

Course Syllabus

Course Number: IGP 486: (Winter)

Course Title: “Advanced Bioinformatics /
Genome Informatics”

Number of Credit Hours: 4

Course Director: Ramana V Davuluri, Ph.D.

Course TA: Elan Ness-Cohn elanness-cohn2017@u.northwestern.edu

TA Office Hours: Wednesdays 3PM-5PM | *SQBRC Krantz Conference Room 1M-200*

Course Objectives:

The course will be oriented towards graduate students in HSIP, DGP and related programs. It will consist of lectures/seminars, each two hours in duration. The course will introduce various high-throughput technologies, such as microarray and Next Generation Sequence data, for measuring and analyzing gene expression, chromosomal deletions and amplifications, methylation patterns and genome architecture. Further, various algorithms and bioinformatics tools for analyzing the produced high-dimensional data will be discussed. The course begins with couple of introductory lectures in the biology part (Experimental/Technology part – no laboratory) followed by presentations on algorithms and data analysis (Informatics/Data Science part). Finally some recently published articles using these technologies will be discussed.

At the end of the course, the students will be expected to gain an overview of the current high-throughput technologies and use of associated bioinformatics algorithms and analytical methods. Students will gain experience in genomic data visualization tools to analyze cancer -omics data for gene expression, genome rearrangement, somatic mutations and copy number variation. The course will conclude with analyzing and conducting pathway analysis on the resultant cancer gene lists and integration of clinical data, using real data sets from publicly available databases, such as International Cancer Genome Atlas and The Cancer Genome Atlas of USA—allowing the participants to build a strong professional portfolio to demonstrate their skills.

Target students: Graduate students of the following programs:

- HSIP
- DGP
- Statistics (Biostatistics, Applied Statistics)
- CIS (Computer and Information Science)

The following are some of the pre-requisites for this course:

- Working knowledge in a Linux-based environment
- Basic Statistical Methods
- Programming in Perl/Python
- Basic R programming skills
- Basic Molecular Biology and Molecular Genetics knowledge

Syllabus:

The following are some of the technologies that will be discussed in this course:

- Aberrant gene expression and cancer
- Human and other genome projects
- Microarrays/gene-chips to classify tumors
- Comparative Genomic Hybridization to identify chromosomal amplifications & deletions
- ChIP-seq, RNA-seq, smallRNA-seq assays
- Bioinformatics tools to analyze the high-throughput data

Prerequisite Courses:

Methods 1 and 2 (HSIP 441, 442)

Student Grading:

Assignments 40%; Weekly Quiz 20% & Final Examination & Project Presentation: 40%.

Schedule:

- Monday & Wednesday 1-3 PM in **SQBRC Krantz Conference Room 1M-200**
- Lecture (Theory part): 1-2 PM
- Practical Part (Programming/Data Analysis Part): 2-3 PM