



## Lahore University of Management Sciences

### BIO 519 –IMMUNOLOGY

Spring 2024

|                     |  |
|---------------------|--|
| Instructor          | Shaper Mirza   |
| Room No.            | 9-318A   |
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| Course URL (if any) |  |

| Course Basics             |    |  |        |  |
|---------------------------|----|--|--------|--|
| Credit Hours              |    |  |        |  |
| Lecture(s)                | 2  |  | 75 min |  |
| Recitation/Lab (per week) | NA |  | 0      |  |
| Tutorial (per week)       |    |  | 75 min |  |

| Course Distribution        |          |
|----------------------------|----------|
| Core                       |          |
| Elective                   | Elective |
| Open for Student Category  | Senior   |
| Close for Student Category |          |

| COURSE DESCRIPTION   |
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| <p>The Immune System is an intricate network of cells tissues and organs that works in sync to protect the organism from pathogens. Through a series of steps known as immune responses, the immune system attacks invaders and foreign substances that enter the body. The remarkable diversity of immune system allows it to detect and eliminate variety of pathogens such as viruses, bacteria, parasites and fungi. Surveillance and memory are two important functions of immune system which In addition to attacking pathogens entering the body, immune systems also keeps a record (memory) of each pathogen that infects the host, so as to handle it better the next time. The course will start with the study of cells and basic components of the two branches of immune systems namely innate and adaptive. Later half of the course will deal with more complex concept, which include initiating and sustaining the immune response. Third section will focus on the diversity of immune responses and the molecular and cellular basis of diversity. Overall the course will cover cells and tissues of the immune system, lymphocyte development, the structure and function of antigen receptors, the cell biology of antigen processing and presentation, including molecular structure and assembly of MHC molecules, the biology of cytokines, leukocyte-endothelial interactions, and the pathogenesis of immunologically mediated diseases. The course is structured as a series of lectures and tutorials in which will provide in-depth information on each topic. Classes are designed to be highly interactive where students will be encouraged to engage in discussions with fellow classmates and with the instructors.</p> |

| COURSE Anti-PREREQUISITE(S)                       |   |
|---|---|
| <ul style="list-style-type: none"><li>•</li></ul> | Basic Biology OR<br>Basic Immunology OR<br>Microbiology |

| COURSE OBJECTIVES   |  |
|---|--|
| <ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul> | <ol style="list-style-type: none"><li>1. Categorize the molecular and cellular elements of the immune system with respect to their roles in innate and acquired (specific) immunity.</li><li>2. Contrast the protective roles played by the innate and specific elements of the immune system.</li><li>3. Compare the development and activation of T and B-lymphocytes.</li><li>4. Distinguish among the four basic mechanisms that are responsible for hypersensitivity reactions.</li><li>5. Predict how defects in the immune system would lead to abnormal responses.</li></ol> |



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|--|--|
|  | 6. Assess the roles that our concepts of innate and acquired immunity play in the design of vaccines, and cite examples of the impact of vaccines on public health.<br>7. Analyze the mechanisms by which pathogens (viral, bacterial, parasitic) can evade and manipulate the host's immune response. |
|  |  |

### Learning Outcomes (SLO)

|   |  |
|---|--|
| <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul> | At the end of the course students will be able to <ol style="list-style-type: none"> <li>1. Differentiate between the two important branches of immunity (innate and adaptive)</li> <li>2. Define the individual roles of each branch of immunity in elimination of infection and the combine role of two in elimination of infection and in development of memory</li> <li>3. Appreciate the complexity of pathways that leads to development of B and T cells</li> <li>4. Integrate this knowledge into a framework by which to understand host defense to infection and microbial immune evasion strategies.</li> <li>5. Critically review the evidence and experimental approaches by which current knowledge in the field was obtained to identify important unanswered questions.</li> <li>6. Analyze mechanisms by which pathogen can evade and manipulate the host immune system.</li> </ol> |
|---|--|

### Assignment(s):

Home Work: Quiz(s): 20% (3 )

Class Participation: Attendance:

Midterm Examination: 30%

Final Examination: 50%

### Examination Detail

|              |  |
|--------------|--|
| Midterm Exam | Yes/No: <b>Yes</b><br>Combine/Separate:<br>Duration: <b>75 min</b><br>Exam Specifications: <b>Multiple choice questions and short answers</b>  |
| Final Exam   | Yes/No: <b>Yes</b><br>Combine: <b>No</b><br>Duration: <b>75 min</b><br>Exam Specifications: <b>Multiple choice questions and short answers</b> |

### COURSE OVERVIEW

| Lectures    | Topics                 | Recommended Readings | Objectives/ Application (SLO) |
|-------------|------------------------|----------------------|-------------------------------|
| <b>Lec1</b> | Introduction to Course |                      | 1                             |



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|               |  |                          |  |
|---------------|--|--------------------------|--|
| <b>Lec2</b>   | Anatomy of the immune system                     | <b>1</b>                 | 1,2  |
| <b>Lec3</b>   | Role of the MHC in the immune response           | <b>5</b>                 | 1,2  |
| <b>Lec4</b>   | Innate Immunity                                  | <b>1,2</b>               | 1,2  |
| <b>Lec5</b>   | Complement                                       | <b>2</b>                 | 2  |
| <b>Lec6</b>   | Acquired Immunity                                | <b>1,8</b>               | 2  |
| <b>Lec7</b>   | Immunogens, Antigens and Interactions            | <b>1,2</b>               | 1  |
| <b>Lec8</b>   | Antibody Structure and Function                  | <b>3</b>                 | 3,4,6  |
|               |  |                          |  |
| <b>Lec9</b>   | Genetic Basis of Antibody Structure              | <b>3</b>                 | 3,4  |
| <b>Lec10</b>  | Cytokine   | <b>Research Papers</b>   | 4,5,6  |
| <b>Lec11</b>  | Biology of B lymphocytes                         | <b>7</b>                 | <b>3</b>   |
| <b>Lec12</b>  | Biology of T lymphocytes                         | <b>7</b>                 | <b>3</b>   |
| <b>Lec13</b>  | Review session                                   |                          |  |
| <b>Lec14</b>  | <b>Mid-term</b>                                  |                          |  |
|               |  |                          |  |
| <b>Lec15</b>  | Activation and function of T and B cells         | <b>8,9,3</b>             | <b>3</b>   |
| <b>Lec16</b>  | Mucosal Immunity and Gut Microbiome              | <b>10</b>                | <b>Understand the role of mucosal immune response</b>                        |
| <b>Lec17</b>  | Hypersensitivity Reaction-1                      | <b>12</b>                | <b>Appreciate variability in host immune response</b>                        |
| <b>Lec18</b>  | Hyper sensitivity reaction - 2                   | <b>12</b>                | <b>Appreciate variability in host immune response</b>                        |
| <b>Lec19</b>  | Tolerance and Autoimmunity                       | <b>13</b>                |  |
|               |  |                          |  |
|               |  |                          |  |
| <b>Lec20</b>  | Danger Theory/ <b>Project</b>                    | <b>Handouts</b>          |  |
| <b>Lec20</b>  | Immunodeficiency Disorders                       | <b>11</b>                | <b>Understanding downstream effects of failure of immune system</b>          |
| <b>Lec21</b>  | Antibody based Immunological methods             | <b>Handout/articles</b>  | <b>Application of immune methods in clinical settings</b>                    |
| <b>Lec22</b>  | Cellular Based immunological methods             | <b>Handout/articles</b>  | <b>Application of immune methods for improving diagnosis</b>                 |
| <b>Lec23</b>  | Transplantation                                  | <b>11</b>                |  |
|               |  |                          |  |
| <b>Lec 24</b> | Immune response to infectious diseases/Bacterial | <b>Handout/articles</b>  | <b>Understanding Role of innate and adaptive immune response</b>             |
| <b>Lec25</b>  | Immune responses to infectious diseases /Viral   | <b>Handouts/articles</b> |  |
| <b>Lec26</b>  | Evolution of Immune system                       | 16                       |  |
| <b>Lec27</b>  | Vaccine development/ <b>Project submission</b>   | <b>Handouts</b>          | <b>Understand how immune response can be manipulated to treat infections</b> |
|               |  |                          |  |
|               | Review Session                                   |                          |  |
|               | <b>Final Exam</b>                                |                          |  |
|               |  |                          |  |
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|               |  |                          |  |

### Textbook(s)/Supplementary Readings

**Janeway's Immunobiology** By Kenneth Murphy Eight Edition