

# COMPUTATIONAL BIOLOGY BA/BS

Computational Biology is a discipline that applies Computer Science as a tool to solve problems in molecular biology. The degree has been developed in collaboration between Computer Scientists and Biologists. Mathematics course work is also represented, as an understanding of statistics is necessary when working as a bioinformatics scientist. This is truly a unique and interdisciplinary degree. This degree is designed as a gateway for students who will pursue graduate programs (MS and PhD) in Bioinformatics and Computational Biology. Students will also have the training to enter the work force as system analysts working with large data sets in clinical research, government research labs, biotechnology and pharmaceutical companies. Our faculty conduct bioinformatics research with a focus on image processing (MRI and histology images), and also genomics and molecular genetics (for example, studying genes associated with behavior/neural processing in mammals or genes involved in regulation drought-tolerance in crops).

The goals of the Computational Biology program are to provide students with learning experiences in both the classroom and laboratory so that they are **well-prepared** to:

- Think critically and apply knowledge in novel contexts;
- Understand the computational analysis of biological systems;
- Understand cell and genome structures, function, and reproduction;
- Understand algorithms and data structures;
- Perform basic laboratory procedures in a safe manner.

## General Education Requirements

| Code                                                                           | Title                                                 | Credits   |
|--------------------------------------------------------------------------------|-------------------------------------------------------|-----------|
| <b>Written Communication</b>                                                   |                                                       |           |
| Select one of the following:                                                   |                                                       | 6.00      |
| ENGL-101<br>& ENGL-102                                                         | WRITING AND RHETORIC I<br>and WRITING AND RHETORIC II |           |
| ENGL-109                                                                       | COLLEGE WRITING AND RESEARCH                          |           |
| <b>Oral Communication</b>                                                      |                                                       |           |
| Select one from the following:                                                 |                                                       | 3.00      |
| COMM-101                                                                       | FUNDAMENTALS OF ORAL COMMUNICATION                    |           |
| COMM-203                                                                       | SMALL GROUP COMMUNICATION                             |           |
| COMM-204                                                                       | PUBLIC SPEAKING                                       |           |
| <b>Mathematical Ways of Knowing</b>                                            |                                                       |           |
| MATH-170                                                                       | CALCULUS I                                            | 4.00      |
| <b>Humanistic &amp; Artistic Ways of Knowing</b>                               |                                                       |           |
| Select two courses from two different categories (Literature, Arts, Language): |                                                       | 6.00-7.00 |
| <b>Literature</b>                                                              |                                                       |           |
| ENGL-175                                                                       | LITERATURE AND IDEAS                                  |           |
| ENGL-257                                                                       | WORLD CLASSICS                                        |           |
| ENGL-258                                                                       | INTERNATIONAL LITERATURE                              |           |
| ENGL-260                                                                       | NATIVE AMERICAN LITERATURE                            |           |
| ENGL-261                                                                       | MYTHOLOGIES                                           |           |
| <b>Arts</b>                                                                    |                                                       |           |
| ART-100                                                                        | INTRODUCTION TO ART                                   |           |
| HUM-101                                                                        | THE ART AND HISTORY OF THE MOTION PICTURE             |           |
| HUM-150                                                                        | INTRODUCTION TO THE ARTS                              |           |
| MUS-101                                                                        | SURVEY OF MUSIC                                       |           |
| MUS-102                                                                        | MUSIC IN AMERICA                                      |           |
| MUS-150                                                                        | WORLD MUSIC                                           |           |
| MUS-151                                                                        | HISTORY OF MUSICAL THEATER                            |           |
| MUS-152                                                                        | HISTORY OF JAZZ AND POPULAR MUSIC STYLES              |           |
| THEA-101                                                                       | SURVEY OF THE THEATER                                 |           |
| <b>Language</b>                                                                |                                                       |           |
| NP-101                                                                         | NEZ PERCE LANGUAGE AND CULTURE                        |           |

|          |                                |
|----------|--------------------------------|
| NP-102   | NEZ PERCE LANGUAGE AND HISTORY |
| SPAN-101 | ELEMENTARY SPANISH I           |
| SPAN-102 | ELEMENTARY SPANISH II          |

**Scientific Ways of Knowing**

|          |                                |      |
|----------|--------------------------------|------|
| BIOF-100 | INTRODUCTION TO BIOINFORMATICS | 3.00 |
| CHEM-111 | PRINCIPLES OF CHEMISTRY I      | 4.00 |

**Social & Behavioral Ways of Knowing**

Select one course from two disciplines: 6.00

|          |                                         |
|----------|-----------------------------------------|
| ANTH-102 | CULTURAL ANTHROPOLOGY                   |
| ANTH-120 | WORLD PREHISTORY                        |
| ANTH-170 | INTRODUCTION TO NATIVE AMERICAN STUDIES |
| ECON-201 | PRINCIPLES OF MACROECONOMICS            |
| ECON-202 | PRINCIPLES OF MICROECONOMICS            |
| GEOG-102 | INTRODUCTION TO GEOGRAPHY               |
| HIST-101 | WORLD HISTORY I                         |
| HIST-102 | WORLD HISTORY II                        |
| HIST-111 | UNITED STATES HISTORY I                 |
| HIST-112 | UNITED STATES HISTORY II                |
| HRPT-184 | DIVERSITY IN ORGANIZATIONS              |
| HRPT-185 | HUMAN RELATIONS IN ORGANIZATIONS        |
| POLS-101 | AMERICAN NATIONAL GOVERNMENT            |
| POLS-237 | INTERNATIONAL POLITICS                  |
| POLS-285 | COMPARATIVE GOVERNMENT                  |
| PSYC-101 | INTRODUCTION TO GENERAL PSYCHOLOGY      |
| PSYC-205 | LIFESPAN DEVELOPMENTAL PSYCHOLOGY       |
| SOC-101  | INTRODUCTION TO SOCIOLOGY               |
| SOC-102  | SOCIAL PROBLEMS                         |
| SS-184   | DIVERSITY IN ORGANIZATIONS              |
| SS-185   | HUMAN RELATIONS IN ORGANIZATIONS        |

**Global Perspectives**

Select one of the following: 3.00-4.00

|          |                                         |
|----------|-----------------------------------------|
| ANTH-102 | CULTURAL ANTHROPOLOGY                   |
| ANTH-120 | WORLD PREHISTORY                        |
| ANTH-170 | INTRODUCTION TO NATIVE AMERICAN STUDIES |
| ANTH-360 | RACE AND ETHNICITY                      |
| COMM-345 | INTERCULTURAL COMMUNICATION             |
| ENGL-258 | INTERNATIONAL LITERATURE                |
| ENGL-474 | NATIVE AMERICAN WRITTEN LITERATURE      |
| GEOG-102 | INTRODUCTION TO GEOGRAPHY               |
| HIST-101 | WORLD HISTORY I                         |
| HIST-102 | WORLD HISTORY II                        |
| HIST-111 | UNITED STATES HISTORY I                 |
| HIST-112 | UNITED STATES HISTORY II                |
| HRPT-184 | DIVERSITY IN ORGANIZATIONS              |
| ID-300C  | ETHICS AND IDENTITY                     |
| KIN-220  | SOCIAL-CULTURAL ASPECTS OF SPORTS       |
| NP-101   | NEZ PERCE LANGUAGE AND CULTURE          |
| NP-102   | NEZ PERCE LANGUAGE AND HISTORY          |
| POLS-285 | COMPARATIVE GOVERNMENT                  |
| SOC-101  | INTRODUCTION TO SOCIOLOGY               |
| SPAN-101 | ELEMENTARY SPANISH I                    |
| SPAN-102 | ELEMENTARY SPANISH II                   |

|                                                      |                            |              |
|------------------------------------------------------|----------------------------|--------------|
| SPAN-201                                             | INTERMEDIATE SPANISH I     |              |
| SPAN-202                                             | INTERMEDIATE SPANISH II    |              |
| SS-184                                               | DIVERSITY IN ORGANIZATIONS |              |
| <b>Integrative Seminar: Ethics &amp; Values</b>      |                            |              |
| Select one of the following:                         |                            | 3.00         |
| ID 300A - 300Z (see course descriptions for options) |                            |              |
| ID-301A                                              | HELLS CANYON INSTITUTE     |              |
| <b>Total Credits</b>                                 |                            | <b>38.00</b> |

## Program Requirements

| Code                                           | Title                                   | Credits      |
|------------------------------------------------|-----------------------------------------|--------------|
| <b>Major Requirements</b>                      |                                         |              |
| BIOF-350                                       | IMAGE ANALYSIS                          | 4.00         |
| BIOL-181                                       | ORGANISMAL BIOLOGY                      | 4.00         |
| BIOL-182                                       | CELLULAR BIOLOGY                        | 4.00         |
| BIOL-331                                       | ECOLOGY                                 | 3.00         |
| BIOL-341                                       | GENETICS                                | 4.00         |
| BIOL-355                                       | GENERAL MICROBIOLOGY                    | 4.00         |
| or BIOL-362                                    | CELLULAR AND MOLECULAR BIOLOGY          |              |
| BIOL-372                                       | COMPUTATIONAL BIOSTATISTICS             | 4.00         |
| BIOL-460                                       | EVOLUTION                               | 4.00         |
| BIOL-490                                       | DIRECTED STUDY IN BIOLOGY               | 3.00         |
| CHEM-112                                       | PRINCIPLES OF CHEMISTRY II              | 4.00         |
| CS-108                                         | INTRODUCTION TO COMPUTER SCIENCE        | 3.00         |
| CS-111                                         | COMPUTER SCIENCE I                      | 4.00         |
| CS-211                                         | COMPUTER SCIENCE II                     | 4.00         |
| CS-226                                         | SQL: STRUCTURED QUERY LANGUAGE          | 3.00         |
| CS-253                                         | INTRO TO SYSTEMS PROGRAMMING            | 4.00         |
| CS-311                                         | ALGORITHMS AND DATA STRUCTURES          | 4.00         |
| GIS-271                                        | GEOGRAPHIC INFORMATION SYSTEMS          | 4.00         |
| WEB-111                                        | FOUNDATIONS OF WEB DEVELOPMENT          | 3.00         |
| <b>Select five from the following courses:</b> |                                         | <b>15.00</b> |
| BIOF-301                                       | COMPUTATIONAL GENOMICS                  |              |
| BIOL-227                                       | HUMAN ANATOMY AND PHYSIOLOGY I          |              |
| BIOL-228                                       | HUMAN ANATOMY AND PHYSIOLOGY II         |              |
| BIOL-312                                       | BIOLOGY OF HUMAN DISEASE                |              |
| BIOL-401                                       | MAMMALOLOGY                             |              |
| BIOL-355                                       | GENERAL MICROBIOLOGY                    |              |
| or BIOL-362                                    | CELLULAR AND MOLECULAR BIOLOGY          |              |
| BIOL-402                                       | ORNITHOLOGY                             |              |
| BIOL-404                                       | ENTOMOLOGY                              |              |
| BIOL-443                                       | IMMUNOLOGY                              |              |
| BIOL-450                                       | FIELD BOTANY                            |              |
| CS-250                                         | COMPUTER ORGANIZATION AND ARCHITECTURE  |              |
| CS-360                                         | SOFTWARE ENGINEERING                    |              |
| CS-430                                         | OPERATING SYSTEMS                       |              |
| CS-435                                         | COMPUTER NETWORKS                       |              |
| CS-445                                         | DATABASES AND KNOWLEDGE MANAGEMENT      |              |
| GIS-471                                        | ADVANCED GEOGRAPHIC INFORMATION SCIENCE |              |
| MATH-175                                       | CALCULUS II                             |              |
| <b>Total Credits</b>                           |                                         | <b>82.00</b> |

## Sequential Plan of Study

| Course                  | Title                                                     | Credits      |
|-------------------------|-----------------------------------------------------------|--------------|
| <b>First Year</b>       |                                                           |              |
| <b>Fall</b>             |                                                           |              |
| BIOF-100                | INTRODUCTION TO BIOINFORMATICS                            | 3.00         |
| CORE                    | Social & Behavioral Ways of Knowing                       | 3.00         |
| ENGL-101                | WRITING AND RHETORIC I                                    | 3.00         |
| MATH-170                | CALCULUS I                                                | 4.00         |
| CHEM-111                | PRINCIPLES OF CHEMISTRY I                                 | 4.00         |
| <b>Credits</b>          |                                                           | <b>17.00</b> |
| <b>Spring</b>           |                                                           |              |
| BIOL-181                | ORGANISMAL BIOLOGY                                        | 4.00         |
| CORE                    | Oral Communication                                        | 3.00         |
| CS-108                  | INTRODUCTION TO COMPUTER SCIENCE                          | 3.00         |
| ENGL-102                | WRITING AND RHETORIC II                                   | 3.00         |
| CHEM-112                | PRINCIPLES OF CHEMISTRY II                                | 4.00         |
| <b>Credits</b>          |                                                           | <b>17.00</b> |
| <b>Second Year</b>      |                                                           |              |
| <b>Fall</b>             |                                                           |              |
| CORE                    | Humanistic & Artistic Ways of Knowing                     | 3.00         |
| CORE                    | Social & Behavioral Ways of Knowing                       | 3.00         |
| CS-111                  | COMPUTER SCIENCE 1                                        | 4.00         |
| WEB-111                 | FOUNDATIONS OF WEB DEVELOPMENT                            | 3.00         |
| CS-226                  | SQL: STRUCTURED QUERY LANGUAGE                            | 3.00         |
| <b>Credits</b>          |                                                           | <b>16.00</b> |
| <b>Spring</b>           |                                                           |              |
| BIOL-182                | CELLULAR BIOLOGY                                          | 4.00         |
| CORE                    | Humanistic & Artistic Ways of Knowing                     | 3.00         |
| CS-211                  | COMPUTER SCIENCE II                                       | 4.00         |
| CS-253                  | INTRO TO SYSTEMS PROGRAMMING                              | 4.00         |
| <b>Credits</b>          |                                                           | <b>15.00</b> |
| <b>Third Year</b>       |                                                           |              |
| <b>Fall</b>             |                                                           |              |
| BIOL-331                | ECOLOGY                                                   | 3.00         |
| BIOL-355<br>or BIOL-362 | GENERAL MICROBIOLOGY<br>or CELLULAR AND MOLECULAR BIOLOGY | 4.00         |
| Program Requirement     | Computational Biology Electives <sup>1</sup>              | 3.00         |
| GIS-271                 | GEOGRAPHIC INFORMATION SYSTEMS                            | 4.00         |
| <b>Credits</b>          |                                                           | <b>14.00</b> |
| <b>Spring</b>           |                                                           |              |
| BIOL-341                | GENETICS                                                  | 4.00         |
| CORE                    | Global Perspectives                                       | 3.00         |
| BIOF-350                | IMAGE ANALYSIS                                            | 4.00         |
| CS-311                  | ALGORITHMS AND DATA STRUCTURES                            | 4.00         |
| <b>Credits</b>          |                                                           | <b>15.00</b> |
| <b>Fourth Year</b>      |                                                           |              |
| <b>Fall</b>             |                                                           |              |
| BIOL-372                | COMPUTATIONAL BIOSTATISTICS                               | 4.00         |
| Program Requirement     | Computational Biology Electives <sup>1</sup>              | 3.00         |
| Program Requirement     | Computational Biology Electives <sup>1</sup>              | 3.00         |
| Program Requirement     | Computational Biology Electives                           | 3.00         |
| <b>Credits</b>          |                                                           | <b>13.00</b> |

**Spring**

|                      |                                              |               |
|----------------------|----------------------------------------------|---------------|
| BIOL-460             | EVOLUTION                                    | 4.00          |
| BIOL-490             | DIRECTED STUDY IN BIOLOGY                    | 3.00          |
| CORE                 | Integrative Seminar: Ethics & Values         | 3.00          |
| Program Requirement  | Computational Biology Electives <sup>1</sup> | 3.00          |
| <b>Credits</b>       |                                              | <b>13.00</b>  |
| <b>Total Credits</b> |                                              | <b>120.00</b> |

<sup>1</sup> Program Requirement: Select 15 credits from the following, BIOF-301, BIOL-227, BIOL-228, BIOL-312, BIOL-355 or BIOL-362, BIOL-401, BIOL-402, BIOL-404, BIOL-443, BIOL-450, CS-250, CS-360, CS-430, CS-435, CS-445, GIS-471, MATH-175.

Graduates with a BA/BS in Computational Biology go on to obtain careers in a variety of fields:

- Research Assistant
- Data Collection/Analysis
- Computer Science