# 2021 - 2022 Certificate Map
## Computational Life Sciences

**School/College:** The College of Liberal Arts and Sciences  
**Location:** Tempe campus

## Program Requirements

The certificate in computational life sciences requires a minimum of 15 credit hours, of which at least 12 credit hours must be upper-division. The core consists of one computing course and one ethics course. A minimum of nine credit hours in elective courses complete the certificate. The computing course not used toward the core requirements may be used toward the elective credit hours. A grade of C (2.00 on a 4.00 scale) or higher is required for all courses used toward the certificate.

### Required Courses -- 6 credit hours

- BIO 312 / PHI 320: Bioethics (HU) or BIO 316 / HPS 330: History of Biology: Conflicts and Controversies (H) or BIO 317 / HPS 323: History of Science II (HU & H) or BIO 318 / HPS 331: History of Medicine (HU & H) or BIO 416 / HPS 410: Biomedical Research Ethics (L) (3)
- BIO 317 / HPS 330: History of Biology: Conflicts and Controversies (H) or BIO 318 / HPS 331: History of Medicine (HU & H) or BIO 416 / HPS 410: Biomedical Research Ethics (L) (3)
- BIO 318 / HPS 331: History of Medicine (HU & H) or BIO 416 / HPS 410: Biomedical Research Ethics (L) (3)
- BIO 439: Computing for Research or BIO 440 / MBB 440: Functional Genomics (3)

### Electives -- 9 credit hours

- BIO 355 / MAT 355 / MBB 355: Introduction to Computational Molecular Biology (CS) (3)
- BIO 411: Quantitative Methods in Conservation and Ecology (4)
- BIO 415: Statistical Models for Biology (CS) (4)
- BIO 439: Computing for Research (3)
- BIO 440 / MBB 440: Functional Genomics (3)
- BIO 494: Data Analysis in Neuroscience (3)
- BIO 494: Data Analysis and Visualization in R (1)
- BIO 494: Genomic Analysis (3)
- BIO 498: Programming for biologists (1)
- BME 494: Systems Biology of Disease (3)
- BMI 311: Modeling Biomedical Knowledge (3)
- BMI 312: Modeling Biomedical Data (3)
- BMI 330: Topics in Translational Bioinformatics (3)
- DAT 301: Exploring Data in R and Python (4)
- GIS 469 / SOC 469: Multivariate Statistics for Social Sciences (3)
- GIS 471: Spatial Statistics for Geography and Planning (3)
MAT 353: Mathematics and Cancer (3)
MAT 451: Mathematical Modeling (CS) (3)

If not used as the required computing course, students may include BIO 439 or BIO 440 as a certificate elective.

Depending on a student's undergraduate program of study, prerequisite courses may be needed in order to complete the requirements of this certificate.