BIOLOGY — M.S.

Program director
Stephen G. Dunbar

Program learning outcomes
By the end of the program, the graduate should be able to:

1. Demonstrate critical independent evaluation of published scientific literature.
2. Plan and carry out independent research.
3. Critically evaluate philosophies of science and their relation to issues of public interest.
4. Demonstrate proficient oral and written skills in communicating science topics.
5. Demonstrate professional aptitude and attitudes.

Student financial aid
Assistantships for research and/or teaching are available in the Department of Earth and Biological Sciences on a competitive basis. Further information can be obtained, including contact information, from the department web page at http://www.llu.edu/medicine/ebs/index.page?http://medicine.llu.edu/research/department-earth-and-biological-sciences/. Qualified students are also encouraged to seek fellowships from federal and private agencies with the help of their advisors.

General requirements
For information about requirements and practices to which all graduate students are subject, the student should consult the relevant sections of this catalog and of the school in which this program is housed.

Seminar attendance requirements
All graduate students in residence must register for and attend seminars (BIOL 607) at this university each quarter.

Research proposal
Students are urged to select a research project early in their programs, in consultation with faculty members and approved by the department. A written research proposal and oral defense of the student's proposed research should be completed early in the third quarter of study. A comprehensive plan for completion of the degree will be approved at that time.

Registration and tuition after normative time
This program is designed for M.S. degree students to finish within the normative time of two years. In certain circumstances, students may require slightly more time for completion. Students who are past the normative time for completing their degrees must register for two units without a tuition waiver each quarter, until they complete their degrees. After their normative time, students may request a one-year grace period that must be approved by the department faculty.

Thesis
The written thesis must be a completed significant, original research paper, formatted in the style of an appropriate scientific journal—since the manuscript is likely to be submitted for publication.

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 requirements:

- Expected undergraduate preparation includes a bachelor’s degree with a biology major or equivalent from an accredited college or university, including the following courses*:
  
  Required:
  - General biology (one year)
  - General chemistry (one year)
  - Genetics (one course)
  - Organic chemistry (one year)
  - General physics (one year)
  - Precalculus
  - Statistics (one course)

  Recommended:
  - Biochemistry
  - Calculus

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

- An undergraduate G.P.A. of at least 3.0 is expected
- an acceptable score on the general Graduate Record Examination (GRE) (the subject GRE is not required)

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

Application time
Applications are accepted at any time, although students are usually admitted for Autumn Quarter. Review of applications begin in February for Autumn Quarter admission. Research assistantships are competitively awarded.

Program requirements
A total of 48 units of courses and research is required, including at least 36 at or above the 500 level. See below for a list of courses.

All values below are in quarter units

<table>
<thead>
<tr>
<th>Required</th>
<th>Additional courses beyond those listed below will be chosen in consultation with the student's advisor</th>
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<tbody>
<tr>
<td>BIOL 502 Orientation to Graduate Biology</td>
<td>1</td>
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<tr>
<td>BIOL 545 Genetics and Speciation</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 558 Philosophy of Science</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 607 Seminar in Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 616 Research and Experimental Design</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 617 Proposal Writing and Grantsmanship</td>
<td>2</td>
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<tr>
<td>BIOL 664 Science Communication Outreach</td>
<td>1</td>
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</tbody>
</table>

Select one or more course(s) from any of the following areas for at least 6 units

Biological systems
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIOL 517</td>
<td>Ecological Physiology</td>
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<tr>
<td>BIOL 555</td>
<td>Molecular Genetics</td>
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<tr>
<td>MICR 540</td>
<td>Physiology and Molecular Genetics of Microbes</td>
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<tr>
<td>MICR 570</td>
<td>Mechanisms of Microbial Pathogenesis</td>
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</tbody>
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**Ecology**
- 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**
- BIOL 409 Mammalogy
- BIOL 426 Invertebrate Paleontology
- BIOL 427 Vertebrate Paleontology
- BIOL 504 Biology of Marine Invertebrates
- BIOL 539 Behavioral Ecology
- GEOL 444 Paleobotany
- GEOL 545 Taphonomy

**Religion**
- REL_5__ Graduate-level Religion 3

**Electives**
Additional courses required by the student's guidance committee to complete the total units required for the degree 8
- 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 698 Thesis Research (1-8) 15

**Total Units** 49

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 minimum of 44 units for the M.S. degree must be numbered 500 or above.
4. Fulfills service learning requirement

**Noncourse requirements**

**Advancement to candidacy**
Students may apply for advancement to candidacy by completing Form A, which requires:

- Completing all deficiencies and corequisites.
- Selecting a research committee.
- Completing an approved written research proposal.
- Passing the oral defense of the research proposal.

**Defense of thesis**
An oral presentation and defense of the thesis, including final oral examination on the student’s field of study, are required.

**Grade requirement for graduation**
All courses applied toward a graduate degree must have a grade of B or higher.

**Length of program**
Two (2) years — based on full-time enrollment; part time is permitted.