

INTEGRATED AND APPLIED SCIENCES, PH.D.

The Integrated and Applied Sciences (IAS) doctoral program was established to broaden student exposure to all areas of science, encourage collaboration across departments and colleges, and better train graduate students to present their research to a more diverse audience. This interdisciplinary program is large enough to provide students with broad exposure to collaborative scientific projects, yet small enough for students to have one-on-one interaction with their faculty mentor. This personalized approach is necessary for developing the communication skills that will enhance employment opportunities for students and, in keeping with SLU's Jesuit tradition, endow them with tools to better contribute to society.

Leadership

Vasit Sagan, Ph.D.
Program Director

Curriculum Overview

The Doctor of Philosophy (Ph.D.) program in integrated and applied sciences (IAS) utilizes interdisciplinary approaches and collaboration within the fields to prepare graduates to confidently assume multi-faceted roles in the changing scientific community. Students specialize in a concentration depending on their primary mentor's research area. Concentrations include: Biology, Chemistry, Physics and Environmental Science and GIS

The distribution of courses in the various IAS areas is determined by the student's dissertation committee with a minimum total of 30 credits between all three areas. A total of 42 credits are required with the remaining 12 credits coming from dissertation credits. An appropriate coursework track is developed by the student and their mentor with subsequent approval by the IAS administrative committee. A typical coursework structure includes:

- Participating departmental core courses (9–12 credits)
- Interdisciplinary credits (18–21 credits)
- Dissertation credits (12 credits)

Biology Concentration

This concentration is geared toward biological research with bioinformatics or integrated geospatial biology. Required core courses may be taken in the Biology Department.

Chemistry Concentration

This concentration is for students interested in chemical research with substantial overlap with other biological or physical science and engineering disciplines.

Environmental Sciences and GIS Concentration

This concentration is for students interested in the application of geographic information systems (GIS) in the field of environmental sciences. Required course are taken in the Earth and Atmospheric Sciences Department as well as the GIS program.

Physics Concentration

This concentration is geared toward students interested in the physics of solid-state and nanomaterials.

Fieldwork and Research Opportunities

This research-intensive doctoral program will train students for careers in pharmaceutical and biochemical industries, as well as in academia. The program's scientific training takes place in an interdisciplinary environment with biology, biomedical science, chemistry, earth and atmospheric science, engineering, and physics faculty.

Careers

This doctoral program trains scientists for careers in academia as well as chemical, biological, environmental and geospatial science industries and prepares them to collaborate with other professionals. Scientific training takes place in an interdisciplinary environment with faculty from science departments in the College of Arts and Sciences.

Admission Requirements

The integrated and applied sciences administrative committee will ensure that the applicant possesses a minimum of a baccalaureate degree from an accredited, recognized college or university in a discipline relevant to the research of the integrated and applied sciences faculty mentor.

Application Requirements

- Application form and fee
- Transcript(s)
- Three letters of recommendation
- Curriculum vitae
- Professional goals statement

Requirements for International Students

All admission policies and requirements for domestic students apply to international students along with the following:

- Demonstrate English Language Proficiency (<http://catalog.slu.edu/academic-policies/office-admission/undergraduate/english-language-proficiency>)
- Proof of financial support must include:
 - A letter of financial support from the person(s) or sponsoring agency funding the time at Saint Louis University
 - A letter from the sponsor's bank verifying that the funds are available and will be so for the duration of study at the University
- Academic records, in English translation, of students who have undertaken postsecondary studies outside the United States must include the courses taken and/or lectures attended, practical laboratory work, the maximum and minimum grades attainable, the grades earned or the results of all end-of-term examinations, and any honors or degrees received. WES and ECE transcripts are accepted.

Review Process

The integrated and applied sciences administrative committee will ensure that the applicant's previous academic record indicates the ability needed to pursue advanced studies. The committee will then make an admissions recommendation to the graduate admissions department, which is responsible for making the final decision and communicating that decision to both the integrated and applied sciences program director and the applicant.

Scholarships, Assistantships and Financial Aid

For priority consideration for graduate assistantship, applicants should complete their applications by the program admission deadlines listed. Fellowships and assistantships provide a stipend and may include health insurance and a tuition scholarship for the duration of the award.

For more information, visit the student financial services office online at <http://www.slu.edu/financial-aid>.

Learning Outcomes

1. Graduates will be able to use scientific principles underpinning the primary scientific discipline in which their concentration is based and by applying basic research methodology, demonstrate their application to their particular field of interest (chemistry, biology, physics, environmental science, sustainability science).
2. Graduates will be able to demonstrate advanced creativity in scientific research methodology in their concentration and appropriately use techniques in a laboratory and/or field setting – including experimental, theoretical, and computational methods.
3. Graduates will be able to integrate methods, theories, paradigms, concepts etc. from more than one discipline.
4. Graduates will be able to demonstrate an ability to communicate (oral and written) results and conclusions from their research, describe techniques and methodology used, and apply their experiences in the greater world in which we live.

Requirements

Code	Title	Credits
Required Courses		
IAS 6010	Interdisciplinary Seminar (taken over multiple semesters)	4
IAS 6030	Interdisciplinary Research (taken over multiple semesters)	8
Concentration Courses		
Select one of the following concentrations: †		18
Biology Concentration (p. 2)		
Chemistry Concentration (p. 2)		
Environmental Sciences and GIS Concentration (p. 3)		
Physics Concentration (p. 3)		
Dissertation Research		
IAS 6990	Dissertation Research (taken over multiple semesters)	12
Total Credits		42

† Concentration Core Department (9-12 credits), Concentration Interdisciplinary credits (6–9 credits)

Non-Course Requirements

Assuming successful completion of oral and written comprehensive exams, students should complete the Ph.D. program in four to five years. Students entering the program with an appropriate M.S. degree may complete the program in less time, again assuming successful completion of oral and written comprehensive exams.

Continuation Standards

Students must maintain a cumulative grade point average (GPA) of 3.00 in all graduate/professional courses.

Biology Concentration

Code	Title	Credits
Concentration Core Department		
Select three to four of the following:		9-12
BIOL 5060	Advanced Topics in Molecular Biology	
BIOL 5070	Advanced Biological Chemistry	
BIOL 5100	Cellular and Molecular Genetic	
BIOL 5120	Signal Transduction	
BIOL 5190	Geographic Information Systems in Biology	
BIOL 5300	Problems in Vertebrate Physiology	
BIOL 5340	Problems in Cell Biology	
BIOL 5350	Current Topics in Cell Biology	
BIOL 5400	Problems in Genetics	
BIOL 5410	Ecological Genetics	
BIOL 5420	Problems in Evolutionary Biology	
BIOL 5450	Biogeography	
BIOL 5460	Exercise Physiology	
BIOL 5480	Conservation Biology	
BIOL 5500	Problems in Ecology	
BIOL 5550	Advanced Ecology	
BIOL 5600	Developmental Genetics	
BIOL 5670	Advanced Population Biology	
BIOL 5700	Advanced Molecular Biology	
BIOL 5770	Coevolution	
BIOL 5840	Graduate Seminar in Ecology, Evolution and Systematics	
BIOL 6040	Current Topics in Developmental Biology	
BIOL 6150	Neural Basis of Behavior	
BIOL 6510	Plant-Water Relationships	
BIOL 6970	Research Topics	
BIOL 6980	Graduate Reading Course	
BIOL 5820	Graduate Seminar in Cell and Molecular Regulation	
BIOL 5860	Scientific Communication Practicum	
Concentration Interdisciplinary Course		
Select two to three courses from Earth & Atmospheric Sciences, Engineering, Physics, Mathematics, Chemistry, Biomedical Engineering, or Biomedical Sciences, Center for Sustainability, or GIS courses		6-9
Total Credits		15-21

Chemistry Concentration

Code	Title	Credits
Concentration Core Department		
Select 3 to 4 of the following:		9-12
CHEM 5150	Statistical Methods of Physical Scientists	
CHEM 5160	Advanced Synthetic Chemistry	
CHEM 5170	Advances in Analysis and Modeling of Chemical Systems	
CHEM 5200	Analytical Chemistry II	

CHEM 5205	Analytical Chemistry III Lab
CHEM 5230	Mass Spectrometry
CHEM 5250	Bioanalytical Meth Analysis
CHEM 5260	Analytical Separations
CHEM 5270	Electroanalytical Chemistry
CHEM 5290	Special Topics
CHEM 5300	Mathematical Techniques in Chemistry
CHEM 5330	Advanced Physical Chemistry
CHEM 5340	Advanced Thermodynamics
CHEM 5350	Elements of Surface/Colloid Science
CHEM 5370	Computational Chemistry
CHEM 5390	Special Topics: Physical Chemistry
CHEM 5400	Organic Spectroscopy
CHEM 5440	Bioorganic Chemistry
CHEM 5450	Advanced Organic Chemistry
CHEM 5460	Synthetic Organic Chemistry
CHEM 5470	Principles of Medicinal Chemistry
CHEM 5480	Heterocyclic Chemistry
CHEM 5500	Inorganic Chemistry
CHEM 5550	Organometallic Chemistry
CHEM 5560	Solid State Chemistry
CHEM 5570	Group Theory & Spectroscopy
CHEM 5590	Special Topics: Inorganic Chemistry
CHEM 5610	Biochemistry 1
CHEM 5615	Biochemistry 2
CHEM 5620	Biophysical Chemistry
CHEM 5630	Introduction to Chemical Biology and Biotechnology
CHEM 5700	Environmental Chemistry
CHEM 5800	Fundamentals and Design of Nanomaterials
CHEM 5850	Polymer Chemistry
CHEM 5299	Introduction to Analytical Research
or CHEM 5399	Introduction to Physical Research
or CHEM 5499	Introduction to Organic Research
or CHEM 5599	Introduction to Inorganic Research

Concentration Interdisciplinary Course
 Select two to three courses from Earth & Atmospheric Sciences, Engineering, Physics, Mathematics, Chemistry, Biomedical Engineering, or Biomedical Sciences, Center for Sustainability, or GIS courses. Students should register for CHEM 5920 Research Seminar (1 cr) each semester of their first two years before registering for IAS 6010 Interdisciplinary Seminar (1 cr) in years 3 and 4.

Total Credits 15-21

Environmental Sciences and GIS Concentration

Code	Title	Credits
Concentration Core Department		
Select three to four of the following: 9-12		
EAS 4410	Hydrology	
EAS 4500	Scientific Communications	
EAS 5190	Seminar in Geoscience	
EAS 5900	Geoscience Journal Club	
EAS 5170	Divergent & Convergent Margins	

EAS 5180	Trans Margins & Plate Interior
EAS 5600	Atmospheric Chemistry
GIS 5010	Introduction to Geographic Information Systems
GIS 5020	Intermediate Geographic Information Systems
GIS 5040	Introduction to Remote Sensing
GIS 5060	Geospatial Methods in Environmental Studies
GIS 5070	Research Methods
GIS 5080	Digital Cartography and Geovisualization
GIS 5090	Introduction to Programming for GIS and Remote Sensing
GIS 5091	Advanced Programming for GIS and Remote Sensing
GIS 5100	Microwave Remote Sensing: SAR Principles, Data Processing and Applications
GIS 5110	Interferometric Synthetic Aperture Radar
GIS 5092	Machine Learning for GIS and Remote Sensing
GIS 5120	Geographic Information Science, Society and Sustainability
GIS 5970	Research Topics

Concentration Interdisciplinary Course
 Select two to three of the following: 6-9

BIOL 4680	Landscape Ecology
BIOL 5190	Geographic Information Systems in Biology
BIOL 5480	Conservation Biology
BIOL 5500	Problems in Ecology
CHEM 5700	Environmental Chemistry
SOC 5205	Science, Technology & Policy
BSDP 5101	Fundamentals of Disaster Planning
EOH 5970	Research Topics in Environmental and Occupational Health
EAS 5340	Cloud Physics

Total Credits 15-21

Physics Concentration

Code	Title	Credits
Concentration Core Department		
9		
PHYS 5010	Nanoscience and Nanofabrication Frontiers	
PHYS 5020	Experimental Physics	
PHYS 5030	Mathematical Methods in Physics	

Concentration Interdisciplinary Course
 Select two to three of the following: 6-9

CHEM 5570	Group Theory & Spectroscopy
CHEM 5340	Advanced Thermodynamics
CHEM 5370	Computational Chemistry
CHEM 5800	Fundamentals and Design of Nanomaterials
CHEM 5560	Solid State Chemistry
ECE 5131	Low Noise Electronics Design
ECE 5132	Analog Integrated Circuit Design
ECE 5142	Microwave Theory & Techniques
ECE 5143	Antenna Theory and Design
ECE 5150	Filter Design

ECE 5235	Digital IC Design	
Total Credits		15-18

Roadmap

Roadmaps are recommended semester-by-semester plans of study for programs and assume full-time enrollment unless otherwise noted.

Courses and milestones designated as critical (marked with !) must be completed in the semester listed to ensure a timely graduation. Transfer credit may change the roadmap.

This roadmap should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor/mentor each semester. Requirements, course availability and sequencing are subject to change.

Course	Title	Credits
Year One		
Fall		
Core Course		3
Credits		3
Spring		
Core Course		3
Credits		3
Summer		
Core or Interdisciplinary Course		3
Credits		3
Year Two		
Fall		
Core or Interdisciplinary Course		3
Credits		3
Spring		
Core or Interdisciplinary Course		3
Credits		3
Summer		
Core or Interdisciplinary Course		3
Credits		3
Year Three		
Fall		
IAS 6010	Interdisciplinary Seminar	1
IAS 6030	Interdisciplinary Research	2
IAS 6990	Dissertation Research	3
Credits		6
Spring		
IAS 6010	Interdisciplinary Seminar	1
IAS 6030	Interdisciplinary Research	2
IAS 6990	Dissertation Research	3
Credits		6
Summer		
IAS 6990	Dissertation Research	3
Credits		3
Year Four		
Fall		
IAS 6010	Interdisciplinary Seminar	1

IAS 6030	Interdisciplinary Research	2
IAS 6990	Dissertation Research	3
Credits		6
Spring		
IAS 6010	Interdisciplinary Seminar	1
IAS 6030	Interdisciplinary Research	2
Credits		3
Total Credits		42

Program Notes

- Core Courses are defined as lecture or lab course offered in concentration home department.
- Interdisciplinary Courses are defined as lecture or lab course offered outside of concentration home department.