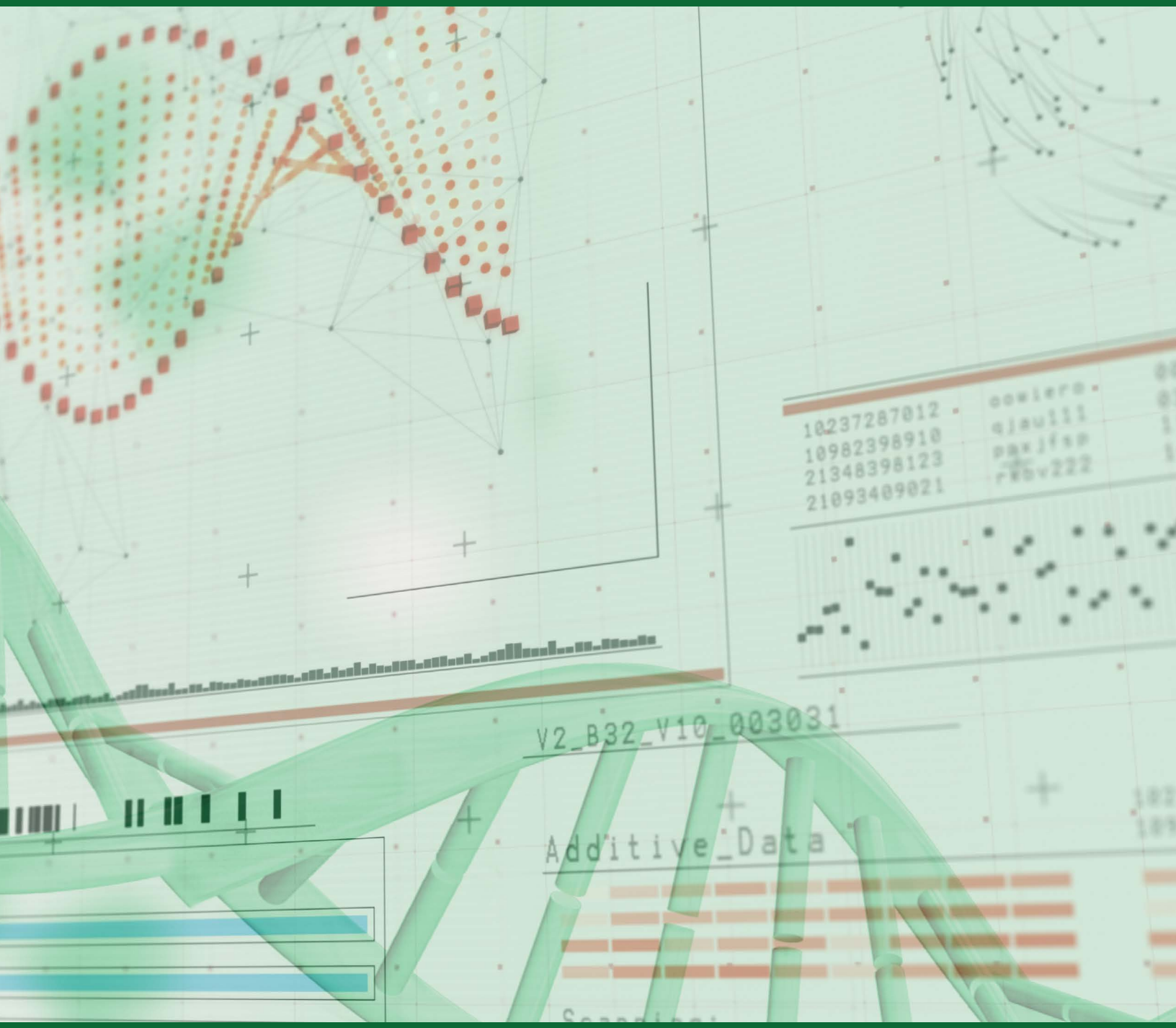
Phil and Penny Knight
Campus for Accelerating Scientific Impact



bioinformatics.uoregon.edu

Bioinformatics and Genomics Master's Program

Course Descriptions | 2022

First 3 Terms: Coursework at Knight Campus

Summer

BI621: Computational Methods in Genomic Analysis (4 cred)
Students learn to think algorithmically by writing scripts in Bash and Python. They manage and analyze next generation sequencing (NGS) data, navigate the UNIX command line, and utilize tools on both their computer and UO's high-performance computer cluster, Talapas.

BI622: Genomics Techniques (4 cred)
Learn about experimental design, genomics history and technology, and the molecular techniques for preparing high-quality nucleic acid sequencing libraries for both short and long-read sequencing. This course also develops students' written and oral scientific communication skills.

BI623: Topics in Genomics Analysis (4 cred)
Students are introduced to wide-ranging topics including phylogenetics, comparative genomics, transcriptome assembly and assessment, metagenomics, RNA-seq preprocessing, alignment and enumeration, and differential gene expression analysis, as well as statistics used in these analyses. Write scripts to manage and visualize data using R/RStudio, create professional reports using R markdown, and continue honing Python scripting skills.

Fall

BI624: Genomics Research Lab (4 cred)
Students write algorithms to analyze NGS data. Expanding upon topics covered in BI623, students are exposed to new topics in genomics analysis, including single-cell RNA-sequencing and statistical classification methods. Students begin team projects, in which they use real world data supplied by UO and external partner labs. This project continues through winter (BI625).

BI610: Advanced Biological Statistics for Omics Data (4 cred)
This course will focus on fundamentals of applied statistical analysis for omics data. Students will gain an understanding of probability theory tenets such as sample spaces, basic and conditional probability, distributions, and Bayes' Theorem. Course material will focus on practical application of non-parametric and parametric statistical tests, regression, generalized linear models, and experimental design to biological data. A strong emphasis is placed on equipping students to have the skills to determine the most appropriate statistical model/test given an omics dataset and biological hypothesis. Computing is done in R.

BI630: Professional Communication and Development for Scientists I (1 cred)
Students learn best practices for professional scientific communication. Core elements include: composing a competitive resume, providing impactful answers during behavioral and technical interviews, and building a strong professional network. Students prepare for internships through a variety of practical workshops.

In this fall term, students may take optional graduate level elective courses: Students may choose to take one or more optional electives during fall and/or winter terms. Students should consult with program faculty when considering electives.

Winter

BI625: Advanced Genomics Analysis (4 cred)
Students continue team projects from BI624 and design and present a poster during the track's annual scientific conference, Genomics in Action. They also gain exposure to special topics/projects throughout the term, including object-oriented programming, structured query language (SQL), analyzing PacBio data, creation of custom figures using Python graphics libraries, and the use of containers and cloud computing.

BI610: Machine Learning for Omics Data (4 cred)
This course introduces core concepts and methods in modern multivariate data analysis and applications to omics data. Major concepts and topics include model selection, validation and bootstrapping, feature selection, and model assumptions for unsupervised and supervised statistical learning. Students will learn to apply a variety of models such as polynomial and logistic regression, discriminant analysis, elastic nets, tree-based methods, k-means, and hierarchical clustering to biological data analysis problems. Methods are presented without heavy reliance on formulas and complex mathematics and instead focus is placed on important the important elements of the application of modern data analysis. Computing is done in R and Python.

BI631: Professional Communication and Development for Scientists II (1 cred)
Building upon fall term BI630.

In this winter term, students may take optional graduate level elective courses: Students may choose to take one or more optional electives during fall and/or winter terms. Students should consult with program faculty when considering electives.

Additional Electives Information

Students may choose to take one or more optional electives during the first fall and/or winter terms. We recommend that students consult with program faculty when considering electives. Some examples of classes taken by our students in previous years include:

Bi 526 - Genetics of Cancer

Bi 527 - Molecular Genetics Human Disease

BIOE 510 - Protein Engineering and Design

For students with more extensive computer science background or those looking for a challenge:

PHYS 510 - Image Analysis with Applications in Physics

CS 571 - Intro Artificial Intelligence

CS 572 - Machine Learning

For more information visit:

UO Class Schedule

Biology Course Information

Chemistry and Biochemistry Course Information

CS Course Information

Second 3 Terms: Internship with Partner Company

Spring, Summer, Fall

BI601: Internship Credits (10 credits per term for a total of 30 credits)
Within an academic, clinical, industrial, or national lab setting, students gain hands-on experience in the application of their knowledge. Each term, students write a review paper to demonstrate advancement of technical knowledge and development of written communication skills. Learn more about the internship by visitng our website at internship.uoregon.edu/bioinformatics.

Academic Timeline

TERM	SPRING	SUMMER	FALL	WINTER
YEAR 1 Coursework (9 months)		PD Week*		
		BI 621 Computation Methods in Genomic Analysis	BI 624 Genomics Research Lab I	BI 625 Advanced Genomics Analysis
		BI 622 Genomics Techniques	BI 610 Advanced Biological Statistics for Omics Data	BI 610 Machine Learning for Omics Data
		BI 623 Topics in Genomics Analysis	BI 630 Professional Communication in Science I	BI 631 Professional Communication in Science II
			BI/CH/CIS Optional Elective	BI/CH/CIS Optional Elective
YEAR 2 Internship (9 months)	BI 601 Research Internship	START OF INTERNSHIP FLEXIBLE Most start on or after April 1		

*Professional Development Week takes place the week before summer classes begin.