

Six-weeks short course in Bioinformatics (2+3) November-December 2021 Session

BIOCOMPUTATIONAL METHODS FOR MOLECULAR SEQUENCE ANALYSIS (SCB-101: 1+2;
Online)

Theory:

Unit I

Introduction to sequence alignment, and its applications: Pairwise, and multiple sequence alignment (MSA), the concept of local, and global alignment, scoring matrices, alignment algorithms, heuristic methods, dot-matrix method, dynamic programming methods (Needleman Wunsch, and Smith-Waterman); Tools of MSA: Clustal-Omega, TCOffee; Molecular Phylogeny; NCBI-BLAST; Primer Designing and quality checking

Unit II

Structure prediction: Basics of protein folding, protein folding problem, molecular chaperons; Secondary structure prediction methods, and algorithms: Homology, *ab initio*, and folding based tertiary structure prediction; Structure validation tools; Drug designing; Protein-ligand docking; A glimpse on Artificial Intelligence and it's application in animal and crop sciences

Practical

NCBI; ExPasy: SwissProt; EBI; Similarity Searching: local alignment using all BLAST variants and interpreting results; Multiple sequence alignment using Clustal Omega; T Coffee; Molecular phylogenetic analysis by MEGA; Primer Designing and quality checking; Protein structure prediction and validation: Secondary, and tertiary structure prediction of protein (Homology modelling, *Ab initio* methods); WhatIf; Ramachandran's plot and interpretation; Protein-ligand docking.

Suggested Readings

- A. Malcolm Campbell & Laurie J. Heyer. 2007. *Discovering Genomics, Proteomics, and Bioinformatics*. Benjamin Cummings.
- Allan Hinchcliffe. 2008. *Modeling for Beginners*. Wiley.
- Baxevanis AD, Ouellette BFF. 2001. *Bioinformatics: A practical guide to the analysis of genes, and proteins*. John Wiley, and Sons.
- Creighton TE. 1993. *Proteins: Structures, and Molecular Properties*. W.H. Freeman
- Mount DW. 2001. *Bioinformatics: Sequence, and Genome Analysis*. Cold Spring Harbor.
- Setubal Joao & Meidanis Joao. 1997. *Introduction to Computational Molecular Biology*. PWS Publishing Company

Core Faculty:

- Dr. Ratan Kumar Choudhary, Assistant Professor, COABT
- Dr. Neeraj Kashyap, Assistant Professor, COABT

PROGRAMMING LANGUAGES WITH PRACTICAL LABS (SCB-102: 1+1; Online)

Theory:

Unit I

R: R programming environment, R-Studio, data-types, operators, file import-export, installation of packages, functions, user-defined functions,

Unit II

Using SAS for statistical graphs, Correlation, regression, ANOVA, post-hoc analysis

Unit III

Introduction to Perl; data-types, operators, file import-export, installation of packages, functions; RegEx

Practical:

R: File import-export, functions, package installation; graph generation using R,

SAS: Correlation, regression, ANOVA, post-hoc analysis, GLM using SAS

Perl: Basic operations in Perl; RegEx with example and application in bioinformatics

Suggested Readings

- Norman Matloff. 2011. The Art of R Programming: A Tour of Statistical Software Design. No Starch Press. India. ISBN-10: 1593273843
- Randal L. Schwartz, Brian D Foy, Tom Phoenix. 2016. Learning Perl: Making Easy Things Easy and Hard Things Possible. O'Reilly; 7th edition. ISBN 1491954329

Core Faculty:

- Dr. CS Mukhopadhyay, Senior Scientist, Department of Bioinformatics, COABT
- Dr. Neeraj Kashyap, Assistant Professor, Department of Bioinformatics, COABT

One week offline classes and exams: Students will require attending mandatory one week classes at the end of the short course. During this period, practical classes, discussion and short assignment/project work will be covered.

Students will appear in offline examination (inclusive of Theory and Practical of 50 marks each) of each of the courses.