# PCB4233C Fundamentals of Immunology

**Course Description:** Students will learn the immunological processes and concepts as they pertain to human health, disease prevention, development, and treatment. Its primary emphasis is on the cellular and non-cellular components of the immune system, and the ways in which these components interact to provide immunity. This is a combination lecture and lab course. Special fee. (3 hr. lecture 2 hr. lab)

Prerequisite: MCB3023L, MCB3023

<table>
<thead>
<tr>
<th>Course Competency</th>
<th>Learning Outcomes</th>
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| **Competency 1:** The student will demonstrate knowledge of the basic components and functions of the immune system by: | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 1. Describing the cells, tissues, and organs essential for immune function | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 2. Comparing the components of the innate and adaptive immunity | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 3. Summarizing the functions of the innate and adaptive immunity | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 4. Listing the differences between passive- and active acquired immunity | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 5. Discussing the benefits the immune system provides over the reticuloendothelial system - specificity, amnestic response, surveillance of self | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 6. Describing the roles of B and T lymphocytes | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 7. Differentiating between the functions of humoral- and cell-mediated immunity | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| **Competency 2:** The student will demonstrate knowledge of immunoglobulin structure(s) and molecular genetics of antibody diversity by: | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 1. Explaining the genetic recombination and expression of immunoglobulin genes | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 2. Describing the basic structure of an immunoglobulin molecule | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 3. Discussing the major features of the 5 classes of immunoglobulins | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 4. Explaining the diversity provided by the kappa and lambda light chains and gamma, alpha, mu, epsilon and delta heavy chains | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| **Competency 3:** The student will demonstrate knowledge of the mechanisms of B-Cell maturation, activation, and differentiation, in antibody mediated immune responses by: | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 1. Describing the steps by which a pre B cell matures into a plasma cell | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 2. Discussing the protective roles of antibodies as opsonins, in complement fixation, precipitin reactions, agglutinins, etc | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
| 3. Summarizing the immunological functions of complement proteins; and the activation of these by antibody-antigen complexes | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
8. Computer / Technology Usage |
4. Explaining the classic and alternate pathways of complement fixation; and of the benefits of maintaining two complement fixation pathways
5. Analyzing the differences between a monoclonal and polyclonal response(s)
6. Explaining how monoclonal antibodies are generated, and of the use of these in the laboratory and clinics

**Competency 4:** The student will demonstrate knowledge of the T-Cell receptor structure and function by:

1. Describing the molecular structure of the T-cell receptor (TCR) and organization of the TCR genes
2. Explaining the genetic mechanism for the generation of diversity in TCR genes
3. Comparing the analogies to immunoglobulin gene rearrangements
4. Discussing the role of Major Histocompatiblity Complex (MHC) proteins in TCR function and antigen recognition/presentation and signal transduction

**Competency 5:** The student will demonstrate knowledge of the mechanisms of T-Cell maturation, activation, and differentiation in cell mediated immune responses by:

1. Explaining the steps of T cell maturation and development in the thymus and immune accessory organs
2. Describing how positive and negative selection generates self-restricted T cells
3. Contrasting the role of the different interleukins in T-cell maturation and cellular immune reactions
4. Describing T-cell commitment to the CD4 or CD8 lineages, and the generation the different T-cell subpopulations (e.g. cytotoxic, helper)
5. Discussing the roles of T-cytotoxic, T-helper, T-DTH, T-suppressor, K and NK cells in cellular immune reactions

**Competency 6:** The student will demonstrate knowledge of the role of the immune system in maintenance of health an in the etiology of disease by:

1. Discussing the use of vaccines and toxoids in establishing acquired immunity
2. Comparing the risks and benefits of different vaccine preparations; and of the role of adjuvants in vaccination
3. Discussing immune disorders related defects in tolerance, leading to hypersensitivity and autoimmunity; and by providing examples of these
4. Defining the terms primary and secondary immunodeficiencies
5. Discussing current global health issues, such as malnutrition and AIDS, and their relationship to immunity, disease prevention and onset
6. Discussing the interactions between microorganisms and the immune system, including microbial/parasitic evasion strategies and immune system responses
7. Summarizing the role of the immune system in the etiology and treatment of oncogenic malignancies/cancer
8. Explaining the immune effector mechanisms mediating antigen recognition and graft rejection during transplantation
9. Discussing the influence of cultural and societal beliefs that impact vaccines, organ
# transplantation and allergies

## Competency 7: The student will demonstrate knowledge of basic laboratory methods and procedures by:

|  | 1. Communication  
|---|---|
|  | 2. Numbers / Data  
|  | 3. Critical thinking  
|  | 8. Computer / Technology Usage  

1. Performing calculations, and appropriately measuring, preparing and diluting reagents, and serological components for use in immunology laboratory  
2. Demonstrating proper handling, use and disposal of potentially infectious/hazardous materials  
3. Safely performing all common forms of serological and immunological techniques and methods  
4. Stating the importance of Quality Control procedures and documentation  
5. Evaluating experimental results and conditions with critical thinking skills, and by providing remediation for any deficiencies noted in experimental results and/or methods  
6. Properly documenting laboratory procedures and record keeping procedures  
7. Communicating clearly and consisely in appropriate scientific form

## Competency 8: The student will demonstrate knowledge and practice of common immunological laboratory procedures used to detect and measure the immune response by:

|  | 1. Communication  
|---|---|
|  | 2. Numbers / Data  
|  | 3. Critical thinking  
|  | 8. Computer / Technology Usage  

1. Performing and ABO typing of blood groups to illustrate antigen antibody reactions  
2. Conducting a C-reactive protein test and explaining its clinical significance  
3. Conducting ELISA assays for the detection of [viral] antigens and/or antibodies  
4. Evaluating Ouchterlony Gel Diffusion assays used to examine antigen-antibody reactions  
5. Assessing radial immunodiffusion assays used to examine antigen-antibody reactions  
6. Interpreting Western Blot analysis of antigenic determinants/proteins