GRADUATE CERTIFICATE IN DATA SCIENCE FOR BIOLOGY AND CHEMISTRY

Modern biological and chemical sciences increasingly require strong computational skills to conduct cutting-edge research. The Data Science for Biology and Chemistry Certificate will enable students to learn computational and programming skills that are relevant to their work in biology and chemistry. This certificate program is a 2-year, 12-unit certificate program that students can complete in line with their Master’s degree program requirements. There are 4 core required courses and 1 elective. Of the 4 core courses, one 3+ unit classes is devoted to learning data and computer science, using assignments and examples drawn from biology and chemistry. One one-unit course is a support course that provide inclusive environments for students to master coding and data science skills. One one-unit course is a professional development course to connect students to opportunities in basic data science with professionals in academics and industry. There is also 3 units required for research, in which students utilize their computational skills in their research projects required for their MS degrees in Biology and Chemistry. Students also select one elective course (3-4 units) that uses computational analysis.

Learning Outcomes

1. Develop computational skills needed to create, debug, and run a computer program to perform data analyses.

2. Obtain, store, manage and share data in a distributed environment through practical, hands-on experience with programming languages and big data tools.

3. Evaluate data, as well as to apply key technologies data science analysis including statistical analysis, machine learning, and data visualizations.

4. Develop data science as an aspect of their professional identity, effectively communicate their data analyses and results, and will connect with professionals outside of the University to further their data science careers.

5. Apply their data science skills to discipline-specific data and questions to solve real-world problems of high complexity.

Graduate Certificate in Data Science for Biology and Chemistry – 12-13 units

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL/CHEM 806</td>
<td>Exploratory Data Science for Scientists</td>
<td>4</td>
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<tr>
<td>BIOL/CHEM 807</td>
<td>Coding Community for Data Science Components of Independent Research Projects</td>
<td>1</td>
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<tr>
<td>BIOL/CHEM 808</td>
<td>Professional Prospects for Quantitative Biologists, Data Scientists, and Bioinformaticians</td>
<td>1</td>
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<tr>
<td>BIOL 897 or CHEM 897</td>
<td>Research</td>
<td>3</td>
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In addition to the courses listed above, students also select one discipline-specific application of data science (3 or 4 units) from the following list:

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<tr>
<td>BIOL 446</td>
<td>Microbial Genomics</td>
<td>4</td>
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<tr>
<td>BIOL 458</td>
<td>Biometry</td>
<td>4</td>
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<tr>
<td>BIOL 490</td>
<td>Ecology of Infectious Diseases</td>
<td>4</td>
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<tr>
<td>BIOL/CHEM 677</td>
<td>Introduction to Optical Engineering for the Biological Sciences</td>
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<td>BIOL 710</td>
<td>Advanced Biometry</td>
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<tr>
<td>BIOL 738</td>
<td>Bioinformatics and Genome Annotation</td>
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<tr>
<td>BIOL 815</td>
<td>Advanced Phylogenetic Analysis</td>
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<tr>
<td>CHEM 370</td>
<td>Computer Applications in Chemistry and Biochemistry</td>
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<td>CHEM 870</td>
<td>Computational Methods in Chemistry</td>
<td>3</td>
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<tr>
<td>CSC 306</td>
<td>An Interdisciplinary Approach to Computer Programming</td>
<td>3</td>
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