

## **BIOINFORMATICS - PROBLEMS AND APPROACHES**

**The objective of the following class and the topics that will be covered is to present the central aspects of biological data and bioinformatic approaches, with an emphasis on common techniques utilized for genomic and proteomic data management and processing. The topics will be covered from a biologist perspective of learning the resources and approaching bioinformatic problems.**

### **OUTLINE**

- Informatics-Bioinformatics-Biotechnology
- Key findings and key themes in bioinformatics
- Challenges in bioinformatics
- Biological data – many types, many sizes, many places
  
- Molecular biology's central dogma
- Biological models and biological problems
  
- Biological data management
  - Public databases
    - Flat file dbs-like book index
    - Relational dbs-looking at data from different angles
    - Object-oriented dbs-provide access to many thing, like text to video to images and survive execution of a process
  - Database software
    - Sequence retrieval systems
    - Oracle, PostgreSQL, Open Source Object DBMS, MySQL
  
- Main computational methods in bioinformatics

Sequence analysis-composition of DNA and RNA, mutations, evolution

Sequence searches

Genefinder and feature detection

Whole genome analysis and gene prediction

Pairwise sequence comparison

Scoring matrix-random or meaningful alignment?

Gap penalty

- Sequence alignment-FASTA, BLAST
- Multifunctional tools for sequence analysis

NCBI SEALS

The Biology Workbench

DoubleTwist

- Multiple sequence alignment
  - Phylogenetic analysis
  - Extraction of patterns and profiles

Motif databases-Blocks, PROSITE, Pfam, PRINTS, COGS

InterPro

MEME

- Protein sequence analysis
- Protein structure prediction
- Protein structure analysis
- Protein structure alignment and comparison
- Primer design

- Relationship between genes and proteins

Genomics-Transcriptomics-Proteomics

DNA microarray analysis

Proteomic analysis

Pharmacogenomics