIOL 3011.

**BIOL (ENT) 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. (Satisfies Organismal Diversity Requirement)

**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 (WFB) 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: BIOE 1010; or 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. Includes Honors sections. May be repeated for a maximum of 24 credits. Preq: Consent of instructor.

**BIOL (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: BIOL 4001.

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

**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: BIOL 1030 or BIOL 1100.

**BIOL (GEN) 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: Junior standing.

**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 (ENR) 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. Coreq: BIOL 4131.

**BIOL (ENR) 4131 Restoration Ecology Laboratory 0 (3)** Non-credit laboratory to accompany BIOL 4130. May also be offered as ENR 4131. Coreq: BIOL 4130.

**BIOL (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. Includes Honors sections. May also be offered as AVS 4140 or MICR 4140. Preq: BIOL 4610 and MICR 3050.

**BIOL (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 ENT 4150. Preq: BIOL 3010. Coreq: BIOL 4151.

**BIOL (ENT) 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. Preq or concurrent enrollment: BIOL 4610.

**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.

**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 (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. May also be offered as ETOX 4300. Preq: CH 2230 and CH 2270; and one of BIOL 3110 or BCHM 3010 or BCHM 3050.

**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 (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 ENT 4360. Preq: ENT 3010. Coreq: BIOL 4361

**BIOL (ENT) 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: BIOL 1040 or BIOL 1110; and GEN 300 or GEN 3020.

**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 4420 Biogeography 3 (3)** Study of patterns of distribution of plants and animals in space and time. Includes Honors sections. Preq: BIOL 3020 or BIOL 3030 or BIOL 3040.

**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 4480 - Marine Ecology 3 (3)** Study of ecological principles underlying the relationships of marine organisms to their ocean environment. Includes physiological, behavioral, population, and community ecology with applications to conservation and sustainability of marine resources. Includes Honors sections. Preq: BIOL 3020 or BIOL 4170.

**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 4530 Integrative Organismal Biology 3 (3)** In describing the integrated physiological functioning of individuals, evolutionary and comparative approaches are emphasized to provide a more complete understanding of how biological systems work, spanning a diverse range of invertebrate and vertebrate taxa in both terrestrial and aquatic environments. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

**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 (ANTH) 4550 - Field Studies in Biological Anthropology 1-6 (1-6)** Students participate in field study experiences related to biological anthropology. The focus of the field studies is on practical aspects of human skeletal biology, paleoanthropology, primate behavior, or other related field study. Students are trained in data collection methods and analysis utilized within biological anthropology. May also be offered as ANTH 4550. Preq: Junior standing.

**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. *Includes Honors sections.* Preq: [BIOL 1040 and BIOL 1060; or BIOL 1110]; and [CH 1020; or PHYS 2080 and PHYS 2100; or PHYS 2210 and PHYS 2230.]

**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 or BCHM 4060.

**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 (ANTH) 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.

**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 (ENT) 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 (ENT) 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 Pre-rehabilitation 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. May also be offered as EDSC 4820. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4821.

**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 4870 Electron and Optical Microscopy Theory 3 (2)** Offers a theoretical and practical introduction to light and electron microscopy. Topics include Koehler illumination, polarization, interference, phase contrast, DIC epifluorescence, laser scanning light microscopy, SEM, TEM, EDS, ultramicrotomy, tomography, and digital imaging. Preq: Consent of instructor. Coreq: BIOL 4871.

**BIOL 4871 Electron and Optical Microscopy Laboratory 0 (2)** Non-credit laboratory to accompany BIOL 4870. Coreq: BIOL 4870.

**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 4900 - Research Experience for Visiting Undergraduates 0 (30)** REU students carry out ten weeks of mentored research under the direction of faculty in the life sciences, and participate in professional development workshops to develop their research careers. Products include a poster presentation, a written report, a research talk and a one-minute video. To be taken Pass/No Pass only. Preq: Acceptance into the Biological Sciences NSF-REU program.

**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. Departmental honors students must take at least six credits under a single research advisor over two semesters, must write an honors thesis, and must make a public presentation of their research. Includes Honors sections. May be repeated for a maximum of 24 credits. 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. To be taken Pass/no Pass only. May be repeated for a maximum of six credits. 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. Departmental honors students must take at least six credits over a two-semester period with the same research advisor, write an honors thesis, and make a public presentation of their research. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as MICR 4940. May be repeated for a maximum of 24 credits. 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.

**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 3130 - Quantitative Analysis 3 (3)** Fundamental principles of volumetric, gravimetric, and certain elementary instrumental chemical analyses. Preq or concurrent enrollment: CH 3150 or CH 3170.

**CH 3150 - Quantitative Analysis Laboratory 2 (6)** Laboratory techniques of volumetric, gravimetric, and elementary instrumental chemical analyses. Credit toward a degree will be given for only one of CH 3150 or CH 3170. Preq or concurrent enrollment: CH 3130.

**CH 4130 Chemistry of Aqueous Systems 3 (3)** Study of chemical equilibria in aqueous systems, especially natural waters; acids and bases, dissolved CO<sub>2</sub>, 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.

**ED 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 Content Area Reading and Writing for Middle and Secondary Teachers 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.

**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 one of BIOL 2110 or BCHM 3010 or BCHM 3050.

**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. Credit for a degree will be given for only one of GEN 3000 or GEN 3020. Preq: BIOL 1030 or BIOL 1100. (Satisfies MICR B.S. Biomedicine Requirement)

**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. Credit for a degree will be given for only one of GEN 3000 or GEN 3020. Includes Honors sections. Preq: BIOL 1100 with C or better. (Satisfies MICR B.S. Biomedicine Requirement)

**HLTH 3800 Epidemiology 3 (3)** Introduces epidemiological principles and methods used in the study of the origin, distribution, and control of disease. Health majors are given enrollment priority. Preq: STAT 2300 or STAT 3090; and at least one 2000-level HLTH course. (Satisfies Biomedicine Requirement)

**MATH 1040 Precalculus and Introductory Differential Calculus 4 (4)**<sup>[SEP]</sup> 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. Not open to students who have received credit for MATH 1060. To be taken Pass/No Pass only. 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. Includes Honors sections. Preq: Score of 80 or better on the Clemson Mathematics Placement Test.

**MATH 1070 Differential and Integral Calculus 4 (4)**<sup>[SEP]</sup> 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 with a C or better or MATH 1070 with a C or better.

**MICR 3050 General Microbiology 4 (3)** Morphology, physiology, classification, distribution, and cultivation of microorganisms. Preq: Sophomore standing and CH 1010 and CH 1020; and BIOL 1030 and 1050, or BIOL 1100; and one of the following: BE 2100, or BIOL 1040 and BIOL 1060 or BIOL 1110, or EES 2020. Coreq: MICR 3051.

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

**MICR 3070 Microbial Diversity 4 (3)** A writing-intensive survey of microbial diversity, including types of diversity, methods for assessing diversity, and mechanisms and impacts of microbial evolution. Skill development is focused on reading and analyzing primary literature and communicating scientific information. Preq: MICR 3050 with a C or higher. Coreq: MICR 3071.

**MICR 3070 Microbial Diversity Laboratory 0 (3)** Non-credit laboratory to accompany MICR 3070. Coreq: MICR 3070.

**MICR 3940 Selected Topics in Creative Inquiry I 1-3 (1)** Disciplinary and multidisciplinary group research projects with the goal of developing the student's ability to discover, analyze, and evaluate data. Departmental honors students must take at least six credits over a two-semester period with the same research advisor, write an honors thesis, and make a public presentation. These credits may include MICR 3940, MICR 4940 or both. Includes Honors sections. May be repeated for a maximum of 24 credits. 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 with a C or higher.

**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 with a C or higher.

**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 with a C or higher; and either CH 2010 and CH 2020; or both CH 2230 and CH 2270.

**MICR 4040 Microbial Ecology 3 (3)** The study of microbial interactions and adaptations in a wide range of environmental conditions and habitats at the individual, population, community, and ecosystem levels. Preq: CH 2010 and CH 2020; or CH 2230 and CH 2270; and MICR 3050 with a grade of C or higher.

**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 3050 with a C or higher.

**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 with a C or higher; 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 with a C or higher; 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 with a C or higher; and either BCHM 3010 or BCHM 3050. Preq. Or concurrent enrollment: BIOL 4610.

**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 with a C or higher and BIOL 4610; and either BCHM 3010 or 3050. (

**MICR 4180 Pathogenic Eukaryotes 3 (3)** The course focuses on molecular mechanisms associated with disease initiation, disease progression, virulence mechanisms, host-pathogen interactions, diagnosis and treatments of eukaryotic pathogens. The course primarily uses research articles to keep up with latest research in these fields. Preq: MICR 3050 with a grade of C or better and BIOL 4610.

**MICR 4190 - Selected Topics in Molecular Medicine 3(3)** Introduction to various areas of molecular medicine. Examines the latest research and developments in molecular medicine. Designed for students interested in medicine and biomedical research. Graduate students may repeat for a maximum of six credits. Preq: BCHM 3010 or BCHM 3050 or MICR 3050 with a C or higher.

**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. Departmental honors students must take at least six hours under a single research advisor over two semesters, must write an honors thesis, and must make a public presentation of their research. Includes Honors sections. May be repeated for a maximum of 24 credits with consent of instructor. 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. To be taken Pass/no Pass only. May be repeated for a maximum of six credits. Preq: Consent of instructor.

**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 student's ability to discover, analyze, and evaluate data. Departmental honors students must take at least six hours under a single research advisor over two semesters, must write an honors thesis, and must make a public presentation of their research. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as BIOL 4940. May be repeated for a maximum of 24 credits. 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 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 620 or higher on the SAT Math section or a score of 26 or higher on the ACT Math section or a score of 60 or higher on the Clemson Mathematics Placement Test. (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 and 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 or STAT course, or a score of 620 or higher on the SAT Math section, or a score of 26 or higher on the ACT Math section, 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.

## **General Education Mission Statement**

In order to become informed and productive citizens, undergraduate students need to think critically and synthetically about substantive and often interlinked aesthetic, ethical, historical, linguistic, philosophical, societal, scientific, and quantitative global challenges and issues.

Therefore, in addition to being prepared to complete a major course of study, Clemson University undergraduate students are required to undertake a general education core course of study to develop and to demonstrate the ability to synthesize information relevant to complex issues, to evaluate the quality and utility of the information, and to use the outcomes of their analysis to reach persuasive logical conclusions.

The Clemson University undergraduate curriculum is designed such that arts and humanities, mathematics, natural sciences, social sciences, and written and oral communication contribute to the holistic development of its students.

### **General Education Student Learning Outcomes**

#### **Communication**

Students will demonstrate competence in communication through organization of a central message with supporting materials in the chosen medium.

#### **Arts and Humanities**

Students will analyze, interpret, and employ aesthetic, ethical, linguistic, and/or philosophical discourse in relevant contexts; or students will create, perform, interpret, reinterpret, and/or criticize artistic works.

#### **Mathematics**

Students will demonstrate mathematical literacy through interpretation of mathematical forms and performing calculations.

#### **Natural Sciences**

Students will demonstrate the process of scientific reasoning through experimental activity and critical comparison of their results to those predicted by accepted natural science principles.

#### **Social Sciences**

Students will use social science concepts and evidence to explain human actions or behaviors in the past, the present, and/or the future.

#### **Cross-Cultural Awareness**

Explain how aspects of culture are integrated into a comprehensive worldview; and then demonstrate how culture influences human behavior.

#### **Science and Technology in Society**

Demonstrate an understanding of issues created by the complex interactions among science, technology, and society.

#### **Critical Thinking**

Demonstrate the ability to assemble information relevant to a significant, complex issue, evaluate the quality and utility of the information, and use the outcome of the analysis to reach a logical conclusion about the issue.

#### **Ethical Judgment**

Demonstrate an ability to identify, comprehend, and deal with ethical problems and their ramifications in a systematic, thorough, and responsible way.

An undergraduate student whose enrollment in a curriculum occurs after May 15, 2005, must fulfill the general education requirements in effect at that time. If a student withdraws from the University and subsequently returns or does not remain continuously enrolled (summers excluded), the requirements in effect at the time of return will normally prevail. Any variation in curricular or general education requirements shall be considered under the curriculum year change or the substitution procedure.

### **Requirements - 31 Credit Hours**

To meet general education competencies, 31 total credit hours are required, distributed as follows: I. General Education Coursework - 31 credit hours; II. Distributed Coursework - included in majors.

#### **I. General Education Coursework - 31 hours required**

General education requirements in some curricula are more restrictive than those shown below. Science and Technology in Society and Cross-Cultural Awareness requirements may be satisfied by other General Education courses, as indicated in the footnotes below, as long as the student completes a total of 31 hours in area I. and satisfies requirements A-F below:

##### **A. Communication: at least 6 credits**

###### **English Composition – 3 credits**

ENGL 1030 (ENGL 1020 for transfer students)

###### **Oral Communication – 3 credits**

COMM 1500, COMM 2500, HON 2230, or an approved cluster of courses such as: AS 3090, AS 3100, AS 4090, AS 4100; or ML 1010, ML 1020. Students taking clusters must still earn at least 31 hours from the General Education Coursework list.

##### **B. Mathematical, Scientific, and Technological Literacy: at least 10 credits**

###### **Mathematics – 3 credits**

MATH 1010, 1020, 1060, 1070, 1080, 2070; STAT 2220, 2300, 3090, 3300. **Note:** For Early Childhood Education, Elementary Education, and Special Education majors only, the approved cluster of MATH 1150, MATH 1160 and MATH 2160 satisfies the requirement.

###### **Natural Science with Lab – 4 credits**

ASTR 1010/1030, 1020/1040; BIOL 1030/1050, BIOL 1040/1060, 1090, 1100, 1110, 1200/1220, 1200/1230; CH 1010, 1020, 1050, 1060; GEOL 1010/1030, 1120/1140, 2020; PHSC 1070, 1080, 1170, 1180, PHYS 1220/1240, 2000, 2070/2090, 2080/2100, 2210/2230, 2220/2240.

**Mathematics or Natural Science – 3 credits**

Any general education Mathematics or Natural Science course listed above or: BIOL 2000, 2010, 2030, 2040, 2100, 2200; ENSP 2000, (PES) 3150; ENT 2000; GEOL 1200, 3000; PES (ENSP) 3150; PHYS 2400, 2450, 2800; PLPA 2130; STS 2160.

**C. Arts and Humanities: at least 6 credits**

**Literature – 3 credits**

Any 2000-level ENGL literature course or any of the other courses listed ENGL 2020, 2120, 2130, 2140, 2150, 2160; CHIN 4010, 4020; FR 3000, 3040; GER 2600, 3060, 3600, 3610; HON 1900, 2210; ITAL 3010, 3020; JAPN 4010, 4060; RUSS 3600, 3610; SPAN 3040, 3110, 3130.

**Non-Literature – 3 credits**

AAH 1010; ART 2100<sup>2</sup>, 3750; ASL 3050<sup>2</sup>; CAAH 2010<sup>2</sup>; CHIN (PHIL) 3120, (PHIL) 3130, (PHIL) 4140, 4990; COMM 1800<sup>2</sup>, 3030, 3080, 3090, 4020; ENGL (GW) 3010, 3550, (WCIN) 3570, (LANG, WCIN) 4540; FR 3070; GER 3400; GW (ENGL) 3010, 4050; HON 1910, 2010<sup>1</sup>, 2030, 2100, 2220; HUM 3010, 3020, 3060, 3090<sup>2</sup>; JAPN 3070, JAPN 3080; LANG 3400, 3420, 3560, (ENGL, WCIN) 4540; LARC 1160<sup>1</sup>; MUSC 2100<sup>2</sup>, (THEA) 3080, (THEA) 3090, 3110, 3120, 3130, 3140<sup>2</sup>, 3170, 3610, 3620, 3630, 3640, 3690, 3700, 3710, 3720; PHIL 1010, 1020, 1030, 1240<sup>1</sup>, 2100<sup>1</sup>, (CHIN) 3120, (CHIN) 3130, 3160, 3170, 3180, 3230, 3240<sup>1</sup>, 3250, 3260<sup>1</sup>, 3270, 3440, 3450<sup>1</sup>, (WS) 3490, (CHIN) 4140; REL 1010<sup>2</sup>, 1020<sup>2</sup>, 3010, 3020, 3030, 3060, 3070, 3090, 3120, 3130, 3150, 3350; RUSS 3400; SPAN 3070, 3080; STS 1010<sup>1</sup>, 1020<sup>1</sup>, 2150, 3010<sup>1</sup>, 3030<sup>1</sup>; THEA 2100, 2790, (MUSC) 3080, (MUSC) 3090, 3150, 3160, 3170; WCIN (ENGL) 3570, (ENGL, LANG) 4540. WS 3010, WS (PHIL) 3490.

**D. Social Sciences: at least 6 credits – Selected from two different fields. Note: AGRB and ECON are considered the same field.**

AGRB 2020; ANTH 2010<sup>2</sup>; ECON 2000, 2050, 2110, 2120; GEOG 1010, 1030<sup>2</sup>, 1060; HIST 1010, 1020, 1220<sup>1</sup>, 1240<sup>1</sup>, 1720<sup>2</sup>, 1730<sup>2</sup>, 1930<sup>2</sup>; HON 1920, 2020, 2200; PAS 3010<sup>2</sup>; POSC 1010, 1020<sup>2</sup>, 1030, 1040<sup>2</sup>; PSYC 2010, 2500<sup>2</sup>, 2750<sup>1</sup>; RS 3010; SOC 2010, 2020.

**Note: Science and Technology in Society and Cross-Cultural Awareness requirements may be satisfied by other General Education courses, as indicated in the footnotes below, as long as the student completes a total of 31 hours in area I.**

**E. Cross-Cultural Awareness: at least 3 credits, if not satisfied by a course in groups A-D**

AAH 1020; AGRB 2050; ANTH 2010, 3010, 3200, 3250, 4280; ART 2100; ASL 3050; CAAH 2010; COMM 1800; ENGL 2120, 2160, 3540; GEOG 1030; HIST 1720, 1730, 1930; HON 1930, 2090; HUM 3090; IS 1010, 2100; LANG 2500, 2540; MUSC 2100, 3140; PAS 3010; POSC 1020, 1040; PSYC 2500, 3570; REL 1010, 1020; WS 1030; *or* Through a University-approved cross-cultural experience.

**F. Science and Technology in Society: at least 3 credits, of not satisfied by a course in groups A-E**

AGED (EDF) 4800, AGRB 2050, (ECON) 4570; AVS 3150, 4150; BIOL 2000, 2010, 2030, 2040, 2100, 2110, 2200, 4730; CH 1050, 1060; COMM 1070, 3070; CPSC 2920; CTE 1150, 2210; ECE 1010; ECON 3190, (AGRB) 4570; EDF (AGED) 4800; EES 4860; ENGL 3490, 3560; ENGR 2200, 2210; ENR 3120, (FOR) 4160; ENSP (GEOL) 1250, 2000, (PES) 3150, 4000; ENT 2000; FDSC 2140; FOR (ENR) 4160; GEOL 1120, 1200, (ENSP) 1250, 2700, 3000; HCG (NURS) 3330; HIST 1220, 1240, 3210, 3220, 3230, 3920, 4240, 4910; HLTH 4310; HON 1940, 2010, 2060; IE 4880; LARC 1160; MATH 2190; MKT 4450; MUSC 3180; NURS 1400, (HCG) 3330; NUTR 2030, 2100; PES (ENSP) 3150, 4760; PHIL 1240, 2100, 3240, 3260, 3280, 3400, 3450; PHYS 2450; PKSC 3680; PLPA 2130; PRTM 2110; PSYC 2750; RS (SOC) 4010; SOC (RS) 4010, 4030; STAT 2220; STS 1010, 1020, 1200, 1710, 2150, 2160, 3010, 3030, 4980, 4990.

**Footnotes:** 1 This course also satisfies the Science and Technology in Society Requirement. 2 This course also satisfies the Cross-Cultural Awareness Requirement.

**II. Distributed Coursework:**

Courses in the majors incorporate critical thinking, ethical judgment, and both written and oral communication skills into the curriculum. Some curricula use a cluster of courses to meet the oral communication student outcome.

## 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>	
<b>Biochemistry</b>	3050		3050 4320		1 <sup>st</sup> 3050††† 2 <sup>nd</sup> 3050†††	
<b>Biological Sciences</b>	1010	4620	1040	4670	1030	1040
	1030	4660	1060	*4690†	1050	1060
<sup>1</sup> Summer Minimester A	1050	4670	1110	*4700	2000†††	2000†††
<sup>2</sup> Summer Minimester B	1100	4890/4891	2000	4710	2220	2230
<sup>3</sup> Summer Minimester C	2000	*4910	2040	4780†	3350††††	4170
<sup>4</sup> Summer Minimester D	2110	4920	2230	4800†	3530††††	4880 <sup>3,4</sup>
<sup>5</sup> Long Summer	2220	4930	2300	4830	4610	*4910
	3010	*4940	*3020	4890/4891	4880 <sup>1,2</sup>	
	*3030	*4950	*3040	*4910	*4910	
	*3040	4960	3060	4920	4920 <sup>5</sup>	
	3070	4970	3080	4930	4940 <sup>5</sup>	
	3080		3160	*4940		
	3150		*3350	*4950		
	3200		3510	4960		
	*3350		3530	4970		
	3510		*3940			
	3530		*4010			
	*3940		4020			
*Honors section also available	*4000††		4100			
	4030		*4110			
	*4140		*4140			
†odd years only	*4200		4150†			
	4250		4340			
††even years only	4260		4480††			
	4360†		4510			
†††Online & On-campus	*4400		4540			
	*4410		*4610			
††††Online only	*4450		4620			
	*4560		4640/4641††			
	*4610					
<b>Genetics</b>	3000		3000		3000††††	
<b>Microbiology</b>	3050	*4950	3050	4920	3050	*4910
	*3940		*3940	4930	*4910	
	*4010		*4000	*4940	4920 <sup>5</sup>	
	*4050		4020†	*4950	4940 <sup>5</sup>	
	*4100		4030††			
	*4140		*4070			
	*4150		*4110			
	*4160		*4120			
	4510		*4130			
	4560		*4140			
	*4910		*4170			
	4920		4500			
	4930		4520			
	*4940		*4910			

## The Department of Biological Sciences Course Sequence Planner

NAME: \_\_\_\_\_

MAJOR: \_\_\_\_\_

CUID: \_\_\_\_\_

DATE: \_\_\_\_\_

Fall:	Hrs	Spring:	Hrs	Summer:	Hrs

Fall:	Hrs	Spring:	Hrs	Summer:	Hrs

Fall:	Hrs	Spring:	Hrs	Summer:	Hrs

Fall:	Hrs	Spring:	Hrs	Summer:	Hrs

**Notes:**