Sophomore Year
First Semester
3 - CH 2230 Organic Chemistry
1 - CH 2270 Organic Chemistry Lab.
1 - COMM 1500 Intro. to Human Comm. or
1 - COMM 2500 Public Speaking
3 - GEN 3020 Molecular and General Genetics
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab. I

Second Semester
3 - BCHM 3101 Molecular Biochemistry
3 - CH 2240 Organic Chemistry
1 - CH 2280 Organic Chemistry Lab.
2 - GEN 3040 Molecular Biology Lab.
3 - STAT 2300 Statistical Methods I
3 - Arts and Humanities (Literature) Requirement*
3 - Social Science Requirement*

Junior Year
First Semester
3 - GEN 4200 Molecular Genetics and Gene Reg.
2 - GEN 4210 Molecular Genetics and Gene Regulation Lab.
3 - GEN (BCHM) 4400 Bioinformatics
3 - Science Requirement*
3 - Social Science Requirement*

Second Semester
3 - BIOL 4610 Cell Biology
3 - GEN 4100 Population and Quantitative Gen.
2 - GEN 4110 Population and Quantitative Gen. Lab.
2 - PHIL 3260 Science and Values
3 - Genetics Requirement*
3 - Elective

Senior Year
First Semester
3 - GEN 4500 Comparative Genetics
3 - Genetics Requirement*
3 - Science Requirement*
6 - Elective

Second Semester
2 - GEN 4930 Senior Seminar
3 - Genetics Requirement*
3 - Science Requirement*
6 - Elective

17

122 Total Semester Hours

Notes:
1. A student is allowed to enroll in science and mathematics courses only when all prerequisites have been passed with a grade of C or better.
2. A minimum grade of C is required in all science and mathematics courses. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any science or mathematics course.

HORTICULTURE
Bachelor of Science
Horticulture connects plants and people to improve our world, be it through the enhancement of the foods we eat, the creation of healthy natural living spaces, the economic and aesthetic enhancement of our homes and communities, or the application of green solutions to the challenges of environmental quality. The plants of horticulture are the foundation of human and environmental well being, and it is horticulture professionals who have the knowledge, skills, and passion to utilize those plants for the betterment of humankind.

The Horticulture degree program includes courses in science, mathematics, business, leadership, law, and communication, combined with a strong foundation in horticultural sciences and arts. The curriculum provides the flexibility to choose courses within those categories that best support the student’s personal interests, goals, and success. Career opportunities are endless.

Students work closely with faculty in creative inquiry groups to investigate and implement solutions to real problems. Internships are excellent opportunities to learn and explore potential careers.

Freshman Year
First Semester
3 - BIOL 1030 General Biology I
1 - BIOL 1050 General Biology Lab. I
4 - CH 1010 General Chemistry
4 - HORT 1010 Horticulture
4 - Spanish Language Requirement*
15

Second Semester
3 - BIOL 1040 General Biology II
1 - BIOL 1060 General Biology Lab II
4 - CH 1020 General Chemistry
3 - ENGL 1030 Accelerated Composition
3 - MATH 1020 Intro. to Mathematical Analysis
3 - Business Requirement*
17

Sophomore Year
First Semester
3 - HORT 2100 Growing Garden Plants in the Fall
3 - HORT 3030 Landscape Plants
3 - MATH 1010 Essential Math. for Informed Soc.
3 - Arts and Humanities (Non-Lit.) Requirement*
4 - Plant Biology Requirement*
16

Second Semester
3 - HORT 2110 Growing Plants in the Spring
4 - PES 2020 Soils
3 - Arts and Humanities (Literature) Requirement*
3 - Social Science Requirement*
13

Summer
3 - HORT 2710 Internship* or
3 - HORT 4710 Advanced Internship*

Junior Year
First Semester
3 - HORT 3080 Sustainable Landscape Garden Design
3 - Business Requirement*
3 - Horticulture Specialization Requirement*
3 - Oral Communication Requirement*
3 - Related Science Requirement*

Second Semester
3 - BIOL 4040 Plant Physiology
1 - BIOL 4020 Plant Physiology Lab
3 - HORT 4040 Plant Propagation
1 - HORT 4050 Plant Propagation Techniques Lab.
3 - Horticulture Specialization Requirement*
3 - Social Science Requirement*
1 - Elective
15

Senior Year
First Semester
3 - HORT 4090 Senior Capstone Course
3 - Business Requirement*
3 - Horticulture Specialization Requirement*
3 - Related Science Requirement*
3 - Elective
15

Second Semester
3 - Horticulture Specialization Requirement*
6 - Related Science Requirement*
3 - Elective
12

121 Total Semester Hours

*See advisor. Select from department-approved list.

MICROBIOLOGY
Bachelor of Science
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.

The Microbiology curriculum with a Biomedicine
<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freshman Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>1 - BIOL 1010 Frontiers in Biology I or 1 - MICR 1010 Microbes and Human Affairs 5 - BIOL 1100 Principles of Biology I 4 - CH 1010 General Chemistry 3 - COMM 1500 Intro. to Human Comm. or 3 - COMM 2500 Public Speaking 4 - MATH 1060 Calculus of One Variable I</td>
</tr>
<tr>
<td>Second Semester</td>
<td>5 - BIOL 1110 Principles of Biology II 4 - CH 1020 General Chemistry 3 - ENGL 1030 Accelerated Composition 34 - Mathematical Sciences Requirement</td>
</tr>
<tr>
<td><strong>Sophomore Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - CH 2230 Organic Chemistry 1 - CH 2270 Organic Chemistry Lab. 3 - ENGL 3150 Scientific Writing and Comm. 3 - Arts and Humanities (Literature) Requirement 3 - Social Science Requirement 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>2 - BIOL 4340 Biol. Chemistry Lab. Techniques 3 - CH 2240 Organic Chemistry 1 - CH 2280 Organic Chemistry Lab. 3 - Arts and Humanities (Non-Lit.) Requirement 3 - Biochemistry Requirement 4 - General Microbiology Requirement</td>
</tr>
<tr>
<td><strong>Junior Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - MICR 4010 Microbial Diversity and Ecology 3 - PHYS 1220 Physics with Calculus I 3 - CH 2230 Organic Chemistry 1 - PHYS 2090 Physics Lab. I or 1 - PHYS 2090 Physics Lab. II 3 - Social Science Requirement 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - MICR 4120 Bacterial Physiology 2 - MICR 4500 Advanced Micro Lab I 3 - Microbiology Requirement 3 - Social Science Requirement 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - MICR 4500 Advanced Micro Lab I 2 - MICR 4510 Advanced Micro Lab II 3 - Virology Requirement 3 - Elective</td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - BIOL 4610 Cell Biology 3 - MICR 4150 Microbial Genetics 2 - MICR 4510 Advanced Micro Lab II 3 - Virology Requirement 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>2 - BIOL 4930 Senior Seminar or 2 - MICR 4930 Senior Seminar 2 - MICR 4520 Advanced Micro Lab III 3 - Microbiology Requirement 3 - Elective</td>
</tr>
<tr>
<td><strong>Sophomore Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - CH 2230 Organic Chemistry 1 - CH 2270 Organic Chemistry Lab. 3 - ENGL 3150 Scientific Writing and Comm. 3 - Arts and Humanities (Literature) Requirement 3 - Social Science Requirement 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - CH 2240 Organic Chemistry 1 - CH 2280 Organic Chemistry Lab. 3 - Arts and Humanities (Non-Lit.) Requirement 3 - Biochemistry Requirement 3 - Biomedicine Requirement 4 - General Microbiology Requirement</td>
</tr>
<tr>
<td><strong>Junior Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - BIOL 4610 Cell Biology 2 - BIOL 4620 Cell Biology Lab. 3 - MICR 4010 Microbial Diversity and Ecology 3 - PHYS 1220 Physics with Calculus I and 1 - PHYS 1240 Physics Lab. I or 3 - PHYS 2070 General Physics I and 1 - PHYS 2090 General Physics I Lab. 3 - Genetics Requirement</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - MICR 4120 Bacterial Physiology 2 - MICR 4500 Advanced Micro Lab I 3 - PHYS 2080 General Physics II and 1 - PHYS 2100 General Physics II Lab. or 3 - PHYS 2210 Physics with Calculus II and 1 - PHYS 2230 Physics Lab. II 3 - Social Science Requirement 3 - Elective</td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - MICR 4140 Basic Immunology 3 - MICR 4150 Microbial Genetics 3 - MICR 4160 Introductory Virology 2 - MICR 4510 Advanced Micro Lab II 3 - Biomedicine Requirement</td>
</tr>
<tr>
<td>Second Semester</td>
<td>2 - BIOL 4930 Senior Seminar or 2 - MICR 4930 Senior Seminar 3 - MICR 4110 Pathogenic Bacteriology 3 - MICR 4170 Cancer and Aging 2 - MICR 4520 Advanced Micro Lab III 3 - Biomedicine Requirement 3 - Elective</td>
</tr>
<tr>
<td><strong>Freshman Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - CH 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100, and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1–2 credits required must be satisfied by completing 1–2 extra credits from departmental course offerings at the 3000 level or above. See advisor.</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - MICR 3050 or other approved coursework at the 2000 level or higher.</td>
</tr>
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<td><strong>Sophomore Year</strong></td>
<td></td>
</tr>
<tr>
<td>First Semester</td>
<td>3 - CH 1100 and 1110 are strongly recommended; however, BIOL 1030/1050 may substitute for BIOL 1100, and BIOL 1040/1060 may substitute for BIOL 1110. The remaining 1–2 credits required must be satisfied by completing 1–2 extra credits from departmental course offerings at the 3000 level or above. See advisor.</td>
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<td>Second Semester</td>
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<tr>
<td><strong>Junior Year</strong></td>
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<td>Second Semester</td>
<td>3 - MICR 3050 or other approved coursework at the 2000 level or higher.</td>
</tr>
</tbody>
</table>

Microbiology majors planning to apply for admission to a medical or dental school should inform their advisors immediately upon entering the program.

Concentration is recommended for students planning postgraduate programs. 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.
Freshman Year
First Semester
1 - BIOL 1030 General Biology I
1 - BIOL 1050 General Biology Lab. I
2 - CH 1010 General Chemistry
2 - MATH 1060 Calculus of One Variable I
2 - PKSC 1010 Packaging Orientation
3 - Social Science Requirement
       16
Second Semester
3 - BIOL 1040 General Biology II
1 - BIOL 1060 General Biology Lab. II
4 - CH 1020 General Chemistry
3 - COMM 2500 Public Speaking
3 - ENGL 1300 Accelerated Composition
2 - PKSC 1020 Intro. to Packaging Science
       16
Sophomore Year
First Semester
3 - CH 2010 Survey of Organic Chemistry and
1 - CH 2020 Survey of Organic Chemistry Lab. or
3 - CH 2230 Organic Chemistry and
1 - CH 2270 Organic Chemistry Lab.
3 - PHYS 1220 Physics with Calculus I and
1 - PHYS 1240 Physics Lab. II or
3 - PHYS 2070 General Physics I and
1 - PHYS 2090 General Physics I Lab.
4 - PKSC 2020 Packaging Materials and Manuf.
4 - PKSC 2200 Product/Package Design and
    - Prototyping
       16
Second Semester
3 - PHYS 2080 General Physics II and
1 - PHYS 2100 General Physics II Lab. or
3 - PHYS 2210 Physics with Calculus II and
1 - PHYS 2230 Physics Lab. II
3 - PKSC 2010 Packaging Perishable Products
3 - PKSC 2040 Container Systems
1 - PKSC 2060 Container Systems Lab.
3 - Arts and Humanities (Literature) Requirement
       14
Summer
0 - COOP 1010 Cooperative Education

Junior Year
First Semester
3 - ENGL 3140 Technical Writing
4 - GC 1030 Graphic Comm. I for Packaging Sci.
4 - PKSC 4010 Packaging Machinery
4 - PKSC 4040 Mechanical Properties of Packages
    and Principles of Protective Packaging
1 - PKSC 4540 Product and Package Eval. Lab.
3 - Emphasis Area Requirement
       17
Second Semester
3 - PKSC 3200 Package Design Theory
3 - PKSC 3680 Packaging and Society
3 - PKSC 4300 Converting for Flexible Packaging
3 - PKSC 4400 Packaging for Distribution
3 - STAT 2300 Statistical Methods I
3 - Emphasis Area Requirement
       18

Senior Year
First Semester
4 - PKSC 4160 Appl. of Polymers in Packaging
4 - PKSC 4640 Food and Health Care Pkg. Syst.
3 - STAT 3300 Statistical Methods II
3 - Emphasis Area Requirement
       14
Second Semester
3 - AGRB 2020 Agricultural Economics
3 - ECON 2110 Principles of Microeconomics
1 - PKSC 4030 Packaging Career Preparation
3 - PKSC 4200 Package Design and Development
3 - Arts and Humanities (Non-Lit.) Requirement
6 - Emphasis Area Requirement
       16
127 Total Semester Hours

PACKAGING SCIENCE
Bachelor of Science
The Bachelor of Science degree in Packaging Science prepares students for careers in industries producing and utilizing packages for all types of products. Packaging is an essential part of industrialized economies, protecting, preserving, and helping to market products. The field of packaging is highly competitive and highly innovative, requiring an ever-increasing number of professional positions. Opportunities for employment include a wide variety of career paths such as manufacturing, marketing, sales, design, purchasing, quality assurance, and customer services. Most career opportunities are in positions requiring technical knowledge combined with marketing and management skills.

The core curriculum assures graduates of having the skills and knowledge required by most entry-level packaging positions. Emphasis area choices or minors allow students to select courses to improve career preparation for specific industry segments, including: Distribution, Transportation and Engineering Technology; Food and Health Care Packaging; Materials; and Package Design and Graphics. Alternatively, any University-approved minor may be completed.

Students changing majors into Packaging Science must:
1. have an overall minimum GPA of 2.0; and
2. have completed four of the following courses with an average GPA of 2.7:
   BIOL 1030, 1040, CH 1010, 1020, MATH 1060, PHYS 1220, 2070, 2080, 2210; or both MATH 1040 and 1070; and
3. have completed PKSC 1020 with a grade of B or higher.

Combined Bachelor of Science/Master of Science Degree Program
The Department of Food, Nutrition and Packaging Sciences also offers an accelerated five-year combined bachelor’s/master’s program that allows students to count up to twelve hours of graduate credit toward both the BS degree in Packaging Science and the MS degree in Packaging Science. Details are available from the Department of Food, Nutrition and Packaging Sciences or at www.clemson.edu/fnps.

PLANT AND ENVIRONMENTAL SCIENCES
Bachelor of Science
The BS degree program in Plant and Environmental Sciences is a multidisciplinary program that educates students with expertise in soils, crop sciences, and applied agricultural biotechnology. It offers students a rigorous, science-based degree with educational opportunities related to management of agricultural commodities and natural resources, as well as soil and water resources. Students can tailor the program to fit their professional and academic goals by selecting one of three concentrations.

The Agricultural Biotechnology Concentration integrates conventional disciplines with molecular advances in plants, pathogens, and biosystem interactions and responds to the educational void between the rapid adoption of biotechnology products into agricultural production and the intermediate- and end-users, farmers, and consumers. Graduates in this concentration will be competitive as scientists in emerging agricultural biotechnology industries, as educators, and as policy makers and officers in regulatory agencies.