Course Title: Computational Vaccinology

Course Code: BI-852

Course Objective:

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

- Computational methods to predict vaccine antigens and immune epitopes.
- Reverse vaccinology approaches for genome-wide vaccine target identification and vaccine development.
- Case studies of applying bioinformatics approaches in vaccine development.
- Informatics methods for improving surveillance of vaccine safety and efficacy.
- Modeling of impact of vaccine immunizations against target diseases (e.g., pandemic influenza)
- Vaccine related databases and analysis systems
- Vaccine related data integration and literature mining

Course Outcomes:

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

Course Contents

- Introduction to Computational Vaccinology
    - Design of New Vaccines in the Genomic and Post-Genomic Era
    - Application of Computational Immunology to Vaccine Design
    - Target Identification for Vaccines
    - Computational vaccinology workflow
    - Cancer vaccines: computational modeling approaches
    - Reverse Vaccinology & Vaccine screening
    - Epitope-driven approaches for vaccine design
    - DNA vaccines
    - Allergen Bioinformatics
- Computational modelling and design of vaccines
- Computer-aided antibody design
    - Antibody CDR modeling
    - Predicting VL/VH domain orientations
    - Antibody-antigen recognition
    - Affinity maturation by somatic mutations and computational design
- Computational T cell vaccine design
- Sequence-based methods
- Structure-based methods

WP No.11-64th ACM-23 Jan 2023

- Computational B cell vaccine design
    - o Sequence-based methods
    - o Structure-based methods
- Peptide-based vaccine design
    - o Insights from MHC-bound peptides
    - o the peptide repertoire of HLA molecules
    - o Predicting Peptide-MHC Binding
- Vaccine database and Data mining36
- Confirmatory tools and databases.
    - o Epitope prediction and Servers & Vaccine candidate design
    - o From immunome to vaccine: epitope mapping and vaccine design tools
- Vaccine safety and quality assessments
    - o Assessment of ADME/Tox deficiencies
    - o Assessment of allergenicity

Recommended / Reference Books:

- Flower, D. R. (2007). Immunoinformatics: Predicting immunogenicity in silico. Springer Science & Business Media.
- Baschieri, S. (2012). Innovation in Vaccinology: from design, through to delivery and testing. Springer Science & Business Media.
- Rappuoli, R., & Bagnoli, F. (2011). Vaccine design: Innovative approaches and novel strategies. Horizon Scientific Press.
- Sakharkar, K. R., Sakharkar, M. K., & Chandra, R. (2015). Post-Genomic Approaches in Drug and Vaccine Development.
- Tong, J. C., & Ranganathan, S. (2013). Computer-aided vaccine design. Elsevier.