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/?_ga=2.151043833.1339926385.1586191480-1836301299.1581545667/).

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 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 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/.

**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**

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>IAS 6010</td>
<td>Interdisciplinary Seminar (taken over multiple semesters)</td>
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<tr>
<td>IAS 6030</td>
<td>Interdisciplinary Research (taken over multiple semesters)</td>
<td>8</td>
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<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>BIOL 5070</td>
<td>Advanced Biological Chemistry</td>
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<tr>
<td>BIOL 5190</td>
<td>Geographic Information Systems in Biology</td>
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<tr>
<td>BIOL 5350</td>
<td>Current Topics in Cell Biology</td>
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<td>BIOL 5400</td>
<td>Problems in Genetics</td>
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<tr>
<td>BIOL 5480</td>
<td>Conservation Biology</td>
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<tr>
<td>BIOL 5550</td>
<td>Advanced Ecology</td>
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<tr>
<td>BIOL 5670</td>
<td>Advanced Population Biology</td>
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<tr>
<td>BIOL 5700</td>
<td>Advanced Molecular Biology</td>
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<tr>
<td>BIOL 5840</td>
<td>Graduate Seminar in Ecology, Evolution and Systematics</td>
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<td>BIOL 6150</td>
<td>Neural Basis of Behavior</td>
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<td>BIOL 6970</td>
<td>Research Topics</td>
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<td>BIOL 6980</td>
<td>Graduate Reading Course</td>
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<tr>
<td>BIOL 5820</td>
<td>Graduate Seminar in Cell and Molecular Regulation</td>
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<tr>
<td>BIOL 5860</td>
<td>Scientific Communication</td>
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<tr>
<td>CHEM 5160</td>
<td>Advanced Synthetic Chemistry</td>
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<td>CHEM 5200</td>
<td>Analytical Chemistry II</td>
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<td>CHEM 5230</td>
<td>Mass Spectrometry</td>
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<td>CHEM 5260</td>
<td>Analytical Separations</td>
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<td>CHEM 5270</td>
<td>Electroanalytical Chemistry</td>
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<td>CHEM 5300</td>
<td>Mathematical Techniques in Chemistry</td>
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<td>CHEM 5370</td>
<td>Computational Chemistry</td>
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<td>CHEM 5390</td>
<td>Special Topics: Physical Chemistry</td>
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<td>CHEM 5400</td>
<td>Organic Spectroscopy</td>
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<td>CHEM 5440</td>
<td>Bioorganic Chemistry</td>
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<td>CHEM 5450</td>
<td>Advanced Organic Chemistry</td>
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<td>CHEM 5460</td>
<td>Synthetic Organic Chemistry</td>
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<td>CHEM 5470</td>
<td>Principles of Medicinal Chemistry</td>
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<td>CHEM 5500</td>
<td>Inorganic Chemistry</td>
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<td>CHEM 5550</td>
<td>Organometallic Chemistry</td>
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<td>CHEM 5560</td>
<td>Solid State Chemistry</td>
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<tr>
<td>CHEM 5570</td>
<td>Group Theory &amp; Spectroscopy</td>
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**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.
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.  

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 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 5092  Machine Learning for GIS and Remote Sensing  
GIS 5100  Microwave Remote Sensing: SAR Principles, Data Processing and Applications  
GIS 5970  Research Topics  

Concentration Interdisciplinary Course  
Select two to three of the following:  6-9  
BIOL 5190  Geographic Information Systems in Biology  
BIOL 5480  Conservation Biology  
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  
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 5800  Fundamentals and Design of Nanomaterials  
CHEM 5560  Solid State Chemistry  
ECE 5132  Analog Integrated Circuit 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  

Credits  3  

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.

**Contact Us**
For more information about our program, please contact:

Vasit Sagan, Ph.D.
Integrated and Applied Sciences Program Director
vasit.sagan@slu.edu