



# IMMUNOLOGY

**PROF. SUDIP KUMAR GHOSH**

**PROF. AGNEYO GANGULY**

Department of Biotechnology  
IIT Kharagpur

**PRE-REQUISITES :** Biochemistry, Microbiology, Cell and molecular biology.

**INTENDED AUDIENCE :** Any branch of life sciences

**INDUSTRIES APPLICABLE TO :** Biologics, Biopharma Industry, Vaccine industry

## **COURSE OUTLINE :**

The course will provide basic knowledge of Immunology for UG students in the field of Life Science and Biotechnology. The course introduces students to a wide range of topics in immunology starting from cells of immune system, innate and adaptive immune systems, humoral immunity, antibody structure and function, basic immunological techniques, autoimmunity, hypersensitivity and vaccine production. The course is well balanced with the basics of immunology as well as advanced topics delivered easily for UG students in particular.

## **ABOUT INSTRUCTOR :**

Prof. Sudip Kumar Ghosh is a Professor and former Head of the Department of Biotechnology and Prof-in-Charge, Advanced Laboratory for Plant Genetic Engineering, IIT Kharagpur. With a Bachelor degree in Chemistry major and Master degree in Biochemistry, Dr. Ghosh joined the Department of Biochemistry, Bose Institute, as a PhD student in Biochemistry. After his doctoral studies, he did his post doctorate from Harvard University, Boston, USA specializing in Immunology and Molecular Cell Biology. He was a visiting scientist in Harvard University, Boston, USA and visiting faculty in Boston University, Boston, USA. He has joined IIT Kharagpur in the year 2000. He is teaching Immunology and Immunotechnology to B.Tech and M. Tech Students respectively since 2001 at the Department of Biotechnology, IIT Kharagpur. Dr. Ghosh has acquired theoretical knowledge, technical skill and research experience in the fields of Cell and Molecular Biology, Immunology and Biochemistry. He is a fellow of West Bengal Science Academy.

Prof. Agneyo Ganguly is an Assistant Professor in Department of Biotechnology, IIT Kharagpur since 2013 and is teaching Immunology for UG students for last 5 years. Dr. Agneyo Ganguly did his PhD in Biochemistry from Indian Institute of Chemical Biology (IICB, CSIR), Kolkata in 2008. Dr. Ganguly did his postdoctoral research in Biozentrum, Switzerland (2008-2011) and University of Muenster, Germany (2011-2013) and has several publications in International peer reviewed journals.

## **COURSE PLAN :**

- Week 1:** Introduction to immune System, Immune cell types, Hematopoiesis, B and T lymphocytes, NK cells, Lymphoid organs (primary and secondary)
- Week 2:** Features of/introduction to inflammation, Adaptive immune system, Innate Immune system
- Week 3:** Antibody structure, Generation of antibody diversity
- Week 4:** Generation of antibody diversity and TCR rearrangement
- Week 5:** Major histocompatibility complex, Antigen presentation, APCs
- Week 6:** Immuno-diffusion assay, ELISA (Sandwich), Immuno-blotting, flowcytometry.
- Week 7:** T-cell development, negative/positive selection, co-stimulatory molecules.
- Week 8:** Humoral immunity/Cell-mediated immunity, T cell subtypes: Th1, Th2, Th17, Tregs etc.
- Week 9:** B-cell maturation/activation BCR signaling, memory B and T cell
- Week 10:** Pro-inflammatory and anti-inflammatory cytokines, cell polarization/Complement activation (classical/alternate), hypersensitivity
- Week 11:** Autoimmunity, host vs graft reaction
- Week 12:** Active immunization Vaccines, Vaccine production, passive immunization, polyclonal and monoclonal antibodies