Biological Sciences
Wayne Hynes, Chair

The Department of Biological Sciences offers a broad selection of course offerings. The undergraduate curriculum is based on a two-semester foundations course and core courses that provide a well-rounded introduction to the major subdisciplines of biology. The elective courses allow students to explore multiple facets of the biological sciences or to deepen their understanding of a single subdiscipline.

Many of our students tailor their undergraduate degrees for entry into professional and graduate schools. The department has an excellent program in secondary science education for those desiring to teach, an outstanding pre-health track for students interested in the medical professions, and the combination of academic and research opportunities necessary to best prepare students for research-based graduate studies.

Students seeking careers in medicine, dentistry, osteopathy, optometry or podiatry should check the College of Sciences section of the catalog for additional information. Students should confer with their advisors to select the most appropriate math courses and science courses. The most frequently recommended biology courses are in the areas of human or vertebrate anatomy and physiology and those stressing the molecular and cellular levels of organization. However, students also are encouraged to explore other disciplines while they have the opportunity to develop a broader view of life processes and the human condition.

Bachelor of Science—Biology Major

Written Communication * 6
  ENGL 110C English Composition (required)
  ENGL 231C Introduction to Technical Writing (required)
Oral Communication 3
  COMM 101R Public Speaking
  or COMM 103R Voice and Diction
  or COMM 112R Introduction to Interpersonal Communication
Mathematics 3
  MATH 162M Precalculus I (required)
Language and Culture 0-6
  Information Literacy & Research 3
  CS 121G Introduction to Information Literacy and Research for Scientists (required)
  Human Creativity 3
  Interpreting the Past 3
  Literature 3
  Philosophy and Ethics 3
The Nature of Science (select one of the following) 8
  PHYS 111N Introductory General Physics
  & PHYS 112N and Introductory General Physics
  OEAS 110N Earth Science
  & OEAS 112N and Historical Geology
  OEAS 111N Physical Geology
  & OEAS 112N and Historical Geology
Impact of Technology 3
  Human Behavior 3
Departmental Requirements **
  BIOL 121N General Biology I 4
  & BIOL 122N and General Biology I Lab
  BIOL 123N General Biology II 4
  & BIOL 124N and General Biology II Lab
Elective Credit

Elective credit will be needed to meet the minimum requirement of 120 credit hours for the degree.

* Grade of C or better required in both courses
** Must be passed with a C (2.0) or better to continue in the program.

Upon completion of BIOL 121N, BIOL 122N/BIOL 123N, BIOL 124N students must complete the following core courses, some of which are prerequisites** or corequisites*** for upper-level biology courses (see course descriptions for prerequisites to individual courses). Core courses [BIOL 291, BIOL 292, BIOL 293, BIOL 303] must be passed with a C (2.0) or better.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 291</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 292</td>
<td>Evolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 293</td>
<td>Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 303</td>
<td>Genetics</td>
<td>3</td>
</tr>
</tbody>
</table>

** Prerequisite – designated course must be completed before enrolling in the course requiring the prerequisite.
*** Corequisite – designated course may have been completed or taken during the same semester the student is enrolling in the course requiring the corequisite.
+ Have (Precalculus) and (Organic Chemistry) as pre- or corequisites.

In addition to the core courses, all majors must complete one of the following writing intensive courses and earn a grade of C or better: BIOL 405W, BIOL 423W, BIOL 430W, BIOL 436W, or BIOL 488W.

Biology Electives. Students must choose at least 16 elective hours at the 300 level or above from the courses offered by the Department of Biological Sciences. A minimum of three of the courses must have a structured laboratory/field component [BIOL 368 (Internship) and BIOL 369 (Practicum) courses cannot be used to satisfy this requirement]. Students may use the four credits of BIOL 251 taken at Old Dominion University towards the upper-division elective requirements. No 200-level transfer credits can be used towards the elective courses. Students may use no more than six credits of unstructured courses to satisfy the requirement (see below). Elective courses must be passed with a grade of C (2.0) or better unless they are specified as Pass/Fail courses, in which case they must be passed (P). A Biology writing intensive course (W) is required and must be completed with a grade of C (2.0) or better unless they are specified as Pass/Fail courses, in which case they must be passed (P). A Biology writing intensive course (W) is required and must be completed with a grade of C (2.0) or better; this should be taken during the junior or senior year after completion of required prerequisites.

Unstructured Courses. Students may take advantage of several non-classroom experiences ("Unstructured Courses") offered by the Department of Biological Sciences and may receive elective credit for these experiences. These include BIOL 368 (Internship), BIOL 369 (Practicum), BIOL 497 (Undergraduate Research) and BIOL 498 (Independent Study). See individual course descriptions and the chief departmental advisor for more information about these opportunities.

Non-biology degree requirements:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 121N</td>
<td>Foundations of Chemistry I Lecture</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CHEM 122N</td>
<td>and Foundations of Chemistry I Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHEM 123N</td>
<td>Foundations of Chemistry II Lecture</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CHEM 124N</td>
<td>and Foundations of Chemistry II Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHEM 211</td>
<td>Organic Chemistry Lecture</td>
<td>3</td>
</tr>
<tr>
<td>CHEM elective 200-level or higher</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>MATH 200</td>
<td>Calculus for Business and Economics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 130M</td>
<td>Elementary Statistics +</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 22

+ Prerequisite for BIOL 303.
Upper Division General Education Requirements

The Professional Education core satisfies this requirement for the secondary education concentration.

- Option A. Approved Disciplinary Minor (a minimum of 12 hours determined by the department) or second degree or second major.
- Option B: Interdisciplinary Minor (specifically 12 hours, 3 of which may be in the major)
- Option C. International Business and Regional Courses or an approved Certification Program such as teaching licensure
- Option D. Two Upper-Division (300 level or above) Courses from outside the College of Sciences and not required by the major (6 hours)

Requirements for graduation (non-teacher education tracks) include a minimum cumulative grade point average of 2.00 overall and in the major, 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or 221C or 231C, and a writing intensive (W) course in the major with a grade of C or better, completion of Senior Assessment, and completion of the Biology Department Senior Assessment when offered.

Marine Biology Concentration

The marine biology concentration provides students with coursework, specialized advising, and practical experience in marine biology while ensuring a strong, balanced education in one of the traditional natural sciences in which students major. The concentration requires completion of the general biology foundation courses (BIOL 121N, BIOL 122N and BIOL 123N, BIOL 124N), or equivalent, with a grade of C (2.0) or better. In addition, at least 15 semester credit hours in approved marine biology related courses (See Marine Biology Concentration Curriculum sheet) at the 300 or 400 level are necessary, with Marine Biology (BIOL 331) and Oceanography (OEAS 306) being required courses. BIOL 331 will satisfy 3 credits toward the required 16 credits of the biology electives; the remaining 13 credit hours needed to satisfy the biology elective requirements should be taken from approved marine biology elective courses. All required and elective courses used for the concentration must be passed with a C (2.0) or better. The mathematics requirement for the concentration is MATH 211 Calculus I, and the non-biology physical science requirements are OEAS 111N (Physical Geology) and PHYS 111N (Introductory General Physics). Students in the program are expected to participate in non-credit, monthly meetings of the ODU Marine Biology Student Association. One course completed at an off-campus marine biology laboratory or study abroad program is strongly recommended, as is a research, practicum, or internship experience in marine biology. Other requirements are listed under the Bachelor of Science—Biology Major. Marine biology students may also select a minor in ocean and earth science.

A variety of facilities are available to students interested in the marine biology concentration. On-campus facilities include a modern marine wet laboratory along with biology faculty research laboratories specializing in marine: benthic ecology, animal biomechanics and physiology, marine fish biology and systematics, conservation biology, phytoplankton biology, coastal wetland plants, disease ecology, microbiology, and tropical ecology. Field studies and course-related trips to nearby marine habitats in the Chesapeake Bay and Atlantic Ocean are supported by departmental field vehicles and small vessels, as well as by the Ocean, Earth and Atmospheric Sciences Department's 55-foot research vessel, the R/V Fay Slover. Research requiring SCUBA is supported by the ODU Academic Diving Program, a local chapter of the American Academy of Underwater Scientists. Off-campus access to marine laboratories on Virginia's Eastern Shore and the Florida Keys are available through collaborative agreements with other colleges and universities.

Bachelor of Science—Biology Major

Secondary Education Concentration

This program leads to eligibility for teacher licensure in Virginia and is available only to individuals holding a baccalaureate degree or completing requirements for a Bachelor of Science degree in biology.

Biology Major with Teaching Licensure in Biology

Students pursuing a biology major with teaching licensure complete the following biology core sequence and 16 credit hours of electives at the 300-level or above, to include three lab or field courses. Students may use four credits at the 200-level to meet their upper-division requirement.

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 121N</td>
<td>General Biology I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOL 122N</td>
<td>General Biology I Lab</td>
<td></td>
</tr>
<tr>
<td>BIOL 123N</td>
<td>General Biology II</td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOL 124N</td>
<td>General Biology II Lab</td>
<td></td>
</tr>
<tr>
<td>BIOL 291</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 292</td>
<td>Evolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 293</td>
<td>Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 303</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 405W</td>
<td>Biology Seminar</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 23

Electives must include one approved course each in botany, zoology, microbiology, and human anatomy and physiology (see chief departmental advisor for details).

Non-biology requirements are:

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</tr>
<tr>
<td>CHEM 211</td>
<td>Organic Chemistry Lecture</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 212</td>
<td>Organic Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>OEAS 110N</td>
<td>Earth Science</td>
<td>4</td>
</tr>
<tr>
<td>or OEAS 111N</td>
<td>Physical Geology</td>
<td></td>
</tr>
<tr>
<td>PHYS 111N</td>
<td>Introductory General Physics</td>
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</tr>
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<td>Calculus for Business and Economics</td>
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</tr>
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<td>STAT 130M</td>
<td>Elementary Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 27

Admission

Students must first declare the biology teacher preparation track as their major with the appropriate advisor. All students must apply for and be admitted into the approved biology teacher preparation program. Students must meet the required criteria for admission by passing the Virginia Board of Education prescribed assessments and earn the minimum required grade point averages (GPA).

Virginia Board of Education prescribed assessments

Old Dominion University students seeking admission to an approved teacher education program must satisfy the Virginia Board of Education Required Assessment for Admission to an Approved Teacher Education Program. This requirement can be satisfied by meeting a passing score in one of the selected criteria below:

1. Passing PRAXIS I composite score of 532 by December 31, 2013; or
2. Passing PRAXIS Core Academic Skills Tests beginning January 1, 2014:
   - Reading Score of 156, Writing Score of 162, and Mathematics Score of 150; or
3. Approved substitute test scores:
   a. SAT score of 1000 with at least 450 verbal and 510 mathematics taken prior to April 1, 1995; or
b. SAT score of 1100 with at least 530 verbal and 530 mathematics taken after April 1, 1995; or
c. ACT composite score of 21 with ACT mathematics score of at least 21, and ACT English plus Reading score of at least 37, taken prior to April 1, 1995; or
d. ACT composite score of 24 with ACT mathematics score of at least 22, and ACT English plus Reading score of at least 46, taken after April 1, 1995; or
e. PRAXIS I Math test score of 178 by December 31, 2013 and a composite Virginia Communication and Literacy Assessment (hereafter referred to as the VCLA) score of 470; or
f. PRAXIS Core Academic Skills Mathematics test score of 150 beginning January 1, 2014 and a VCLA score of 470; or
g. SAT Mathematics test score of at least 510 taken prior to April 1, 1995 and a VCLA score of 470; or
h. SAT Mathematics test score of at least 530 taken after April 1, 1995 and a composite VCLA score of 470; or
i. ACT Mathematics test score of at least 21 taken prior to April 1, 1995 and a composite VCLA score of 470; or
j. ACT Mathematics test score of at least 22 taken after April 1, 1995 and a composite VCLA score of 470.

Note: ACT scores taken prior to 1989 are not valid.

For the most current information on the prescribed Virginia Board of Education admission assessment, visit the Teacher Education Services website, http://www.odu.edu/tes and review the Teacher Education Handbook.

Required grade point averages (GPA)

- A cumulative GPA of 2.75 is required.
- A major/content GPA of 2.75 is required - all biology courses must be passed with a grade of C (2.0) or above and all other science content courses must be passed with a grade of C- or higher.
- A professional education GPA of 2.75 is required – all professional education courses must be passed with a grade of C- or higher

Although students may enroll in a limited number of education courses, students must be admitted into the approved biology teacher preparation program prior to enrolling in any instructional strategies practicum education course. Students must also meet with an education advisor in the Office of Teacher Education Services.

Continuance

Students must maintain a cumulative GPA of 2.75, a major/content GPA of 2.75 and a professional education GPA of 2.75. Biology courses must be passed with a grade of C (2.0) or higher. The remaining courses required for the major and in the professional education core must be completed with a grade of C- or higher for continuance. A professional education GPA of 2.75 is required for continuance. Students must take and pass the Virginia Communication and Literacy Assessment (VCLA) and the PRAXIS II Biology Content examination prior to or while enrolled in the instructional strategies course. All assessments must be passed prior to the start of the Teacher Candidate Internship Orientation session.

Background Clearance Requirement

Old Dominion University requires a background clearance check of candidates admitted to the professional education programs. Professional education programs have several field experiences that are required for continuance and graduation from the program. The background clearance must be successfully completed prior to a field experience placement. Candidates will be provided a field experience placement when the background check process is completed with resolution of any issues. The process to complete the ODU clearance background check is located at: http://www.odu.edu/success/academic/teacher-education/placement/background-checks. The ODU clearance process includes: an FBI fingerprint, a child protective service/social service review, and a Virginia State Police sex offender registry review. Candidates interested in the professional education programs are advised to complete this clearance process immediately upon entry into the program since the clearance process takes a minimum of eight weeks to complete.

Virginia Board of Education prescribed assessments

Virginia Communication and Literacy Assessment (VCLA) – a passing composite score of 470 is required on this reading and writing assessment

PRAXIS II Biology: Content Knowledge (test code: 0235 or 5235) – passing score of 155 is required

To review more information on the Virginia Board of Education prescribed assessments visit the Teacher Education Services website, www.odu.edu/tes.

Graduation

Requirements for graduation include completion of ENGL 110C, ENGL 211C or 221C or 231C, and the writing intensive (W) course in the major with a grade of C or better, completion of the Biology and Senior Assessments, a minimum cumulative 2.75 GPA, in the major area, and in the professional education core, with no grade less than a C in the major and C- in the professional education core; successful completion of the Teacher Candidate Internship and a minimum of 125 credit hours, which must include both a minimum of 32 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University. Note that a grade of C (2.0) or better must be earned in all biology courses used to satisfy departmental requirements.

The Professional Education core courses and requirements are as follows:

Achieve overall 2.75 GPA

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM 101</td>
<td>Step 1 – Inquiry Approaches to Teaching STEM</td>
<td>1</td>
</tr>
<tr>
<td>STEM 102</td>
<td>Step 2 - Inquiry Based STEM Lesson Design</td>
<td>1</td>
</tr>
<tr>
<td>STEM 201</td>
<td>Knowing and Learning in STEM Education</td>
<td>3</td>
</tr>
<tr>
<td>STEM 202</td>
<td>Classroom Interactions in STEM Education</td>
<td>3</td>
</tr>
<tr>
<td>STEM 401</td>
<td>Project Based Instruction in STEM Education</td>
<td>3</td>
</tr>
<tr>
<td>STEM 402</td>
<td>Perspectives on STEM</td>
<td>3</td>
</tr>
<tr>
<td>SCI 468</td>
<td>Research Methods in Math and Sciences</td>
<td>3</td>
</tr>
<tr>
<td>STEM 485</td>
<td>Apprentice Teaching</td>
<td>9</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>26</td>
</tr>
</tbody>
</table>

Due to changing University requirements, national accreditation standards, and the Virginia Board of Education licensure regulations, the teacher preparation programs in the College of Sciences are under constant revision. Any changes resulting from these factors supersede the program requirements described in this Catalog. Students are encouraged to obtain current program information from their advisors and from the Teacher Education Services website at: www.odu.edu/tes.

Minor in Biology

The minor in biology offers students additional support to their chosen majors, prepares students for post-baccalaureate professional or graduate programs, offers greater job opportunities to graduates, and/or provides recognition of study in this academic area. The minor requires the successful completion of a minimum of 12 credit hours of coursework (a maximum of three credits at the 200-level, selected from the Biology 200-level core courses, and a minimum of nine credits at the 300-400 level). Courses selected at the 300-400 level may not include BIOL 303 or unstructured coursework and may include only one course from the Biology core. For completion of the minor, a student must have a C (2.0) or better in BIOL 121N & BIOL 122N, BIOL 123N & BIOL 124N, and the 200-level course, if any, used to fulfill the requirements of the minor. The student must also have a minimum overall cumulative grade point average of 2.0 in all courses designated for the minor and taken by the student exclusive of 100-level and prerequisite courses and complete a minimum of six hours of upper-level work through courses offered at Old Dominion University.
Honors Program in Biology

A. Honors Research

Undergraduates with junior or senior standing and a GPA of 3.00 or better are eligible to participate in Honors Research. After consultation with the program director (Dr. Deborah A. Waller), students select a professor who agrees to oversee the research project. Students then enroll in two 4-credit courses, BIOL 487 and BIOL 488W. The courses may be taken in any sequence: fall-spring, spring-summer, summer-summer, summer-fall. Normally both semesters are required but a student may receive credit for only one semester. The research project, time commitment by the student and the basis for the grade are mutually determined by the student and professor. Because first-semester research results are often preliminary, the grade for BIOL 487 is based on a review paper and/or research proposal, which provides the student with an overview of the field. The second semester is graded on the final research paper and a seminar presented to the honors committee and interested faculty. Professors should encourage students to publish results and present papers at scientific meetings when appropriate. Students should also be urged to apply for funds from agencies that provide seed money to undergraduates. The program director can provide information on scientific societies that sponsor meetings and/or offer small grants. Successful completion of both courses with a C (2.0) or better will allow the student to use BIOL 488W as a lab course in meeting his/her requirements.

B. Bachelor's Degree with Honors in Biological Sciences and Honors Designation for Biology courses

Students maintaining an overall GPA of at least 3.25 and of 3.50 in biology can receive a "Bachelor's Degree with Honors in Biological Sciences" subject to satisfaction of the minimum University standards for the Honors degree and completion of one of the following two options:

Option 1: Successful completion of two semesters of biological research taken as BIOL 487 / BIOL 488W (Honors Research).

Option 2: Successful completion of three upper-division courses in Biological Sciences and achievement of the "Honors" designation in each.

Students petitioning for designation of an upper-division biology course as "Honors" must have a minimum overall GPA of 3.25 and a GPA of at least 3.50 in biology.

To receive the "Honors" designation for a course, students must achieve a final course score of at least 95% or the equivalent of an "A" on the University grade scale.

Faculty are encouraged to assign and work with students on other activities deemed appropriate for an "Honors" course designation and utilize the results of these activities in the assignment of a course grade.

Advanced Placement

Students may receive advanced placement (AP) credit for BIOL 121N & BIOL 122N or BIOL 123N & BIOL 124N (4 credits) by a score of 3 on the advanced placement examination. Students receiving a score of 4 or 5 will receive credit for both BIOL 121N & BIOL 122N and BIOL 123N & BIOL 124N (8 credits). Official AP score reports should be sent to the Office of Admissions prior to registration for evaluation.