Name of the Programme: M.Sc. Biotechnology

Course Code: GBT-528

Title of the Course: VACCINE TECHNOLOGY

Number of Credits: 2

Effective from AY: 2022-23

Pre-requisites for the Course:	Basic concepts in Immunology	
Course Objectives:	1) To understand the conventional to the latest technology in vaccine production. 2) To understand the immunological effect and strategies for vaccine design.	
Content:	**MODULE I** • Protective immune response in bacterial; viral and parasitic infections; Primary and Secondary immune responses during infection; Antigen presentation and Role of Antigen-presenting cells: Dendritic cells in immune response; • Innate immune response; Humoral (antibody-mediated) responses; Cell-mediated responses: role of CD4+ and CD8+ T cells; • Memory responses: Memory and effector T and B cells, Generation and Maintenance of memory T and B cells Correlates of protection. • Epitopes, linear and conformational epitopes, characterization and location of APC, MHC, and immunogenicity • History of vaccines, Conventional vaccines; Vaccination and immune response; • Different types of Vaccines: Inactivated Vaccine, Attenuated Vaccine, Toxoid Vaccine, Subunit Vaccine, Conjugate Vaccine, Valence Vaccine, Heterotypic Vaccine, mRNA vaccine with Examples • Vaccines based on routes of administration: oral, intranasal, intramuscular. Subcutaneous, intravenous. Case examples of injectable vaccines, and combination vaccines.	**No. of hours** 15

	• Physical method of gene delivery: tattooing, gene gun, electroporation, ultrasound, and laser • Maternal Immunization	
	MODULE II • Vaccines with and without adjuvants. Different types of adjuvants: oil-based adjuvants such as Freunds, aluminum hydroxide, aluminum phosphate, [AS04] aluminum potassium sulfate monophosphoryl lipid A (MPL) + aluminum salt, [MF59] Oil in water emulsion composed of squalene. [AS01] Monophosphoryl lipid A (MPL) and QS-21, a natural compound extracted from the Chilean soapbark tree, combined in a liposomal formulation, [cpG1018] Cytosine phosphoguanine (CpG), a synthetic form of DNA that mimics bacterial and viral genetic material. • Vaccine delivery systems (e.g., emulsion (water- in-oil-in-water multiple emulsions, microemulsions, or nanoemulsions) microparticles, immune-stimulating complexes ISCOMs liposomes, nanoparticles, dendrimer and micellar) with examples such as PLGA, Chitosans, polyphosphazene, polyanyhydrides, polymethacrylic acid, liposomes, and their derivatives, virosomes, polymeric nanoparticle delivery system, • New emerging diseases and vaccine needs (Ebola, Zika). • Quality control and regulations in vaccine research	15
Pedagogy:	Lectures, tutorials, assignments	
References/ Readings:	1. C. Barton, "Advances in Vaccine Technology and Delivery", Espicom Business Intelligence, 2009. 2. R.W. Ellis, "New Vaccine Technologies", Landes Bioscience, 2001. 3. C. A. Janeway, Travers, P., Walport, M.; Shlomchik, M. J. Immuno Biology: the Immune System in Health and Disease. USA: Garland Science Pub, 2005. 4. S. H. Kaufmann, Novel Vaccination Strategies. Weinheim: Wiley-VCH, 2004.	

	5. T. J. Kindt, B. A. Osborne, R. A. Goldsby; Kuby, J. Kuby Immunology. New York: W.H. Freeman, 2013. 6. D. Male, et al., “Immunology”, Mosby Publication, 2007.
Course Outcomes:	1. Understanding the progress in the development of various types of vaccines. 2. Correlating the immunological responses with immunisation/vaccination. 3. Understanding of vaccine design and strategies for vaccine delivery. 4. Understand the significance of adjuvant, immunogens, and other ingredients for developing an effective vaccine.

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