INTEGRATED AND APPLIED SCIENCES, PH.D.

Saint Louis University’s 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 multifaceted 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 SLU’s Department of Biology (https://www.slu.edu/arts-and-sciences/biology/).

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 courses are taken in SLU’s Department of Earth and Atmospheric Sciences (https://www.slu.edu/arts-and-sciences/earth-atmospheric-sciences/), as well as the GIS program (https://catalog.slu.edu/colleges-schools/arts-sciences/earth-atmospheric-sciences/geographic-information-science-ms/).

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 SLU’s College of Arts and Sciences (https://www.slu.edu/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 from the sponsor’s bank verifying that the funds are available and will be so for the duration of study at the 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 a 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](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 5070  Advanced Biological Chemistry
- BIOL 5190  Geographic Information Systems in Biology
- BIOL 5350  Current Topics in Cell Biology
- BIOL 5400  Problems in Genetics
- BIOL 5480  Conservation Biology
- BIOL 5550  Advanced Ecology
- BIOL 5670  Advanced Population Biology
- BIOL 5700  Advanced Molecular Biology
- BIOL 5840  Graduate Seminar in Ecology, Evolution and Systematics
- BIOL 6150  Neural Basis of Behavior
- BIOL 6970  Research Topics
- BIOL 6980  Graduate Reading Course
- BIOL 5820  Graduate Seminar in Cell and Molecular Regulation
- BIOL 5860  Scientific Communication

**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 5160  Advanced Synthetic Chemistry
- CHEM 5200  Analytical Chemistry II
- CHEM 5230  Mass Spectrometry
- CHEM 5260  Analytical Separations
- CHEM 5270  Electroanalytical Chemistry
- CHEM 5300  Mathematical Techniques in Chemistry
- 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 5500  Inorganic Chemistry
- CHEM 5550  Organometallic Chemistry
- CHEM 5560  Solid State Chemistry
- CHEM 5570  Group Theory & Spectroscopy
CHEM 5610  Biochemistry 1  
CHEM 5615  Biochemistry 2  
CHEM 5620  Biophysical Chemistry  
CHEM 5630  Introduction to Chemical Biology and Biotechnology  
CHEM 5800  Fundamentals and Design of Nanomaterials  
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.  

Environmental Sciences and GIS Concentration  

<table>
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<th>Title</th>
<th>Credits</th>
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<tr>
<td>EAS 4410</td>
<td>Hydrology</td>
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<td>EAS 4500</td>
<td>Scientific Communications</td>
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<td>EAS 5190</td>
<td>Seminar in Geoscience</td>
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<td>EAS 5900</td>
<td>Geoscience Journal Club</td>
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<td>EAS 5170</td>
<td>Divergent &amp; Convergent Margins</td>
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<tr>
<td>EAS 5180</td>
<td>Trans Margins &amp; Plate Interior</td>
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<td>EAS 5600</td>
<td>Atmospheric Chemistry</td>
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<tr>
<td>GIS 5010</td>
<td>Introduction to Geographic Information Systems</td>
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<tr>
<td>GIS 5040</td>
<td>Introduction to Remote Sensing</td>
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<tr>
<td>GIS 5060</td>
<td>Geospatial Methods in Environmental Studies</td>
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<tr>
<td>GIS 5070</td>
<td>Research Methods</td>
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<tr>
<td>GIS 5080</td>
<td>Digital Cartography and Geovisualization</td>
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<tr>
<td>GIS 5090</td>
<td>Introduction to Programming for GIS and Remote Sensing</td>
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<td>GIS 5091</td>
<td>Advanced Programming for GIS and Remote Sensing</td>
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<td>GIS 5092</td>
<td>Machine Learning for GIS and Remote Sensing</td>
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<tr>
<td>GIS 5100</td>
<td>Microwave Remote Sensing: SAR Principles, Data Processing and Applications</td>
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<td>GIS 5970</td>
<td>Research Topics</td>
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Concentration Interdisciplinary Course  
Select two to three of the following: 6-9  

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<td>BIOL 5190</td>
<td>Geographic Information Systems in Biology</td>
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<td>BIOL 5480</td>
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<td>BSDP 5101</td>
<td>Fundamentals of Disaster Planning</td>
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<td>EOH 5970</td>
<td>Research Topics in Environmental and Occupational Health</td>
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<td>EAS 5340</td>
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Total Credits 15-21  

Physics Concentration  

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<td>PHYS 5010</td>
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<td>PHYS 5020</td>
<td>Experimental Physics</td>
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<td>PHYS 5030</td>
<td>Mathematical Methods in Physics</td>
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Concentration Interdisciplinary Course  
Select two to three of the following: 6-9  

<table>
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<td>CHEM 5800</td>
<td>Fundamentals and Design of Nanomaterials</td>
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<td>CHEM 5560</td>
<td>Solid State Chemistry</td>
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<td>ECE 5132</td>
<td>Analog Integrated Circuit Design</td>
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<td>ECE 5150</td>
<td>Filter Design</td>
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<td>ECE 5235</td>
<td>Digital IC Design</td>
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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.

Year One  
Fall  
Core Course 3 Credits  

Spring  
Core Course 3 Credits  

Summer  
Core or Interdisciplinary Course 3 Credits  

Year Two  
Fall  
Core or Interdisciplinary Course 3 Credits  

Spring  
Core or Interdisciplinary Course 3 Credits  

Summer  
Core or Interdisciplinary Course 3 Credits  

Year Three  
Fall  
IAS 6010 Interdisciplinary Seminar 1 Credits  
IAS 6030 Interdisciplinary Research 2 Credits
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<td><strong>Spring</strong></td>
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<td>IAS 6010</td>
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<tr>
<td>IAS 6030</td>
<td>Interdisciplinary Research</td>
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<td>IAS 6990</td>
<td>Dissertation Research</td>
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<td>6</td>
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<td><strong>Summer</strong></td>
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<td>IAS 6990</td>
<td>Dissertation Research</td>
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<td><strong>Year Four</strong></td>
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<td><strong>Fall</strong></td>
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<td><strong>Total Credits</strong></td>
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</table>

**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.

**Contact Us**

For more information about our program, please contact:

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Integrated and Applied Sciences Program Director
vasit.sagan@slu.edu