



School of Interdisciplinary Engineering & Sciences (SINES)
National University of Sciences & Technology

Course Title: Computational Immunology

Course Code: BI-851

Course Objective:

Primary focus of the program under which the proposed course will be conducted is

- To analyze immune systems Strategies to find desirable genes and proteins for their application in infectious diseases and host responses.
- Analysis of Antibody-antigen-MHC interactions.
- Comparison of patients with autoimmune responses or diseases.
- Computational prediction of graft rejection for particular donor/recipient pairs.
- Computer modelling in an attempt to understand the processes of adaptive cellular cancer immunotherapy.
- The results of these analyses may be incorporated into peer reviewed publications part of the student thesis/research projects

Course Outcome:

After the course the students will be able to apply different concepts of Computational Immunology on various practical problems.

Course Contents

- Introduction to Computational Immunology
 - Use of Bioinformatics in immunology
 - Applications of Computational Immunology
 - Immunomics
- Various tools and algorithms
 - Structure-based prediction
 - Prediction using other machine learning methodologies
 - Prediction through matrix-driven methods
 - Prediction methodology for discontinuous B-cell epitopes
 - Prediction using machine learning methodologies
 - Predicting Virulence Factors of Immunological Interest
- Various datatypes and databases
 - Interpretation of Experimental data and applications
 - Immunomic microarray technology and analysis
 - B-cell epitope databases
 - T-cell epitope databases
 - Allergy prediction databases
 - Databases related to molecular evolution of immune genes and proteins

- Computational modelling and simulation of the immune system.
 - Visual modelling and simulation of adaptive immune system.
 - Existing Immunological models.
 - Pathways comparative analysis and reconstruction
- Structural Computational Immunology
 - Modelling of proteins having important role in immune systems pathways
 - Important Protein-Protein interactions generating immune responses.³⁴
 - Protein-Peptide Interactions analysis to identify therapeutic targets
 - Computational Docking of Antibody-Antigen Complexes
- System approaches in Computational Immunology

Recommended / Reference Books:

- Flower, Darren R., ed. Immunoinformatics: Predicting immunogenicity in silico. Springer Science & Business Media, 2007.
- Bassaganya-Riera, Josep. Computational Immunology: Models and Tools. Academic Press, 2015.
- Castro, Leandro Nunes, Leandro Nunes De Castro, and Jonathan Timmis. Artificial immune systems: a new computational intelligence approach. Springer Science & Business Media, 2002.
- Lund, Ole, et al. Immunological bioinformatics. MIT press, 2005.
- Latest Research papers from the domain of Computational Immunology, other Internet resources and lectures.