

# TEXTBOOK OF IMMUNOLOGY

Arvind Kumar



The Energy and Resources Institute

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# Preface

The human being is constantly threatened by a variety of organisms and their molecules. The immune system, which is the human body's defence mechanism, makes a distinction between these non-self organisms and molecules and its own healthy tissues. The branch of science that analyses the structure and function of the immune system is known as immunology. It developed as a distinctive subject in the mid-20th century.

This book is an attempt to give a broad coverage on the subject. Including the latest advance information as the subject has steadily progressed during the last couple of years, the book leads to the new dimension of understanding immunology and immune system. The book provides to its reader including graduate, undergraduate and postgraduate students all the information on immunology, starting from basic to advance, in simple comprehensible language. This has been further complemented by the descriptive subtitle-based chapters that provide a concise overview of the important subject areas in immunology.

Divided into 14 chapters, the book is written in a clear and lucid manner and each topic is organized into sub-topics. For clarity the book has been illustrated with simple well-labelled diagrams.

Chapter 1, Basics of Immunity, describes the historical paradigm of immunology with the focus on sequential advancement in immunity. It gives a comprehensive précis of immunology and its components to make the reader inquisitive to know about the subject. The special attraction of this chapter is Major Histocompatibility Complex (MHC), which has been discussed in brief, and clonal selection of B cells along with cooperative interdependent function of innate and adaptive immunity. Specificity of antibodies, allergic and anaphylactic response, components of immune system, antigen presentation, and immunodeficiency have also been covered.

Chapter 2, Composition of Immune System, explains the composition of immune system, which can be described as a backbone of immunity in immunology, immunological cells, lymphocytes and lymphoid organs with their structural details. The special attraction of this chapter is the immunological cells markers.

Chapter 3, *Antigens and Immunogens*, details the antigenicity and immunogenicity of the antigens in the host and the various types that help in bringing out the advance descriptive knowledge without which there can be no talk on immunity. The focal points of this chapter are the nature of B-cell epitopes and T-cells epitopes, with description of pattern recognition receptors (PRRs) protein and TLR. In continuation to Chapter 3, Chapter 4, *Antigen Determinants*, analyses immunoglobulin proteins raised against specific antigens. It details their types and sub-types and the essential structure. Topics such as diversity of antibody which is due to shuffling of gene fragment or segment production help the reader understand how and why infinite diversity of antibodies are present in the vertebral hosts.

Chapter 5, *Antigen and Antibody Interaction*, examines the interaction between antigen and immunoglobulin and the various techniques developed based on it for clinical uses and application. The chapter focuses on immunological techniques and their clinical application with the inclusions of modern advance and highly research-oriented techniques, such as nanotechnology and quantum dot.

Chapter 6, *Major Histocompatibility Complex*, as the name suggests, describes in detail MHC structure and types including the functions. On reading this chapter, readers will get a grasp on MHC-based naming of various mice strains, linkage disequilibrium including immune responsiveness.

Chapter 7, *Complement System*, is a small chapter written with the aim to clarify without compromising on basic information.

Chapter 8, *Regulation of Adaptive Immune Response*, examines the regulation of adaptive immune system with an emphasis on B- and T-lymphocyte cells and their receptors and co-receptors.

In Chapter 9, *Cell-mediated Immunity and Cytotoxicity*, the role of CTLs, NK cells and other cytotoxic cells including macrophages-based immunity mechanism are discussed in brief based on the recent discoveries in this area. The experimental proof of cell mediated cytotoxicity mechanism and immunity have also been included in this chapter.

Chapters 10 and 11, *Allergic Reactions or Hypersensitivity and Autoimmunity* respectively, describe hypersensitivity and autoimmunity with the help of examples and causes. Allergic reactions of various allergen present in an environment based on different mechanism are written in a simplified but articulate form.

Chapter 12, *Immunity to Infections and Tumours*, discusses immunity to infection and the most contagious disease—cancer. Viral, bacterial and protozoan infection based diseases have also been explained along with recent techniques of cancer immunotherapy and causes of cancer.

In Chapter 13, *Immunology of Graft Rejection or Transplant Rejections*, transplantation of organs and graft and recent advancement in respect to immunological development

have been discussed. The major focus is on immunotherapy and drug-based acceptance of graft.

Finally, Chapter 14, Cytokines, describes key immunomodulatory immunological molecules, that is, cytokines and chemokines with their receptors. The discussion on the role of cytokines in T-cell and B-cell immunity, functionality of Th 17 and Regulatory T cells (Tregs), and cytokines in cancer therapy would interest the reader. This chapter, written in detail, illustrates the recent advancement of research in this key immune regulator molecules with their sub-types Th 1 and Th 2.

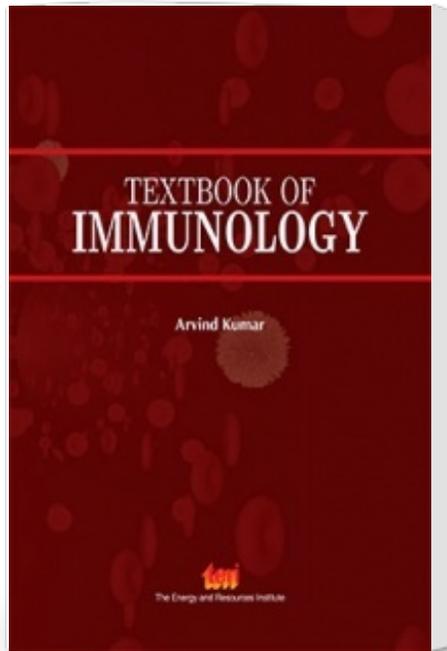
I hope that the reader will find this book both enjoyable and useful, and any comments and suggestions for improvements in future editions would be gratefully received. I would like to thank all those people including reviewers, editors, associate editors, copyeditors whose endurance have helped and influenced in making this book possible. Special thanks are also due to those whose help in the production of the book has been indispensable. My parents' blessing has always been with me and empowered me when writing this book. At the end I cannot forget to bestow gratitude to all my family members especially my wife Anamika, daughter Omi Richa, and son Animesh for their patience and support.



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# Textbook of Immunology



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