

# MIC-Microbiology

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## **MIC 600. The Microbiome in Health and Immunity. 3 Hours.**

This course will review the functions of the immune system and discuss the role of the microbiome in health and disease. This course will use a personal microbiome analysis project to develop information literacy, critical thinking, and communication skills while investigating the interplay between the microbiota and immune system components. Additional topics including the role of the microbiome in maintaining gut health, influencing the gut-brain axis, and nutrient synthesis will also be discussed.

**Prerequisites:** MIC 275 [Min Grade: C]

## **MIC 601. Foundations in Immunology: The Innate Immune System. 3 Hours.**

This course will introduce the cells, receptors, signaling pathways and soluble mediators associated with the innate immune response. The basic components of the innate immune system will then be discussed in the context of their role in the physical, physiological, phagocytic and inflammatory barriers that comprise the innate immune system. Importantly, emphasis will be placed on the molecular and cellular mechanisms that are used by the innate immune system to detect and respond to microbial pathogens to provide the first line of defense.

**Prerequisites:** MIC 275 [Min Grade: C]

## **MIC 602. Foundations in Immunology: The Adaptive Immune System. 3 Hours.**

This course will provide an in-depth analysis of the cells (T, B and antigen presenting cells), tissues (primary and secondary) and soluble factors (cytokines and chemokines) that comprise the adaptive humoral immune response. The course will examine how cells of the adaptive immune system discriminate self from non-self, including the nature of antigen receptors, the types of antigens recognized and the signals involved in the generation of effector cells that mediate the response.

**Prerequisites:** MIC 275 [Min Grade: C]

## **MIC 603. Foundations in Immunology: Microbial Pathogen-Immune System Interaction. 3 Hours.**

This course will provide an overview of major concepts related to virulence mechanisms utilized by microbial pathogens and their effect on the host immune response. Emphasis will be placed on important virulence factors/mechanisms associated with bacterial, viral and fungal pathogens and how these alter various components of the innate and adaptive immune responses to allow escape of the pathogen and its survival. This course will introduce the concept of emerging infectious diseases and how their spread is related to their ability to escape detection by the immune system.

**Prerequisites:** MIC 401 [Min Grade: C] and MIC 402 [Min Grade: C]

## **MIC 604. Foundations in Immunology: Immunologically-Mediated Diseases. 3 Hours.**

This course will focus on the role of the immune system, including the molecular and cellular processes, that contribute to morbidity and mortality associated with immunodeficiency (congenital and acquired), asthma/allergy, autoimmunity (systemic and organ-specific), transplantation and inflammatory syndromes associated with heart disease, cancer, chronic neurological disease and diabetes.

**Prerequisites:** MIC 401 [Min Grade: C] and MIC 402 [Min Grade: C] or MIC 601 [Min Grade: C] and MIC 602 [Min Grade: C]

## **MIC 660. Introduction to the Immune System. 3 Hours.**

The objective of this Course is to provide a concise overview of the immune system, its cellular and molecular components, and their function in relation to host protection against pathogens. Students will follow clear principles by which these different components of the immune system interact with each other to ensure an effective immune response. Students will learn how the immune system is capable of such enormous diversity in terms of the foreign antigens that it can specifically recognize and react against, while at the same time avoiding similar responses against our own cells, tissues and organs. By describing paradigmatic examples of these immune response mechanisms in the context of exposure to typical bacteria and viruses, a solid basic foundation for subsequent immunology courses will be provided, including those courses that are focused on immune-mediated diseases, immune protection against cancer and its evolution during tumor progression, vaccines, and immune-based therapeutics in immune-mediated and other diseases. Throughout the course, Students will be encouraged to consider the concept of immune balance in terms of how over-reactivity of the immune mechanisms they will be learning about can lead to excessive (or chronic) inflammation or autoimmunity, and why certain key physiological and life-style factors can adversely affect this balance and are therefore recognized as urgent topics in biomedical research and medicine. Undergraduate-level Biochemistry or Cell Biology must be taken before registering for this course.

## **MIC 661. Immune-mediated Diseases. 3 Hours.**

The objective of this Course is to condense knowledge of the cellular and molecular components of the immune system and their function in relation to host protection against pathogens (covered in the previous Masters Immunology Program course MBS 696 ST: Introduction to the Immune system) into clear paradigmatic principles by which these different branches of the immune system interact with each other and other biological systems such as the microbiome to maintain normal immune balance. Students will learn how modifications of immune cell development or function associated with genetic, pathogenic and environmental factors affect this balance, promoting immune hypersensitivities, causing immune deficiency, or predisposing to the development of autoimmune diseases. Systemic Lupus Erythematosus and Multiple Sclerosis will be used as prototypical examples of systemic and organ-specific autoimmunity respectively to exemplify key aspects related to the pathogenic mechanisms, clinical features, therapeutics, and potential future curative approaches built from basic immunological research utilizing animal models.

**Prerequisites:** MIC 660 [Min Grade: C]

## **MIC 665. Current Topics in Immunology. 3 Hours.**

The current topics courses will in general cover current topics related to immunology, host defense, and immune-based therapeutics. This specific course will examine the factors influencing the disease course of COVID-19 and current treatment and prevention options with an emphasis on discussing the appropriate immune response that leads to mild symptoms and clearance of SARS-CoV-2 and the immune dysregulation that contributes to severe COVID-19. Topics in viral infection with an emphasis on coronaviruses and the concept of spillover will be discussed. Additionally, anti-viral responses of the innate and adaptive immune responses, concepts in immune regulation, and their application in developing vaccines and therapeutics to prevent and treat COVID-19 will be covered.

**Prerequisites:** MIC 660 [Min Grade: C]