- Primrose S. and Twyman R. (2006). Principles of Gene Manipulation & Genomics, 7th edition. Black well Publishing, Malden. (ISBN: 978-1405135443)
- Rastogi, C., Mendiratta, N. and Rastogi P., (2013) Bioinformatics: Methods and applications, 4th Ed. PHI learning Pvt. Ltd.
- Selzer P.M. (2008) Applied Bioinformatics an Introduction, Springer (ISBN: 9783540727996)
- Sharon, M., Sharon, M., Pandey, S., & Oza, G. (2012). Bio-nanotechnology: Concepts and Applications. ANE Books, New Delhi. (ISBN: 978-1439852149)
- Twyman, R. (2004). Principles of proteomics. Taylor & Francis. (ISBN: 978-1859962732)
- Xiong, J., (2009). Essential Bioinformatics, Cambridge University press. (ISBN: 9780521706100)
- Young-Chul Lee and Ju-Young Moon, (2020) Introduction to Bionanotechnology. Springer.

MB 2003: ADVANCES AND CHALLENGES IN IMMUNOLOGY

1. Course Code & Title

Course code: Core course III
Course title: Advances and Challenges in Immunology
Course type: Core
Course credits: 04

2. Course overview and Course Objectives

This paper focuses on principles of immunology, molecular pathogenesis, immune-technology and immunotherapy. It also provides understanding and studying the molecular mechanism of pathogen in causing infections and the response of the host against the pathogens which would enable in developing therapy, vaccine development and the control of transmission.

Course Objectives

Unit 1: To study receptor biology and the interaction of antigens with the immune cells. To learn the immunological responses during transplantation
Unit2: To learn activation of T cells and B cells and the role of helper T cells in activation of immunological responses against antigens
Unit 3: To understand the induction of cancer and oncogenes, to understand tumor biology and the different immunotherapeutic approaches and applications
Unit 4: To gain insight of the challenges like antibiotic drug resistance and the advances in immunology

3. Course Content

UNIT 1	**RECEPTOR BIOLOGY**
	Teaching duration: Lectures 16

1.1	The MHC Complex 1.1.1 Structure of MHC molecules 1.1.2 Binding of peptide to MHC molecules 1.1.3 Genomic organization of the MHC 1.1.4 Expression of MHC molecules
1.2	B cell surface receptor for antigen
1.3	T cell surface receptor for antigen
1.4	Transplantation

UNIT 2	**ACTIVATION OF LYMPHOCYTES** **Teaching duration: Lectures 16**
2.1	Activation of T cells 2.1.1 Activation of CD4+ Lymphocyte 2.1.2 Activation of CD8+ T cells
2.2	Activation of B cells 2.2.1 Antigen recognition and antigen induced B cell activation 2.2.2 Helper T cell dependent antibody response to protein antigen 2.2.3 Antibody response to T cell independent antigen
2.4	Primary B and T cells deficiencies

UNIT 3	**CANCER AND IMMUNOTHERAPY** **Teaching duration: Lectures 16**
3.1	Cancer: Origin and Terminology
3.2	Malignant transformation of cells
3.3	Oncogenes and cancer induction
3.4	Tumors of the immune system 3.4.1 Tumor antigens 3.4.2 Tumor invasion of immune system 3.4.3 Cancer Immunotherapy
3.5	Engineered antibodies for therapy
3.6	Immuno- conjugates and its applications

UNIT 4	**Immunological challenges and advances** **Teaching duration: Lectures 16**
4.1	AMR 4.1.1 Evolutionary Biology of Drug Resistance 4.1.2 Mechanisms of Antibacterial Resistance: Shedding Some Light 4.1.3 Antimicrobial resistance: Selection vs. Induction 4.1.4 Colonization and Its Importance for the Emergence of Clinical resistance
4.2	Emerging zoonosis disease 4.2.1 Swine and Avian Influenza Outbreaks in Recent Times 4.2.2 Emerging Animal Coronaviruses: SARS, MERS, SARS-CoV-2
4.3	Stem cell therapy 4.3.1 Stem cell-based therapy for human diseases

4.4	Gut flora transplantation

Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: Students shall learn the biology of cell receptors and the importance of molecular interactions in immunological responses

Unit 2: Students shall gain knowledge of the activation of T cells and B cells and the defects leading to immunodeficiency

Unit 3: Students will gain an understanding of tumor antigens and the oncogenes leading to induction of cancer, they shall also learn the strategies of immunotherapies to combat cancer

Unit 4: Students shall become aware of the challenges and the advancement in immunology

Recommended learning resources

- Abbas A.K., Lichtman A.H., Pillai S., (2007) Cellular and Molecular Immunology, 6th Edition, Saunders Elsevier. (ISBN;978-81-312-1034-5)
- Biazzo, Manuele, and Gabriele Deidda. "Fecal microbiota transplantation as new therapeutic avenue for human diseases." *Journal of Clinical Medicine* 11, no. 14 (2022): 4119.
- Delves P.J., Martin S. J., Burton D.R., and Roitt I.M., (2017) Roitt's Essential Immunology, 13th Edition, Willy Blackwell. (ISBN;978-1-118-41577-1)
- Douglas L. Mayers, Antimicrobial Drug Resistance, Volume 1, Mechanisms of Drug Resistance Edited by Douglas L. Mayers, 2009, Humana press, ISBN: 978-1-60327-592-7 e-ISBN: 978-1-59745-180-2 and DOI: 10.1007/978-1-59745-180-2
- Hoang, Duc M., Phuong T. Pham, Trung Q. Bach, Anh TL Ngo, Quyen T. Nguyen, Trang TK Phan, Giang H. Nguyen et al. "Stem cell-based therapy for human diseases." *Signal Transduction and Targeted Therapy* 7, no. 1 (2022): 1-41.
- Kateryna Kon and Mahendra Rai, Antibiotic Resistance Mechanisms and New Antimicrobial Approaches, 2016, Elsevier, ISBN: 978-0-12-803642-6
- Kerry L. LaPlante Cheston B. Cunha, Haley J. Morrill, Louis B. Rice, Eleftherios Mylonakis, Antimicrobial Stewardship: Principles and Practice, 2017, CABI, ISBN-13: 978 1 78064 439 4.
- Kindt T.J., Goldsby R.A., and Osborne B.A., (2007) Kuby Immunology, 6th Edition, W.H.Freeman and Company, New York. (ISBN;0716767643)
- Nash A.A., Dalziel R.G., and Fitzgerald J.R., (2015) Mims' Pathogenesis of Infectious Disease, 6th Edition, Academic Press (Elsevier). (ISBN;978-0-12-397188-3)
- Praful B. Godkar, Darshan P. Godkar, 2021 COVID-19 edition, Textbook of Medical Laboratory Technology - Vol 2 - Revised Reprint 2021 (3rd Edition), ISBN-10: 9789381496190, ISBN-13: 978-9381496190, Bhalani Publishing House
- Wang, Jiunn-Wei, Chao-Hung Kuo, Fu-Chen Kuo, Yao-Kuang Wang, Wen-Hung Hsu, Fang-Jung Yu, Huang-Ming Hu, Ping-I. Hsu, Jaw-Yuan Wang, and Deng-Chyang Wu. "Fecal microbiota transplantation: Review and update." *Journal of the Formosan Medical Association* 118 (2019): S23-S31.