HOST DEFENSE
COURSE OBJECTIVES

At the completion of Host Defense, you will be able to describe the immunologic strategies employed by humans to mount an effective immune response and to counter infectious challenge. You will be able to describe the cellular and molecular components of the immune system, how they function in normal and pathologic responses and then visualize how a clinician can exploit this knowledge to benefit the patient.

LEARNING OBJECTIVES

MEDICAL KNOWLEDGE

Identify the functions of the major parts (innate, adaptive and specialized) of the immune system.

Describe the components of the innate system (physical/mechanical and collaborating system of cells, cytokines, chemokines and proteins).

List the general histologic appearance and functions of the cells of the innate and adaptive systems including neutrophils, macrophages, basophils/mast cells, eosinophils, natural killer cells, dendritic cells and lymphocytes.

State the clinically relevant growth factors (e.g. G-CSF) that drive the development of cells of the innate and adaptive systems and the clinical implications of growth factor deficiencies.

Describe the general morphology and organization of primary and secondary lymphoid organs, particularly in relation to antigen transport and processing and the initiation of cellular, cytokine and antibody responses.

Identify the role of toll and other innate system receptors in the immune response and defense of the host.

Differentiate the role of cytokines in dictating different types of immune responses-including manipulations of cytokine responses and the clinical effect of cytokine abnormalities/deficiencies.

Describe the pro-inflammatory molecules IL-1, 6, 8 and TNF-alpha, the clinical effects of their excess and deficiency as observed in toxic shock and in immunodeficiency states, and their potential for pharmacologic manipulation.

Relate the general mechanism and consequences of complement system activation.

State the general characteristics of the adaptive system including concepts of its specificity, clonal expansion, memory and genes specific to the adaptive and innate systems.

Explain the diversity of MHC molecules, and how that diversity differs from immunoglobulin and T cell receptor diversity.

Identify how MHC molecules present antigens, and how antigens are processed before presentation.

Recognize the primary importance of T lymphocytes in facilitating all adaptive immune responses.
Distinguish the role of the thymus in T cell development, the recognition of self versus non-self and tolerance, together with the clinical implications of thymus absence or dysfunction, including T cell immunodeficiencies and autoimmunity.

Distinguish the various types of dendritic cells and their influence on the immune response.

Compare the role of cytokines in the four basic T cell pathways:

a. T helper response (Th1 by IL-12 and Th2 by IL-4),
b. T regulatory response by TGF beta,
c. T-17 response by IL-6 and 23, and
d. T cytotoxic response by IFN gamma.

Compare the four major subsets of T lymphocytes and their respective cytokines:

a. Th1 macrophage cytotoxicity and CD8 antigen specific cytotoxicity/IFN gamma,
b. Th2 helper functions for B cells/IL-4, 5, 6, 10,
c. CD3, 4, 25, FoxP3 regulatory functions/TGF beta and IL-10,
d. Th17 mediated chronic inflammation/IL-17.

Identify leukocytes by specific cell surface markers (CD3, 4, 8, 14, 19 and 56).

Describe the basic functions of B lymphocytes and plasma cells including the concepts of antibody diversity and somatic hypermutation.

Explain the structure and function of the mucosal immune system.

Describe the physiologic significance of communication among the immune system and the microbiota.

Recognize how the effector functions of antibodies, T cells, macrophages, neutrophils, and NK cells can eliminate pathogens or lead to pathology.

Explain how cells in both innate and acquired immunity can encounter a pathogen first at one site, and then fight an infection at distal sites.

Describe the traditional classification of hypersensitivity syndromes; Type 1 (IgE mediated), Types 2 and 4 (loss of tolerance), Type 3 (immune complex mediated).

Recognize the strategies used by tumor cells to evade destruction by the immune system, including conceptual mechanisms of inappropriate suppression of cytotoxic responses to tumors, the logic of histologic and array methods to predict clinical response and a general rationale for treatment methods for tumors based on these concepts.

Contrast the clinical implications of specific types of immune response defects-including the rationale for determining the type of treatment and expected infections for:

a. isolated B cell deficiency (e.g. X linked agammaglobulinemia),
b. isolated T cell deficiency (e.g. thymic aplasia),
c. combined B and T cell deficiency (e.g. severe combined immunodeficiency or SCID),
d. stem cell deficiencies, and
e. complement deficiencies and intracellular white cell deficiencies (e.g. chronic granulomatous
disease).

Relate the general concepts of how microbial agents can evade the immune system and certain
microbial antigens (super antigens) can excessively activate inflammatory cytokine systems.

Formulate the mechanisms by which the MHC system is activated and dictates the intensity of an
anti-allograft response.

Discuss the utilization of all aspects of the immune system in response to an allograft and the
implications of each for clinical intervention.

Recognize the importance of maternal/fetal immunology-especially mechanisms of rejection
prevention.

Discuss the general concepts of how physicians can exploit their knowledge of the immune system to
protect hosts from disease including vaccines, modification of immune effector systems (e.g.
amplification of T regulatory cells), modulation of immune effector cells and cytokine/chemokine
systems.

Describe the immunological effector mechanisms that are associated with autoimmune disease
states.

Organize the utilization of the clinical laboratory to assess immunologic functions and deficiencies
including specific immunologic tests:

- a. flow cytometry for enumeration and clonality of lymphocytes and other immune effector
cells,
- b. serum protein electrophoresis and light chain detection for quantification and clonality of
antibodies,
- c. immunofluorescence techniques for antibody detection,
- d. skin testing for in-vivo assessment of T cell function, and
- e. the logic of array analysis for detection of specific patterns of immune responses.

INTERPERSONAL AND COMMUNICATION SKILLS

Demonstrate the ability to effectively communicate and work collaboratively together with peers in the
small group setting to successfully address problems of immunological significance.

Contribute to the education of peers by actively engaging in small group sessions.

PRACTICE-BASED LEARNING AND IMPROVEMENT

Critically evaluate one’s performance in the course to identify strengths and personal limitations in
either immunological knowledge or study methods; develop learning goals to address any
deficiencies and actively seek out assistance from appropriate sources to successfully remediate any
deficiencies.
Demonstrate an ability to use online resources to objectively identify and evaluate the primary basic scientific and clinical literature relevant to Host Defense small group sessions.

PROFESSIONALISM

Demonstrate professional behavior by completing all course requirements, including course evaluations, in a timely manner.

Demonstrate professionalism by behaving in a professional, courteous and respectful manner when engaged in course activities or interacting with course faculty and staff.

Demonstrate responsibility and accountability by attending and being punctual at all required course activities.

Demonstrate professional behavior by requesting any excused absence from required course activities well ahead of the scheduled date.

Demonstrate professional behavior by responding to direct communication from the Course Director in a timely fashion, particularly in circumstances when a face-to-face meeting is requested to discuss issues related to academic performance.

Demonstrate professional and ethical behavior by honestly completing course examinations without attempting to seek an advantage by unfair means; and by reporting any unethical behavior of peers to the course administration.