

Reverse Vaccinology: Genome to Vaccinome (SSB-917) CHR (3-0)

Educational Objectives

This course has been designed for students to learn Reverse Vaccinology which is a widely used approach to identify potential vaccine candidates (PVCs) by screening the proteome of a pathogen through computational analyses.

Course Outcomes

Students should at the end of the course have,

- Knowledge of how vaccines work immunologically and epidemiologically.
- To attain knowledge on the different types of conventional vaccines and vaccines developed through reverse vaccinology.
- Understand the framework and pipeline used for development of these vaccines.
- To implement the rules and regulations for testing new vaccines and key developmental stages such as pre-clinical and clinical (Phase I-IV) vaccine trials.
- Understand the challenges in the development of new vaccines.

Course contents

Unit – I

Molecular basics of the Immune System: Innate & Adaptive Immunity, Cells of the Immune System, Antigens, Antibodies-Immunoglobulin Classes & Subclasses, Synthesis and class switching of antibody molecules.

Unit – II

Membrane Receptors for Antigen: BCR, TCR, Major Histocompatibility Complex-MHC Polymorphism, Causes & Supertypes of MHC; Antigen Processing & Presentation: The Cytosolic & Endocytic Pathway, Epitopes-Affinity Maturation, Recognition of Antigen by B Cells, Neutralizing Antibody.

Unit – III

Immunoinformatics-Principles and its Uses; Databases, Tools and Web Resources for Immunoinformatics: The International ImmunoGenetics information system (IMGT), AntigenDB, The Immune Epitope Database (IEDB), The Immuno Polymorphism Database (IPD). Unit – IV Epitope Mapping & Prediction: B-cell epitope prediction methods, T-cell epitope prediction methods; Role of Immunogenomics & Immunoproteomics in Vaccine Development, Peptide Modeling.

Unit – V

Computational Vaccinology: Concept, Application & Workflow; Computer Aided Selection of Vaccine Antigens; Vaccine candidate design, Reverse Vaccinology, Vaccinomics role in Bioinformatics.

Recommended books

1. Flower Darren R. Bioinformatics for Vaccinology Publisher: UK, John Wiley & Sons Inc.
2. Flower Darren R. Immunoinformatics: Predicting Immunogenicity In Silico Publisher: New Jersey, Humana Press.
3. Kindt, Thomas J., Osborne Barbara A., Goldsby Richard A. Kuby Immunology 6th Edition. Publisher: New York, W. H. Freeman.
4. Lund Ole , Nielsen Morten , Lundegaard Claus, Kesmir Can, Brunak Søren. Immunological Bioinformatics. Publisher: London, MIT Press
5. Pedro A Reche, Richard Moxon, Rino Rappuoli, Reverse Vaccinology, Frontiers Media SA