

SCHOOL OF HEALTH AND SCIENCES

SYLLABUS

TITLE:	Immunology
CODE:	BIO 320
PREREQUISITE	BIO 206
CORREQUISITE	BIO 320L
CREDITS:	4 credits 45 contact hours 45 lab hours 1 term

DESCRIPTION

This course studies the basic immunological principles and mechanisms, including immunogenics. Students will analyze the structure and function of immunoglobulins, antigens, complement, antigen-antibody interactions, cell interactions, and cellular immunity.

JUSTIFICATION

The discipline of Immunology has roused great interest among scientists, healthcare professionals, and students due to the role that lymphoid cell populations and histocompatibility complex proteins play in protecting against infectious diseases and other clinical conditions. In recent years, research has yielded significant findings on the role of immunoglobulins, T lymphocytes, APC cells, HLA proteins, and immune hormones against pathogenic microbes that infect humans. Advances in the molecular cellular aspect of the interactions of monocytic and lymphocytic populations with their receptors and cytokine production have allowed us to understand very important mechanisms of the human immune system. Immunotherapy as one of the novel alternatives in the treatment of different types of cancer represents a great advance in medicine. It is also important to know and evaluate the function and involvement of cell populations and chemical metabolites such as proteins in the development of autoimmune diseases, transplant reactions, and hypersensitivities. The course includes online labs and activities.

COMPETENCES

The course develops the following competences in students:

- **Critical questioning**
- **Research and exploration**

OBJECTIVES

After completion of the course, students will be able to:

1. Recognize the structure and function of the immune system, the cells involved, the lymphatic circulatory system, organs, lymphatic tissues, and blood circulation of cellular elements.
2. Explain the basic structure of immunoglobulins; classes and subclasses, allotypes and idiotypes; including genetic concepts about them.
3. Recognize the interactions of antigens with antibodies.
4. Analyze the mechanisms of innate immunity against microorganisms, such as phagocytosis and inflammation, and of acquired immunity in the role of secreting immunoglobulins circulating in the blood and resistance to viral infections and T-cell-mediated responses.
5. Compare the functional concepts of lymphocyte subpopulations taking into consideration B and T cells, and T cell subclasses.
6. Analyze the histocompatibility system.
7. Identify hypersensitivity and autoimmunity reactions, discuss humoral response, T-cell-mediated responses including graft or transplant immunology.
8. Discuss and analyze the genetic control of the immune response and the role that lymphocytes play in immunosuppression and the consequences on the immune system.
9. Apply knowledge about the immune system in serological and immunological tests and interpret the results obtained in immunochemical tests for the diagnosis of diseases.

CONTENTS

- I. Introduction
 - A. Basic principles
 1. Three lines of defense
 - a. First – nonspecific
 - b. Second – nonspecific
 - c. Third - specific

- B. Mononuclear Phagocyte System (MPS)
- C. Immune system
 - 1. Humoral immunity
 - 2. Cellular immunity
- D. Types of immunity
 - 1. Innate (non-specific)
 - 2. Adaptive (specific)
 - a. Active: natural, artificial
 - b. Passive: natural, artificial
- E. Immunocytology
 - 1. Cellular interactions
 - 2. Host response
- II. Antigens and Antibodies
 - A. Characteristics of antigens
 - 1. Hapten
 - 2. Valency
 - 3. Antigenic determinants (epitopes)
 - B. Serum fractionation
 - 1. Serum proteins
 - 2. Immunoglobulin structure
 - 3. Classification of immunoglobulins
 - 4. Immunoglobulin G
 - 5. Immunoglobulin M
 - 6. Immunoglobulin A
 - 7. Immunoglobulin E
 - 8. Immunoglobulin D
- III. Antibody Synthesis and Interactions Between Immunocompetent Cells: Cell Responses and Cooperation
 - A. Experimental Background
 - 1. Bursa of Fabricius
 - 2. Bursa-equivalent tissue
 - 3. Lymphoid tissues, primary and secondary lymphoid organs
 - 4. Lymphocytes

- a. B cell and Its receptors
 - b. T cell, Its subpopulations, and Its receptors
 - c. Null cell and Its receptors
- B. Interaction between immunocompetent cells
 - 1. Macrophage role in immune response
 - 2. Function of T lymphocytes: cell-mediated response
 - a. Helper cells and their receptors
 - b. Suppressor cells and their receptors
 - c. Killer cells
 - d. Memory Cells
 - 3. B lymphocyte function: humoral response (antigen stimulation), maturation (memory cells), plasmacytes (division and differentiation)
 - 4. Function of antigen-presenting cells (APCs)
 - 5. Molecular receptors on cells involved in immune responses

CLINICAL CONTENT (Optional)

- IV. Measurement of Antibodies (Serology) and Other Tests to Determine Antigen Concentration
 - A. Precipitation
 - B. Agglutination
 - C. Complement fixation
 - 1. Biological description and function
 - 2. Classical complement pathway (cascade)
 - 3. Alternate pathway
 - a. Properdin pathway
 - b. Lectins
 - D. Enzyme-linked-immunosorbent assay (ELISA)
 - E. Immunofluorescence (direct and indirect)
 - F. Electrophoresis (SDS-PAGE)
 - G. Radioimmunoassay (RIA)
 - H. Immunoelectrophoresis
 - I. Western blot and others
- V. Immunopathology
 - A. Immunoproliferative diseases

- B. Hypersensitivities: immediate and late
- C. Autoimmune diseases
- VI. Grafts (Transplants) and Oncoimmunology
 - A. Graft rejection
 - B. Histocompatibility antigens
 - 1. Mouse
 - 2. Man
 - C. Immunosuppression
 - D. Oncoimmunology
 - 1. Etiology of cancer
 - 2. Serological indicators of cancer
 - 3. Prophylactic possibilities and immunotherapy

LABORATORY EXPERIENCES

- Differential white blood cell count
- Agglutination and blood type determination
- Agglutination: Detection of Ag-Abs
- Latex particle agglutination: Pregnancy test: Detection of the hormone gonadotropin
- Precipitation: Detection of the Ag-Ab complex
- Detection of antigens in biological samples: Determination of protein concentration using the Bio-RAD method: Spectrophotometry analysis
- ELISA test
- Immunoelectrophoresis
- Immunofluorescence
- Western blot

METHODOLOGY

The following strategies from the active learning methodology are recommended:

- Lectures & class discussion
- Use of visual resources including molecular modeling
- Lab activities where students answer questions through different activities and experimental techniques
- Collaborative work
- Solving a problem posed
- Web-supported education

- Literature research

EVALUATION

Participation	10%
Partial assignments	30%
Oral presentation	10%
Final project or exam	25%
Immersion experience	25%
Total	100%

LEARNING ASSESSMENT

The institutional assessment rubric is applied to the course's core activity.

BIBLIOGRAPHY

TEXTBOOK

Abbas, A. K. (2020). *Basic Immunology: Functions and Disorders of the Immune System*. Elsevier Health Sciences

REFERENCES

Abbas, J., Lichtman, A. H., & Pillais, S. (2018). *Cellular and Molecular Immunology* (9th ed.). Elsevier Saunders.

Capra, D., Edmundson, A. B. (1977). The antibody combining site. *Scientific American*, 236(1), 50-59.

Delves, P.J. (2017). *Roitt's Essential Immunology*. Wiley-Blackwell.

Howard, M., Sette, A., & Buss, S. (1989). How T cells see antigens. *Scientific American*, 261(5), 56.

Male, D., Brostoff, J., Roth, D. B., & Roitt, I. (2013). *Immunology* (8th ed.). Elsevier Saunders.

Punt, J. (2019). *Kuby Immunology* (8th ed.). WH Freeman.

ELECTRONIC REFERENCES

<http://www.biology.arizona.edu/immunology/immunology.html>

www.microbiologybook.org

www.cdc.gov

www.asm.org

For more information resources related to the course's topics, access the library's webpage <http://biblioteca.sagrado.edu/>

REASONABLE ACCOMMODATION

For detailed information on the process and required documentation you should visit the corresponding office. To ensure equal conditions, in compliance with the ADA Act (1990) and the Rehabilitation Act (1973), as amended, any student in need of reasonable accommodation or special assistance must complete the process established by the Vice Presidency for Student Affairs.

- Students participating in the Student Support Program (PAE, in Spanish) shall request their reasonable accommodation in PAE's offices.
- Students who do not participate in PAE shall request their reasonable accommodation at the Integral Wellness Center (*Centro de Bienestar Integral*, in Spanish).

ACADEMIC INTEGRITY

This policy applies to all students enrolled at Universidad del Sagrado Corazón to take courses with or without academic credit. A lack of academic integrity is any act or omission that does not demonstrate the honesty, transparency, and responsibility that should characterize all academic activity. Any student who fails to comply with the Honesty, Fraud, and Plagiarism Policy is exposed to the following sanctions: receive a grade of zero in the evaluation and / or repetition of the assignment in the seminar, a grade of F (*) in the seminar, suspension, or expulsion as established in the Academic Integrity Policy effective in November 2022.

RESEARCH COURSES

This course may require students to practice tasks related to the research process, such as taking informed consent or assent, administering instruments, conducting interviews, observations, or focus groups, among others. These assignments are part of an academic

exercise and the information collected will not be used to share with third parties or disclose it in settings other than the classroom with the professor teaching the course. Every student, as well as their professor, who will interact with human subjects as part of their research practice must be certified in ethics with human subjects in research by the Collaborative Institutional Training Initiative (CITI Program).

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