



BIOLOGY

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The Biology Curriculum

Biology is the science of life. It is a broad and rapidly changing field with many unanswered questions. Thus, our curriculum starts with a course in which faculty experts teach students the critical skills necessary to answer biological questions including how to formulate hypotheses, design experiments, interpret data, apply quantitative skills, and communicate complex information. The next two courses build upon these skills, while also integrating five principles that link all levels of biology, from molecules to ecosystems: evolution, structure-function, information flow, energy transformation, and emergent properties.

The foundation built by these three core courses prepares students for advanced coursework in topics such as development, cancer, eco-epidemiology, epigenetics, comparative vertebrate anatomy, medical botany, immunology, neurobiology, and molecular virology.

Requirements for a biology degree include the introductory courses (Introduction to Biological Thinking or SMART; Integrated Biological Principles I and II; Introductory Chemistry; Organic Chemistry I and II; and five additional units of upper-level biology electives. The Bachelor of Science degree requires one semester of calculus and two approved quantitative science courses, while the Bachelor of Arts degree allows flexibility to integrate interests in other academic disciplines with biology coursework.

Partnerships exist with several programs including Duke University Marine Sciences Laboratory and the University of St. Andrews in Scotland. Biology majors may pursue a concentration in neuroscience in partnership with the Psychology Department. Majors are also encouraged to participate in study abroad programs.

Facilities and Equipment

Biology shares the Gottwald Center for the Sciences with the chemistry and physics departments. This arrangement encourages collaboration among faculty and students in the three disciplines. The department maintains diverse, modern equipment to support teaching and research. An imaging center (TEM, SEM,

and confocal microscope), animal facility, greenhouse and herbarium, electrophysiological equipment, epifluorescent microscopes, a fluorescence-activated cell sorter, thermocyclers, and digital gel documentation are all available for student and faculty use. The University owns a 20-foot Boston Whaler for marine research and the department has additional vehicles to reach field sites.

Internships and Career Opportunities

Students are encouraged to participate in internships that offer practical experience in careers related to life sciences. Biology graduates enter a variety of fields, including medical professions, teaching, biological research, forensics, museum restoration, natural history, science illustration, science writing and publishing, photography, and agricultural professions, such as forestry, wildlife management, and conservation biology.

Departmental Scholarships/Fellowships

The Denoon Scholarship and Cole Memorial Scholarship are awarded annually to natural science students. The John Neasmith Dickinson Memorial Research Award and the Robert F. Smart Award in Biology are fellowships awarded to biology majors to support summer research projects.

Undergraduate Research

The biology faculty's varied research interests provide opportunities for students to participate in active scholarly inquiry. Majors are encouraged to join a faculty research program early in their studies. More than 50 students each semester and more than 70 each summer pursue research. Faculty research grants, department awards, Arts and Sciences Summer Fellowships, and institutional grants support students in this work.

Collaborations with other departments are encouraged (for example, a biology and psychology concentration in neuroscience). Students often present results of their investigations at the

Richmond Arts & Sciences Undergraduate Research Symposium and at regional and national meetings. Students also publish findings with faculty in scientific journals.

Recent Publications with Student Co-Authors

DuMez R, Miyajima EH, Corado-Santiago L*, Barrameda B*, Zhou Y, Hettiarachchi SD, Leblanc RM, and Skromne I. In vivo characterization of carbon dots-bone interactions: towards the development of bone-specific nanocarriers for drug delivery. *Drug Delivery*, 2021, 28:1281-1289. <https://doi.org/10.1080/10717544.2021.1938753>

Richardson JL, Michaelides S, Combs M, Djan M, Bisch L, Barrett K, Silveira G, Butler J*, Aye TT*, Munshi-South J, Dimatteo M, Brown C, and McGreevy Jr T. Dispersal ability predicts spatial genetic structure in native mammals persisting across an urbanization gradient. *Evolutionary Applications*, 2021, 14:163-177, DOI: 10.1111/eva.13133.

Swackhammer A*, Provencher E, Donkor AK, Garofalo J*, Dowling S*, Garchitorea K*, Phyo A*, Ramirez Veliz N*, Karen M*, Kwon A*, Diep R*, Norris M, Safo MK, and Pierce BD. Mechanistic Analysis of the VirA Sensor Kinase in *Agrobacterium tumefaciens* Using Structural Models. *Frontiers in Microbiology*, 2022 May; 13: 898785.

* indicates student co-author

Student Presentations at Recent Meetings

Cassady E*, Coovert H, Thompson L, Walter J, and K Grayson. 2022. The ability of environmental growth chambers to replicate outdoor growth conditions: A test using the invasive forest insect *Lymantria dispar* (L.). Annual Conference of The Wildlife Society, Virginia Chapter. Waynesboro, VA.

Franco G, Harty J*, and WJ Hayden. 2022. Pulvinus structure in *Phyllanthus urinaria* (Phyllanthaceae). Virginia Academy of Science, Lynchburg, VA.

Ononju C, Hall K*, Baraban S, C Carpenter. 2022. Using zebrafish to dissect the genetic drivers of epilepsy-related comorbidities. The 17th International Zebrafish Conference, Montreal, Canada.

Perkins Z*, Hilleary R, Huang C, Hayward A and I Skromne. 2022. A signaling

switch in zebrafish underlies the induction and maintenance of the spinal cord specification and patterning regulatory gene *cdx4*. Society for Developmental Biology Meeting, Bethlehem, PA.

Pham D* and CA Wu. 2022. Seed bank dynamics of the emerging invasive species, wavyleaf basketgrass (*Oplismenus undulatifolius*). Southeastern Population Ecology and Evolutionary Genetics Conference, Eatonton, GA.

* indicates student presenters

Recent Graduate School Acceptances

Duke University
Emory University
Massachusetts Institute of Technology
Princeton University
The Rockefeller University
Stanford University
University of California, Berkeley
University of Chicago
University of North Carolina, Chapel Hill
University of Texas
University of Virginia
Vanderbilt University
Virginia Commonwealth University
Virginia Tech
Washington University, St. Louis
Yale University

Medical Schools Recent Graduates Matriculated

Brown University
Case Western Reserve University
Columbia University
Weill Cornell Medical College
Duke University
Emory University School of Medicine
Georgetown University
Harvard Medical School
Jefferson Medical School
Johns Hopkins University
Mount Sinai School of Medicine
New York University
Stanford University
Tulane University School of Medicine
University of Chicago
University of Colorado School of Medicine
University of Massachusetts
University of North Carolina School of Medicine
University of Pittsburgh
University of Texas -Southwestern
University of Virginia School of Medicine
Virginia Commonwealth University School of Medicine
Wake Forest University School of Medicine
University of Wisconsin

URISE and SMART

With support from the Howard Hughes Medical Institute, the School of Arts and Sciences developed the Integrated Inclusive Science program to help STEM-interested students, particularly those who are underrepresented in the sciences, get excited about STEM disciplines and careers early in their college career.

URISE (University of Richmond Integrated Science Experience) is a comprehensive program combining early and extensive undergraduate research with an emphasis on interdisciplinary STEM education. URISE aims to remove barriers that impede the persistence, retention, and success of underrepresented students in STEM disciplines. URISE begins with a paid pre-first year summer research, skill and community-building experience. URISE is followed by Science, Math and Research Training (SMART) which focuses on interdisciplinary, integrated, and discovery-based problems in science.

Faculty

Krista Stenger
Department Chair
Ph.D., Virginia Commonwealth University
Areas of specialty: immunology, regulation of macrophage activity

Linda M. Boland
Ph.D., University of North Carolina, Chapel Hill
Areas of specialty: molecular physiology of ion channels, neurobiology, bioethics

Emily J. Boone
Director of Biological Instruction
M.S., University of South Alabama

R. Jory Brinkerhoff
Ph.D., University of Colorado, Boulder
Areas of specialty: epidemiology, vector-bourne zoonotic disease dynamics

Colleen Carpenter
Ph.D., University of Michigan
Areas of specialty: Neuropharmacology, Genetics, Epilepsy, Addiction, Zebrafish modeling

Stacey Criswell
Director of Microscopy and Imaging
Ph.D., University of Virginia

Rafael O. de Sá
Ph.D., University of Texas, Austin
Areas of specialty: systematics, evolution and development of amphibians and reptiles

Priscilla Erickson
Ph.D., University of California, Berkeley
Areas of specialty: evolutionary genetics and genomics, quantitative genetics, evolutionary developmental biology

Kristine L. Grayson
Ph.D., University of Virginia
Areas of specialty: physiological ecology, invasive forest pests, conservation of amphibians and reptiles

W. John Hayden
Ph.D., University of Maryland
Areas of specialty: anatomy, morphology and systematics of vascular plants

Angela Hilliker
Ph.D., University of Chicago
Area of specialty: yeast molecular genetics

Shannon Z. Jones
Director of Biological Instruction
URISE coordinator
Ph.D., University of North Carolina, Chapel Hill

B. Daniel Pierce
Ph.D., Johns Hopkins University
Areas of specialty: bacterial pathogenesis and host response, biochemistry, synthetic biology

Omar A. Quintero
Ph.D., Duke University
Area of specialty: cell biology of motor proteins and the cytoskeleton

Jonathan L. Richardson
Ph.D., Yale University
Areas of specialty: urban ecology and evolution, wildlife biology, conservation genetics

Maren B. Reiner
Director of Biological Instruction
M.S., New York University

Laura J. Runyen-Janecky
Ph.D., University of Wisconsin
Distinguished Educator Award, 2009
Area of specialty: molecular genetics of bacterial symbionts

Peter D. Smallwood
Ph.D., University of Arizona
Area of specialty: science policy, behavioral ecology, conservation biology

Amy M. Treonis
Ph.D., Colorado State University
Area of specialty: microbial ecology

John Vaughan
Co-Coordinator, Healthcare Studies Program
Director of Pre-Health Education
Ph.D., Virginia Commonwealth University

John Warrick
Co-Coordinator, Neuroscience Program
Ph.D., Temple University
Area of specialty: analysis of neurodegenerative disease via transgenic *Drosophila*

Carrie A. Wu
Coordinator, Environmental Studies Program
Ph.D., University of California at Irvine
Areas of specialty: ecology, evolution and genetics of local adaptation in natural plant populations

Eugene Wu
Coordinator, Biochemistry and Molecular Biology
Ph.D., The Scripps Research Institute
Areas of specialty: structure-based drug design, nucleic acid polymerases, virology, viral evolution

Melinda A. Yang
Ph.D., University of California at Berkeley
Areas of specialty: population genetics, human evolution, computational biology



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