

UNDERGRADUATE PROGRAM CHANGE

Proposal for a Program Change

Department Biological and Environmental Sciences **Submission Date** 09/08/2015

Major **Minor** **Concentration**

Semester of Implementation Fall 2016

Retroactive? (If yes, please specify catalog year) No

I. Summary of Proposed Program Change:

	CURRENT	Check Box if no Change	PROPOSED CHANGE
Program Name	<u>Biology</u>	<input checked="" type="checkbox"/>	<hr/>
Credit Hours	<u>120</u>	<input checked="" type="checkbox"/>	<hr/>
Course(s) to be Added	<hr/>	<input type="checkbox"/>	<u>BIOL 120, 250, 251, 288, 301, 302, 305, 309, 315, 395, 455, 460, 465, 488, and 489; MATH 171, 261, and 301</u>
Course(s) to be Removed	<hr/>	<input type="checkbox"/>	<u>BIOL 121, 122, 206, 207, 292, 308, 400, 405, 410, 435, 441, and 443; CHEM 212 and CHEM 214</u>
Indicate courses to be substituted for removed courses	<hr/>		<u>On old catalogs, substitute BIOL 309 for 308 and substitute BIOL 488 for 400; other substitutions will be approved individually, as needed</u>
Course(s) to be Changed	<hr/>	<input type="checkbox"/>	<u>BIOL 303, 304, 306, 324, 341, 342, 360, 361, 399, 404, 425, 426, 427, 430, 434, 445, 450, 470, 471, 474, 475</u>

Other Changes _____

See catalog changes for modifications of major requirement areas and the shift of some courses between these areas.

II. Proposed revision in catalog description of program.

Provide proposed revisions in catalog copy – use **bold** for new information, ~~strike through~~ for deletions, and *italicize* changes.

See catalog changes below

III. Rationale for proposed changes. *Attach extra sheet if necessary.*

This proposed program change is the result of several years of a curriculum mapping project. This effort began in 2009 and has been informed by two bodies of information: 1) assessment data collected annually by the faculty and archived in WEAVEonline and 2) national calls for curriculum reform in the life sciences, including *BIO2010*, the AAAS *Vision and Change* report, and the HHMI/AAMC *Preparing Future Physicians* report.

The curriculum review and revision process has involved all faculty in the program in critical discussions of teaching and learning. The collaborative effort started “with the end in mind” as faculty identified the knowledge, skills, and dispositions desired in all biology graduates. They then sought to map the development of knowledge and skills across the four-year student experience. The goal was to scaffold courses and student learning experiences so that knowledge and skills are progressively introduced, reinforced, mastered, and assessed. The proposed program changes are designed to achieve this goal.

The new proposed curriculum can be visualized by our “Rotunda Model” (see last page of this document). The previous 2-semester introductory series of BIOL 121 and 122 will be replaced by a 3-semester, 2-tiered foundational series consisting of BIOL 120, 250, and 251. Upon successful completion of these three foundational courses, students will then complete BIOL 288 Sophomore Seminar, which serves as the “gateway” transition to upper-level courses. The next level of the curriculum will be the pillar courses, which are designed to provide substantial foundational knowledge within the three major categories of biological study: (1) cell and molecular, (2) ecology and evolution, and (3) organismal. These three “pillars” are referred to as “areas” within the catalog copy. A student must have already completed BIOL 288 or be currently enrolled in BIOL 288 to enroll in a pillar course. Each pillar provides a choice of four courses. After taking the pillar courses, or while concurrently finishing the pillar courses, students will select additional upper-level electives, including at least 7 credits (two courses) at the 400 level. All 400-level courses have the prerequisite of BIOL 288 with a minimum grade of C-, allowing for these 400-level courses to include major projects and assignments that rely on the critical thinking and scientific communication skills that are emphasized in BIOL 288. Finally, the “dome” of the rotunda model is composed of the capstone course, BIOL 488 Senior Seminar, and the program assessment course, BIOL 489 Senior Assessment.

Throughout the process of developing the new biology curriculum, we have considered the requirements for the career paths that our students pursue and the revisions that have been made at

peer institutions in recent years. The new proposed biology curriculum removes Organic Chemistry II (lecture and lab) from the core requirements for the major. Students who plan to pursue Health Pre-Professional training (such as medical and dental school) will still be advised to take Organic Chemistry II and it will continue to be a prerequisite for BIOL/CHEM 412 Biochemistry. However, the majority of our students do not continue with Pre-Professional studies post-graduation and several other institutions have also reduced their chemistry requirements in recent years. The elimination of Organic Chemistry II from the biology major requirements allows our new curriculum to be accomplished without an increase in total credit hours.

Our current biology major requirements do not specify the courses that students must complete for their math courses (General Education Goal 5 and Additional Degree Requirement). Most students listen to advising and take courses that will benefit them most within the major, but advising does not guarantee compliance. Thus, the most beneficial MATH courses are set as requirements in the new curriculum and are utilized as prerequisites, as appropriate, for BIOL 288 and various upper-level courses.

The curriculum changes also necessitate several changes to the text of the biology program description and the "Health/Pre-professional" description. Furthermore, we propose a re-organization the catalog to place the "Health/Pre-professional" section immediately after the Biology program description.

IV. Resource Assessment

A. Estimate any change in staff requirements that would result from this program change.

No additional staff will be required as a result of this program change.

B. Estimate the amount and cost of any extra equipment, library resources, computer hardware or software, or other resources that would be required to carry out this program change.

None

V. Affected Departments or Programs:

If the proposed program changes could have an impact on other departments or programs, the appropriate affected chairs or program directors should be notified of the proposed changes.

A. List other departments/programs that might be affected:

Integrated Environmental Sciences, Math, Nursing, HARK, Chemistry & Physics, Liberal Studies, Psychology (Minor in Neurostudies)

B. Individuals contacted and date contacted:

David Shoenthal (Math) - 9/11/2015
Deb Ulmer (Nursing) – 9/11/2015
Rena Koesler (HARK) – 8/27/2015
Melissa Rhoten (Chemistry & Physics) - 9/12/2015
Gena Southall (Liberal Studies) - 9/11/2015
Stephanie Buchert (Psychology) - 8/27/2015

**SIGNATURE PAGE
UNDERGRADUATE PROGRAM CHANGE**

Department Biological and Environmental Sciences Program Name Biology Major

VI. Approvals **Date Received** **Date Approved** **Signature**

1. Department Curriculum Committee Chair _____

2. Department Chair _____
The Department Chairs, whose programs may be affected, have been notified:

Department	<u>Math</u>	Date Notified	<u>9/11/2015</u>
Department	<u>Nursing</u>	Date Notified	<u>9/11/2015</u>
Department	<u>HARK</u>	Date Notified	<u>8/27/2015</u>
Department	<u>Chemistry & Physics</u>	Date Notified	<u>9/12/2015</u>
Department	<u>Liberal Studies</u>	Date Notified	<u>9/11/2015</u>
Department	<u>Psychology</u>	Date Notified	<u>8/27/2015</u>

3. College Dean _____

4. College Curriculum Committee _____

5. Educational Policy Committee _____

6. *Faculty Senate _____

7. *VPAA _____

8. *OAIR (notification only) _____

9. *BOV/SCHEV - VPAA will submit materials for approval

10. Date received by Registrar _____

*Substantive change (see definition and consult EPC chair prior to submitting materials)

All curriculum proposals/changes are processed in the date order received. In order to be included in the next academic year's catalog, all paperwork must be submitted no later than:

February 1st to the College Curriculum Committee
March 1st to the Educational Policy Committee (EPC)

Submission within the deadlines does not guarantee processing in time for the next academic year's catalog.

Proposed Catalog Revisions

BIOLOGY PROGRAM

The biology major at Longwood provides training in many areas of the biological sciences so that graduates may pursue graduate study or careers in research, industry, teaching, medicine, dentistry, or allied health fields. To ensure that students have a broad background in the diverse field of biological sciences, each student must take the following courses: **Integrative Biology, Introduction to Genetics and Cell Biology, Introduction to Ecology and Evolution, Sophomore Seminar, Senior Seminar, and Senior Assessment. In addition, students will take one course from each of three areas (Cell and Molecular; Ecology and Evolution; Organismal) and upper-level elective courses. The Unity of Life, The Diversity of Life, Evolution, Genetics, General Ecology, and Unifying Biological Principles. In addition, students must choose a specialization in one of the following concentrations: ecology and evolutionary biology, general biology, or health/biomedical. Students who plan to pursue careers in medicine, dentistry, veterinary medicine, or other health-related areas are encouraged to consider the health concentration.**

Students may take a maximum of 5 credits total in internship (BIOL ~~292~~, 392, 492, 494) and research (BIOL 496, 497) courses for quality points (A, B, and C grades). Beyond 5 credits, such courses must be taken on a pass/fail basis and will not count toward requirements for the major or minor. Please note: 40 hours of internship experience equals 1 university credit hour.

No grade below C- in biology courses is accepted for graduation requirements in the biology major or minor.

A student may seek ~~a~~ secondary teaching **endorsement licensure** in biology. This program consists of courses required for the biology major as well as additional education coursework and the professional semester consisting of 12 hours in the senior year. If an additional endorsement in chemistry or physics is desired, the student must minor in that discipline and meet all state-mandated core requirements for that endorsement. Interested students should meet with secondary science education faculty for advising on preparation for secondary science teaching.

HEALTH-CAREERS/PRE-PROFESSIONAL PREPARATON

~~Most students interested in pursuing health-related professions will be best served by the health/biomedical concentration option of the biology major program (described earlier in this catalog), however it should be noted that a biology degree is not an entrance requirement for most professional school programs. The health/biomedical concentration is designed for students planning post-graduate study leading to a health career, such as in medicine, dentistry, veterinary medicine, and physical and occupational therapy. As a general rule, students applying to professional school programs will complete their four-year degree at Longwood before matriculating at the professional school.~~

~~Each student~~ **Students interested in pursuing health-related professions** should become familiar with selected professional school(s) early in ~~his/her~~ **their** academic career as course requirements for individual schools vary. Typical courses required for admission into most professional schools include: at least 8 credits of Biology coursework, 8 credits of General Chemistry, 8 credits of Organic Chemistry, 6 credits of English, 6 credits of Math (with at least 1 course in statistics), and 8 credits of Physics. **Although a biology degree is not an entrance requirement for most professional school programs, the majority of applicants are from life science majors. Furthermore, The the** four-year biology major curriculum **already includes the courses that are typically required and** will prepare students ~~with the foundation courses necessary~~ for the required admissions exams (MCAT, DAT, or GRE), usually taken ~~during-after~~ **completing** their junior year. Please note: ~~in 2015, that~~ the MCAT exam ~~will add~~ **includes** the topics of Biochemistry, Sociology, Psychology, and Statistics. **Students who intend to take the MCAT are strongly encouraged to choose coursework in these topics for electives within the biology major or for general education classes.** As minimal preparation, students should complete ~~the-all~~ required courses ~~listed above~~ by the end of their junior year. **Students should also invest a substantial amount of time preparing for the requisite admission exam.**

For admission into graduate or professional school, students should have a strong GPA and score competitively on the admissions exam. To be a viable candidate for admission to a medical/dental/veterinary/allied health professions school, students must also demonstrate firsthand experience in their chosen area of study. This can be accomplished by “shadowing” a clinician whereby a pre-professional student observes and assists practicing health professionals or through volunteer or paid work in a hospital, clinic, or other health setting. Course credit can be obtained for these experiences by registering for BIOL ~~292~~, 392, ~~or~~ 492, **or 494** Internship in Biology.

The Department of Biological and Environmental Sciences also maintains articulation agreements with several clinical lab programs within Virginia for students interested in certification/licensure in medical technology and/or clinical lab sciences. These curricula may require transfer to another institution for part of the undergraduate program of study.

BIOLOGY MAJOR, BS DEGREE

A. General Education Core Requirement/33 credits

MATH 171 is required for General Education Goal 5.

PHIL 315 or 316 is required for General Education Goal 12.

BIOL 490, 492, 496, or 498 ~~is required for~~ **satisfies** General Education Goal 14.

B. Additional Degree Requirements/7 credits

MATH 261 or MATH 301/3 credits ~~Mathematics/Computer Science/3 credits~~

CHEM 111/4 credits

C. Major Requirements/~~63 credits~~ **43 credits**

1. **CORE REQUIREMENTS/35 credits** ~~Core Curriculum (required of all biology majors)~~

BIOL 120 Integrative Biology/4 credits

BIOL 250 Introduction to Genetics and Cell Biology/4 credits

BIOL 251 Introduction to Ecology and Evolution/4 credits

BIOL 288 Sophomore Seminar/3 credits

BIOL 488 Senior Seminar/3 credits

BIOL 489 Senior Assessment/0 credits

~~BIOL 121~~ ~~The Unity of Life/4 credits~~

~~BIOL 122~~ ~~The Diversity of Life/4 credits~~

~~BIOL 324~~ ~~Genetics/4 credits~~

~~BIOL 341~~ ~~General Ecology/4 credits~~

~~BIOL 399~~ ~~Evolution/3 credits~~

~~BIOL 400~~ ~~Unifying Biological Principles/3 credits~~

BIOL 490 Directed or Independent Study, BIOL 492 Internship in Biology, BIOL 496 Research in Biology, or BIOL 498 Honors research in Biology /1 credit (satisfies General Education Goal 14)

CHEM 112 Fundamentals of Chemistry II/4 credits

CHEM 211 Organic Chemistry I Lecture/3 credits

~~CHEM 212~~ ~~Organic Chemistry II Lecture/3 credits~~

CHEM 213 Organic Chemistry Laboratory I/1 credit

~~CHEM 214~~ ~~Organic Chemistry Laboratory II/1 credit~~

PHYS 101 General Physics I/4 credits

or PHYS 201 University Physics I/4 credits *

PHYS 102 General Physics II/4 credits (waived from General Education Goal 6)

or PHYS 202 University Physics II/4 credits (waived from General Education Goal 6)

*PHYS 101 is a prerequisite for PHYS 102. PHYS 201 is a prerequisite for PHYS 202.

2. AREA REQUIREMENTS/12 credits

All students must successfully complete at least one class from each area below.

CELL AND MOLECULAR AREA

- BIOL 305: General Microbiology/4 credits**
- BIOL 324: Genetics/4 credits**
- BIOL 326: Cell Biology/4 credits**
- BIOL 360: Developmental Biology/4 credits**

ECOLOGY AND EVOLUTION AREA

- BIOL 330: Conservation Biology/4 credits**
- BIOL 341: Ecology/4 credits**
- BIOL 342: Biogeography /4 credits**
- BIOL 399: Evolution/4 credits**

ORGANISMAL AREA

- BIOL 301: Comprehensive Human Anatomy and Physiology/4 credits**
- BIOL 303: Vertebrate Morphology/4 credits**
- BIOL 309: Plant Biology/4 credits**
- BIOL 315: Invertebrate Zoology/4 credits**

3. BIOLOGY ELECTIVE REQUIREMENTS/16 credits

Students must complete at least 16 additional Biology elective credits from BIOL 208-498, with a minimum of 7 credits from BIOL 400 to BIOL 491. These biology electives may be selected from additional courses in the areas or from the elective courses offered on a rotating basis. Students are encouraged to talk with their academic advisors regarding elective courses that are most applicable to their intended field of graduate work or employment.

~~**D. BIOLOGY MAJORS MUST CHOOSE ONE OF THE FOLLOWING CONCENTRATIONS:**~~

~~**Ecology and Evolutionary Biology Concentration/20 credit hours**~~

~~Choose three courses from the following:~~

- ~~BIOL 303 ———— Vertebrate Morphology/4 credits~~
- ~~BIOL 306 ———— Vertebrate Physiology/4 credits~~
- ~~BIOL 308 ———— Plant Form and Function/4 credits~~
- ~~BIOL 361 ———— Freshwater Ecology/4 credits~~
- ~~BIOL 430 ———— Conservation Biology/4 credits~~
- ~~BIOL 435 ———— Advanced Ecology/4 credits~~

~~Choose an additional 8 credits of biology electives from BIOL 206-498.~~

~~**General Biology Concentration/20 credit hours**~~

~~Choose 20 credits of biology electives from BIOL 206-498.~~

~~**Health/Biomedical Concentration/20 credit hours**~~

~~Choose three courses from the following:~~

- ~~BIOL 206 ———— Human Anatomy and Physiology I/4 credits~~
- ~~BIOL 207 ———— Human Anatomy and Physiology II/4 credits~~
- ~~BIOL 304 ———— Microbiology/5 credits~~
- ~~BIOL 404 ———— Immunology/4 credits~~
- ~~BIOL 412 ———— Biochemistry/4 credits~~
- ~~BIOL 426 ———— Cell Biology/4 credits~~

~~Choose at least 7 credits of biology electives from BIOL 206-498.~~

~~The health/biomedical concentration is designed for students planning further study leading to a health career, such as in medicine, dentistry, veterinary medicine, nursing, physical and occupational therapy, and medical technology, or for those planning to pursue graduate education in the biomedical sciences.~~

E. D. General Electives BS Degree /17 credits

F. E. Total Credits Required for BS in Biology/120

BIOL 488: Senior Seminar (3 credits)

Prereq: BIOL 288 with minimum grade of C-;
one course in each pillar; one 400-level BIOL course;
and MATH 261 or 301

+ BIOL 489: Senior Assessment (Zero credits)

Prerequisite or may be taken concurrently: BIOL 488

BIOL electives

(16 credits, with minimum of 7 credits
from BIOL 400-491)

**Cell and Molecular
(4 credits)***

BIOL 305: General
Microbiology

BIOL 324: Genetics

BIOL 326: Cell Biology

BIOL 360:
Developmental Biology

**Ecology and
Evolution
(4 credits)***

BIOL 330: Conservation
Biology

BIOL 341: Ecology

BIOL 342: Biogeography

BIOL 399: Evolution

**Organismal
(4 credits)***

BIOL 301: Advanced
Human A&P

BIOL 303: Vertebrate
Morphology

BIOL 309: Plant Biology

BIOL 315: Invertebrate
Zoology

BIOL 288: Sophomore Seminar (3 credits)

Prereq: BIOL 120, BIOL 250, and BIOL 251 with minimum
grades of C- and MATH 171

**BIOL 250: Introduction to
Genetics and Cell Biology**

(Foundation Course II; 4 credits)

Prereq = BIOL 120 with minimum
grade of C-

**BIOL 251: Introduction to
Ecology and Evolution**

(Foundation Course III; 4 credits)

Prereq = BIOL 120 with minimum
grade of C-

BIOL 120: Integrative Biology

(Foundation Course I; 4 credits)

* Pillar courses prerequisite or may be taken concurrently: BIOL 288