BIOLOGY — PH.D.

Program director
Stephen G. Dunbar

Program learning outcomes

At the end of this program, the student should be able to:

1. Demonstrate critical independent thinking.
2. Plan and carry out independent research.
3. Critically evaluate links between philosophies of science and societal responsibilities.
4. Effectively communicate professional practice through oral and written skills.
5. Demonstrate a professional aptitude and attitude.

General requirements

Seminar attendance requirements

All graduate students in residence must register for and attend Seminars (BIOL 607) each quarter at Loma Linda University.

Teaching experience

Teaching is recommended for at least one quarter. This experience may be obtained through laboratory teaching, or it may include presenting lectures for a course in consultation with the student's major professor and the course instructor.

Research proposal

A written research proposal and oral defense of the student's proposed research should be completed early in the Spring Quarter.

Comprehensive

A written and oral comprehensive is required after the first summer of research. The student is required to provide a written report in the form of a publishable manuscript and to orally defend previous research in front of their research committee by the end of the Winter Quarter following the first summer of research work.

Dissertation

The written dissertation must demonstrate completion of significant, original research and must be written in publishable paper format. At least one manuscript from the dissertation must be submitted for publication before the Ph.D. degree is granted.

Professional development

Ph.D. degree students are expected to publish papers, present papers at scientific meetings, and submit research grant proposals.

Registration and tuition after normative time

The program is designed for completion in the normative time of four years. In certain circumstances, students may need more time for completion. Students are required to be registered every quarter until the dissertation is completed and defended. For details, see the continuous enrollment and personal leave of absence policies (http://llucatalog.llu.edu/about-university/academic-policies-information/enrollment/) listed in this CATALOG. Students who go beyond the normative time for completing their degree must register for two (2) units without a tuition waiver each quarter until they complete their degree. After their normative time, students may request a one-year grace period that must be approved by the department faculty.

Admissions

In addition to Loma Linda University (http://llucatalog.llu.edu/about-university/admission-policies-information/#admissionrequirementstext) admission requirements, the applicant must also complete the following:

- A bachelor's degree with a biology major (M.S. degree recommended) from an accredited college or university
- An acceptable score on the general GRE examination (the subject GRE is not required)
- Recommended G.P.A. of 3.5 or higher in a M.S. degree program
- Complete the following courses*:

  Required:

  - General biology (one year)
  - General chemistry (one year)
  - General physics (one year)
  - Genetics (one course)
  - Organic chemistry (one year)
  - Precalculus
  - Statistics (one course)

  Recommended:

  - Biochemistry
  - Calculus

*Some courses may be taken during residence at this university, with the approval of the EBS admissions committee.

*Prerequisites may be waived for applicants who enter the program with a masters degree in a biological discipline.

Application

Applications are accepted at any time. Review of applications begins in February for Autumn Quarter admission. Research assistantships are competitively awarded.

It is also recommended that applicants contact the department at ebs@llu.edu.

Program requirements

A minimum of 65 units of didactic and research coursework is required, including at least 53 at or above the 500 level. See below for a list of courses. The student's advisory committee may require the student to take additional courses as electives

All values below are in quarter units.

Required		
Additional courses beyond those listed below will be chosen in consultation with the student's advisor		
BIOL 502	Orientation to Graduate Biology	1
BIOL 545	Genetics and Speciation	4
BIOL 558	Philosophy of Science [1]	4

BIOL 607	Seminar in Biology [2]	6
BIOL 616	Research and Experimental Design	2
BIOL 617	Proposal Writing and Grantsmanship	2
BIOL 664	Science Communication Outreach [4]	1
Select course(s) from each of the following areas		
Biological systems		2
BIOL 517	Ecological Physiology	
BIOL 555	Molecular Genetics	
MICR 540	Physiology and Molecular Genetics of Microbes	
MICR 570	Mechanisms of Microbial Pathogenesis	
Ecology		2
BIOL 444	Paleobotany	
BIOL 505	Marine Biology	
BIOL 515	Biogeography	
BIOL 539	Behavioral Ecology	
BIOL 546	Techniques in Vertebrate Ecology	
BIOL 549	Biodiversity and Conservation	
Organismal biology		2
BIOL 409	Mammalogy	
BIOL 426	Invertebrate Paleontology	
BIOL 427	Vertebrate Paleontology	
BIOL 444	Paleobotany	
BIOL 504	Biology of Marine Invertebrates	
BIOL 539	Behavioral Ecology	
GEOL 545	Taphonomy	
Religion		
Select one course with the RELT prefix:		3
RELT 527	The Bible and Ecology	
RELT 558	Old Testament Thought	
RELT 559	New Testament Thought	
RELT 560	Jesus the Revealer: The Message of the Gospel of John	
RELT 564	Apostle of Hope: The Life, Letters, and Legacy of Paul	
RELT 565	Vision of Healing: The Message of the Book of Revelation	
RELE 5__	Graduate-level Ethics	3
RELR 5__	Graduate-level Relational	3
Electives		
Additional courses required by the student's guidance committee to complete the total units required for the degree [3]		10
ANAT 516	Neuroscience GS	
ANAT 542	Cell Structure and Function GS	
BCHM 515	Introduction to Bioinformatics	
Research		
Typically research units will be graded each quarter and can be repeated for additional credit		
BIOL 699	Dissertation Research (1-8)	21
Total Units		**66**

[1] BIOL 559 Philosophy of Science and Origins required for students who have taken BIOL 475 Philosophy of Science and Origins or equivalent

[2] each quarter in residence; 0.5 unit per quarter (Total units required may very depending on the number of quarters a student is on campus.)

[3] In addition to this list, courses may also be chosen from unused courses listed above for biological systems, ecology, and organismal biology. When choosing elective, keep in mind that a maximum of 12 units below the 500 level may be applied to the 65 units for the Ph.D. degree.

[4] Fulfills service learning requirement

Noncourse requirements

Comprehensive examination

An oral comprehensive examination is given in connection with a written and oral presentation of an initial research project approved by the student's guidance committee. Its purpose is to measure the student's knowledge of their field of study, and their ability to find, understand, and synthesize the research literature on a topic, and to conduct original research. The oral examination covers the student's field of study, as well as defending the research. The comprehensive exam will take place during the Autumn Quarter of the second year, after the first summer of research.

Advancement to candidacy

Students may apply for advancement to candidacy after:

- Completing all deficiencies and corequisites.
- Passing the comprehensive examinations.
- Selecting a research committee.
- Completing an approved written and oral research proposal and budget presentation for the research committee.
- Being recommended by the department faculty.

Defense of dissertation

An oral dissertation presentation and defense are required.

Grade requirement for graduation

All courses applied toward a graduate degree must have a grade of B or higher.

Normal time to complete the program

Four (4) years — based on full-time enrollment; part time permitted.