ASTROBIOLOGY

A Graduate Certificate Program at the University of Washington

Student Guide

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Certificate Requirements

A minimum of 15 credits is required for a Certificate in Astrobiology, including the following courses:

- ASTBIO 501 Astrobiology Disciplines (4 cr)
- ASTBIO 502 Astrobiology Topics (4 cr)
- Three Winter ASTROBIOLOGY "in-house" Seminar Series (1 cr each)
- One cognate course approved by the student's advisory committee to ensure sufficient breadth (var. cr)

Additional credits may be earned through:

- A second cognate course
- Research Preparation course for research rotation (3-10 cr)
- Autumn/Spring Public Seminar Series (1 cr)

Additional requirements include:

- One quarter research rotation in an area outside the student's home discipline
- Participation in three workshops
- Astrobiology ethics seminar

Successful completion of the program requires a cumulative GPA of 3.0 for courses required for the Certificate and a grade of 2.7 or higher for any other course counted toward the Certificate. A checklist of requirements is appended.

Course Descriptions

Our curriculum in Astrobiology is designed to provide a strong interdisciplinary grounding for each student in the study of astrobiology, irrespective of the student's primary field of expertise. Each student will be provided with opportunities to develop creative initiative and insightful approaches to astrobiology research challenges.

The core curriculum includes two primary courses and a "capstone" experience composed of a series of annual workshops held at various field sites and laboratories.

Primary Courses

ASTBIO 501 Astrobiology Disciplines (4 credits)

Offered every other Autumn Quarter, alternating with ASTBIO 502.

Astrobiology is the study of the origin of life on Earth and the distribution of life in the Universe. The cross-disciplinary nature of this field mandates effective collaboration among biologists, astronomers, oceanographers, atmospheric scientists, chemists, planetary scientists, and geologists. To this end, participants are required to understand the fundamental concepts in all of these disciplines. This course provides students with a concise background of the subject matter relevant to astrobiology within these disciplines. Students write a term paper and give a talk on an astrobiology topic of their choice.

ASTBIO 502 Astrobiology Topics (4 credits)

Offered every other Autumn Quarter, alternating with ASTBIO 501.

Astrobiology is a rapidly evolving discipline, and this course is designed to acquaint students with issues of current research interest. Two or three related segments provide students with an exposure to astrobiological topics in subjects that are particular strengths at the UW.

Each segment is led by a different faculty member involved with the particular research under examination. At least one segment provides information related to the Workshop scheduled for that year. A lead faculty member is present throughout the course to provide connections and to coordinate all the segments. Students do a literature presentation during finals week.

Topics will be taken from a variety of disciplines including, for example, Earth Sciences (e.g., Archean chemistry, atmospheres and geology, hydrothermal vents, meteorites and impacts), Planetary Sciences (e.g., water on Mars, extrasolar planets, Europan ocean), Space Technology (e.g., Mars biology experiments, Mars exploration, Moon exploration), and Biology (e.g., origin of life, the Archean fossil record, extremophiles, mass extinctions).

CAPSTONE EXPERIENCE—Astrobiology Workshop (non-credit)

The annual Astrobiology Workshop is a required two/three-day event held at a field site or laboratory. These workshops as a group are a "capstone" experience in that they provide a unifying experience. Over the years, by means of the workshops, the student gets experience

in a broad range of physical and biological sciences and interacts closely with other students and faculty in the Program.

Past workshops have included (partial list):

- NASA Ames Research Center, Moffett Field, California (Autumn 2000)

  Visits were made to labs dealing with microbial mats, the prototype for the planned Kepler mission to detect transits of extrasolar planets, and simulation of the conditions for interstellar ices and organic chemistry. Finally, we carried out an exercise centered on analyzing imagery in order to evaluate potential landing sites to search for evidence of life on Mars.

- UW Friday Harbor Lab, San Juan Island, Washington (Autumn 2005)

  Marine biology and paleontology in the San Juan Islands.

- Kitt Peak National Observatory, Tucson, Arizona (Spring 2005)

  Solar astronomy, radio astronomy of interstellar molecules, optical and infrared astronomy of star-forming regions

- Yellowstone National Park (Autumn 2006)

  Hydrothermal systems and microbial communities.

- Eastern Washington (Autumn 2007)

  Channeled Scablands evidence for Lake Missoula flood events.

- Mt Baker (Autumn 2008)

  Glaciers, ice, and microbial life in ice.

Other Courses and Activities

Cognate Courses

This is not an exclusive list. Special-topic interdisciplinary graduate seminars often qualify. Ask your advisor if in doubt.

Astronomy 555/Atm Sci 555/ESS 581: planetary atmospheres
Astronomy 557/ESS 583: origin of the solar system
ESS 450: paleobiology
ESS 588/Atm Sci 588/Ocean 588: global carbon cycle and climate
ESS 590: the early earth
Microbiology 530: microbial diversity
Microbiology 412: fundamentals of microbiology (prokaryotes)
Ocean 523/Atm Sci 508: global biogeochemical cycles
Ocean 530: biological oceanography: bacteria and protozoa
Ocean 534: methods in biological oceanography
Ocean 535: biological oceanography for non-biologists
Ocean 570: marine microbial interactions

Genome Sciences 570: construction of phylogenetic trees
Aero & Astro 499: space mission design seminar
Tech Commun 440 or 540: science writing

Astrobiology Ethics Seminar (offered triennially)

Every three years the Astrobiology seminar will focus on ethical questions of particular concern to astrobiologists.

Astrobiology Seminar (ASTR 599 1 credit, Tuesdays 2:30 pm)

A lecture series on astrobiology research topics. Some quarters, the lectures are open to the University community and consist of colloquia mostly by visiting researchers. In other quarters the focus is on research talks by Astrobiology faculty, postdocs and students. In Winter Quarter, the seminar series is closed to the public ("in-house") and focuses on a particular astrobiology topic, with tutorial presentations by student participants under faculty guidance. Past topics have been Planetary Atmospheres, Origin of Life, and Engineering Aspects of Astrobiology.

New Policy on Selection and Execution of the Research Rotation Required for the AB Certificate

December 2008. In order to help solve the problem of students waiting too long in their graduate careers to do their rotations and to improve the rotation experience in general, the AB Faculty have made the following changes in the requirement for the AB Certificate; these changes apply to those who entered the Program in 2007 or later.

Requirement

Astrobiology Research Rotation (min 3, max 10 cr)

One quarter of research outside the student's discipline is required, in an AB research group, either at the UW or at another institution. The topic and mentor for this experience must be approved beforehand by the Astrobiology Graduate Advisor as being both sufficiently broadening and relevant to the student's research interests. In particular, students in the physical sciences are encouraged to do their rotation in the biological sciences, and vice-versa. At the end of the rotation the student will make an oral presentation of the research accomplished.

Students are encouraged to consider delay using one of their IGERT quarters in order to use it for their rotation quarter.

Choosing the topic and completing the rotation

Before the end of his/her second year in the AB Program (normally Spring quarter), each student will submit for approval to the Astrobiology Graduate Advisor a proposal (maximum of 2 pages) for the rotation that includes:

- planned research project and any needed preparations (such as background reading or training)
- rationale for the project (relevance to thesis direction, relevance to AB)

- justification that the research project is sufficiently beyond the student's major field to provide breadth
- planned dates for the rotation
- evidence of agreement that any costs for the rotation research have been discussed and adequate funds identified (funds may be available to help with this)
- concurrence of student's advisor and rotation supervisor

With regard to schedule, completion of the project by the end of the third year is strongly encouraged. If the intended project becomes impossible, or if significant changes must be made for any reason, then the changes should be submitted for approval as soon as possible during the third year.

Annual Evaluations of Student Progress

In Spring Quarter each year the Astrobiology faculty review the progress of each student working towards the Certificate. This is in addition to any periodical departmental reviews undergone by students. The review procedure is as follows.

1. Prior to the annual evaluation, each students prepares a 1-2 page report of his/her progress over the previous year in academics, research, and specifically for the AB Certificate. The latter is summarized through updating the AB checklist of Certificate. requirements (at end of this Guide). This report is discussed with the primary AB Advisor.

2. All AB faculty meet as a group to discuss each student's progress and make recommendations regarding:
   a. Academic performance
   b. Research progress
   c. Student participation in AB activities and progress toward meeting AB program requirements
   d. Status of financial support
   e. Status of PhD Committee composition. A minimum of two AB faculty members should be on the Committee, with representation from both the biological and physical sciences.

Each student's primary advisor brings the student's report (and academic file if necessary) to the meeting in order to lead a discussion on the student. Should any advisor not be able to attend the scheduled meeting, a copy of the yearly progress report, including a paragraph by the advisor addressing items a-e above, is made available to the meeting.

3. Faculty advisor meets with student to discuss recommendations of the AB faculty.

4. Faculty advisor prepares a final progress report for student's file, with a copy to the student.

International Internships

NSF recognizes the increasing global character of research and education and the need for US students to become globally aware. The IGERT international internship program was initiated to foster international perspective and encourage the development of international experience, competence, and outlook among new generations of US scientists.

Selection and Training of Interns

Participation in this program is limited to IGERT Astrobiology students who are U.S. citizens or permanent residents. Eligible students may apply for an internship after their first year of study, when they have identified their Astrobiology faculty research advisor and have formulated a research plan. To apply a 2-3 page proposal, with the concurrence of their Astrobiology faculty advisor, describing the proposed internship activity and demonstrating the scientific value it will hold for their research.

Applications for internships will be reviewed by a special committee of the IGERT faculty on an individual, *ad hoc* basis. Successful applicants will be placed in contact with the liaison person at the host institution to request permission to work closely with a specific scientist who will function as the intern's research mentor. A mutual agreement of responsibilities and activities, by letter or other appropriate communication, between the host institution's research mentor and the intern's Astrobiology faculty supervisor at the University of Washington, will be required before the international internship is approved.

Internships are anticipated to last from 3 to 6 months, permiting sufficient time for the intern to learn new procedures or carry out essential experimental work. Internship support includes roundtrip airfare and limited per diem to help defray living expenses. A small institutional allowance may be available to help cover approved research expenses at the host institution.

Upon conclusion of the internship, the host research mentor will be requested to prepare an evaluation of the intern's performance. Upon their return, interns will be asked to submit a written report of their activities and present a seminar on their research accomplishments.

Max Planck Institute for Marine Microbiology, Bremen, Germany

Professor Dr. Bo Jørgensen

The Max Planck Institute (MPI) for Marine Microbiology in Bremen is an institute renowned for its studies in marine microbial processes as well as for the development of technical approaches for the *in situ* identification and assessment of microbial activities using fluorescent *in situ* hybridization (FISH) techniques and microautoradiography.

Student Research/Travel Support Policy

Limited funding is available for approved travel and research support for AB students. Students should first determine if their needs can be met through departmental resources (access to computers/software, lab services, etc.).

Requests for funding are addressed to the Chair of the AB Steering Committee and must be accompanied by a letter of support from the student's AB faculty advisor.

Orders for services, equipment or supplies, as well as travel arrangements, must be coordinated through the Astrobiology Program Office (Nancy Quense). Otherwise, students may be liable for certain expenses.

Conference travel. Conferences in the US are preferred, although international conferences are possible in unusual cases. Students beyond the first year must have a poster or talk scheduled on the program.

Research travel. Requests must be supported in writing by the host lab and the student's AB faculty advisor. Duties and scope of work must be clearly defined, and planned costs must be itemized. Unforeseen costs must be approved in advance of expenditure in order to receive reimbursement.