<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>OBJECTIVES</th>
<th>INSTRUCTOR</th>
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<tbody>
<tr>
<td>Aug 29</td>
<td>Lecture 1</td>
<td>Introduction</td>
<td>Dr. Laouar</td>
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</table>
|            |                              | • Understand course requirement  
• Meet the team  
• Process of review session and exam preparation  
• Introduction to the world of microbes and immune cells |              |
| Aug 31     | Lecture 2                    | Generation of the Immune System                                                                                                                                                                             | Dr. Laouar   |
|            |                              | • Describe components of the immune system including cells and organs  
• Introduce the concept of stem cell research  
• Properties of hematopoietic stem cell (HSC)  
• Describe the process of Hematopoiesis  
• Describe lymphoid and myeloid progenitors  
• Provide examples of diseases treated with HSC therapy |              |
| Sep 5      | Lecture 3                    | Innate defense                                                                                                                                                                                            | Dr. Laouar   |
|            |                              | • Describe the 1st line of defense:  
- Anatomic barriers  
- Physiologic barriers  
- Chemical barriers  
- Microflora barriers  
- Inflammatory barriers  
• Introduce the 2nd line of defense:  
- Properties of Macrophages  
- Properties of Granulocytes  
- Properties of Natural Killer cells  
- Properties of Dendritic cells |              |
| Sep 7      | Lecture 4                    | Mechanisms and consequence of sensing Pathogens                                                                                                                                                            | Dr. Laouar   |
|            |                              | • Explain the principal of Pathogen Associated Microbial Pattern (PAMP) recognition  
• Study of some examples of Toll-like Receptor (TLR), Nod-like Receptor  
• Introduce the concept of cytokine network  
• Define what is a cytokine and a cytokine receptor  
• Provide some examples to study the secretion, action, and roles of cytokine  
• Nomenclature of cytokines  
• Describe the principal of cytokine storm |              |
| Sep 12     | Lecture 5                    | T cells and Antigen presentation                                                                                                                                                                          | Dr. Laouar   |
|            |                              | • Explain the functions and attributes of the adaptive immune system  
• Describe properties of T lymphocytes  
- Structure of TCR  
- Structure of TCR/CD3 Complex  
- Structure of MHC Co-receptors  
- Antigen Peptide Processing  
• Explain the process of antigen presentation  
- Structure of MHC molecules  
- Antigen Peptide Processing  
- MHC class I presentation  
- MHC class II presentation  
• Overview of CD4 and CD8 T cell responses  
• Explain difference between antigens and super-antigens |              |
| Sep 14     | Lecture 6                    |                                                                                                                                                                                                            | Dr. Laouar   |
|            |                              | • Describes the steps of T cell development in the thymus including:  
<p>|</p>
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| Sep 19     | Lecture 7 | Requirement & Consequences of T cell     | - Define signal 1 and 2  
- Explain the process of T cell anergy  
- Describe elements of the immunological synapse  
- Describe the process of T cell clonal expansion  
- Describe the process of T cell memory | Dr. Laouar          |
|            |           | Activation                               |                                                                        |                     |
| Sep 21     | Lecture 8 | B cells and antibodies -I               | - Define humoral immunity  
- Describe the structure, class, and form of antibodies  
- Explain the difference between secretory and membrane-bound antibodies  
- Describe the process of VDJ recombination  
- Explain the process of B cell development  
- Explain how B cells are activated  
- Discuss the importance of Plasma B cells and memory B cells | Dr. Laouar          |
| Sep 26     | Lecture 9 | B cells and antibodies -II              | - Describe the role of Immunoglobulins  
  - Immobilization  
  - Agglutination/Precipitation  
  - Neutralization  
  - Opsonization  
- Explain the process of Ig Class switching  
- Explain how memory B cells form  
- Provide comparison between T and B cells  
- Provide comparison between antibodies and TCR | Dr. Laouar          |
| Sep 28     | Lecture 10| Vaccination & Immunotherapy             | - Describe syndromes of immunodeficiency  
- Describe disorders of autoimmunity  
- Describe disorders of autoimmunity  
  - Describe the principal of CAR Therapy  
  - Cytokine therapy (IL-15)  
  - Inhibitor of TGFb pathway  
- Describe the principal of Vaccination | Dr. Laouar          |
| Sep 29     | Pre-exam  | Optional Virtual mode                   | 6-7pm                                                                  | Dr. Laouar          |
|            | discussion|                                         |                                                                        |                     |
| Oct 2      | Exam Unit 1| Virtual mode                             | - Open book exam  
- 50 questions  
- 2 hours | Dr. Laouar          |
| OCT 3      | Lecture 1 | Introduction to Viruses                 | - Virus structure  
- Viral genomes  
- How do we study and assay viruses | Dr. Imperiale       |

End of the Immunology Module
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<thead>
<tr>
<th>OCT 5</th>
<th>Principles of Replication I</th>
<th>OCT 10</th>
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<tbody>
<tr>
<td>Lecture 2</td>
<td>Viral disease burden, Outcomes of infection</td>
<td>Lecture 3</td>
<td>Receptors, How viruses get into cells, How viruses traffic within cells, Early stages of the viral life cycle, Genome replication</td>
</tr>
<tr>
<td>OCT 12</td>
<td>Lecture 4</td>
<td>OCT 19</td>
<td>Lecture 5</td>
</tr>
<tr>
<td>Viral Pathogenesis</td>
<td>transmission, Epidemiology, Immune response, Immune evasion, How viruses cause disease</td>
<td>Influenza</td>
<td>Viral genetics, Zoonosis, Vaccines</td>
</tr>
<tr>
<td>OCT 24</td>
<td>Lecture 6</td>
<td>OCT 26</td>
<td>Lecture 7</td>
</tr>
<tr>
<td>Herpesviruses</td>
<td>Persistent infection, Latency and reactivation</td>
<td>HIV and Other STIs</td>
<td>Retroviruses, Chronic infections, Vaccine hurdles, Viral reservoirs, Antivirals and resistance</td>
</tr>
<tr>
<td>OCT 31</td>
<td>Lecture 8</td>
<td>OCT 31</td>
<td>Lecture 8</td>
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<tr>
<td>Oncogenic Viruses</td>
<td>Cellular growth control, Oncogenes, Tumor suppressor genes, Viral oncogenes, Vaccines</td>
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<tr>
<td>Nov 2</td>
<td>Emerging Viruses and SARS-CoV-2</td>
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<tr>
<td>Lecture 9</td>
<td>Insect vectors, Central nervous system viruses, Hemorrhagic viruses, COVID-19, Zoonoses, Vaccines and antivirals, Future spillovers</td>
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<td>Nov 3</td>
<td>Pre-exam discussion</td>
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<tr>
<td>Optional Virtual mode</td>
<td>6-7pm</td>
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<tr>
<td>Nov 6</td>
<td>Open book exam</td>
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<tr>
<td>Exam Unit 2</td>
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<td>End of the Virology Module</td>
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</table>
| **Nov 7** Lecture 1 | Intro to Bacteria | • Describe bacterial size, shape & aggregation patterns  
• Describe the major bacterial cell structures & their functions  
• Understand differences between Gram positive and Gram-negative bacteria and the basis for the Gram stain  
• Understand basics of bacterial genetics  
• How do bacteria cells & genetics differ from those of eukaryotic cells? | Dr. Hanna |
| **Nov 9** Lecture 2 | Antibiotics & Resistances | • Understand the underlying principles for anti-bacterial therapeutics  
• Describe the major classes of antibiotics, their cellular targets and modes of action  
• Understand the causes and consequences of current & emerging resistances to antibiotics  
• Describe the genetics and physiology of antibiotic resistance | Dr. Hanna |
| **Nov 14** Lecture 3 | Bacterial Pathogens & their Virulence Factors | • Know & apply the principles of Koch’s Postulates  
• Describe the major classes of virulence factors, with examples, & and their specific contributions to infections  
• Describe the molecular actions of bacterial toxins and their roles in pathology during infection | Dr. Hanna |
| **Nov 16** Lecture 4 | The Staphylococci | • Describe the various infections & associated pathologies of Staphylococcal infections  
• Describe the virulence mechanisms of *S. aureus* and *their specific roles in infections*  
• Describe the role of host during *S. aureus* infections | Dr. Hanna |
| **Nov 21** Lecture 5 | The Streptococci & Pneumococci | • Describe the various infections & pathologies for these major human pathogens  
• Understand and describe the roles of the major *S. pyogenes* virulence factors  
• Understand and describe the roles of the major *S. pneumoniae* virulence factors  
• Describe the roles of host during these infections | Dr. Hanna |
| **Nov 28** Lecture 6 | Corynebacterium & Listeria | • Compare and contrast these pathogens, their infections & associated pathologies  
• Describe *C. diphtheriae* specific virulence factors & mechanisms  
• Describe *L. monocytogenes* specific virulence factors & mechanisms  
Compare & contrast the various roles of the host immune responses for each infection | Dr. Hanna |
| **Nov 30** Lecture 6 | GI Infections - I | • Describe infections caused by *H. pylori*, *V. cholerae* & *C. difficile*  
• Understand specific virulence factors employed by each pathogen | Dr. Hanna |
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<tr>
<td>Dec 5</td>
<td>Lecture 8 GI Infections - II</td>
<td>• Be able to differentiate between each, and compare &amp; contrast with each other (including those from next lecture) • Describe infections caused by the <em>E. coli</em> &amp; the <em>Shigella</em> • Understand specific virulence factors employed by each pathogen • Be able to differentiate between each, and compare &amp; contrast with each other (including those from previous lecture)</td>
<td>Dr. Hanna</td>
</tr>
<tr>
<td>Dec 7</td>
<td>Lecture 9 The Mycobacteria</td>
<td>• Describe the infections caused by <em>M. tuberculosis</em> • Describe the infection caused by <em>M. leprae</em> • Describe the virulence strategies for each • Describe the role of the host for each</td>
<td>Dr. Hanna</td>
</tr>
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<td>Dec 8</td>
<td>Pre-exam discussion Optional Virtual mode</td>
<td>6-7pm</td>
<td>Dr. Hanna</td>
</tr>
<tr>
<td>Dec 11</td>
<td>Exam Unit 3 Virtual mode</td>
<td>• Open book exam • 50 questions • 2 hours</td>
<td>Dr. Hanna</td>
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<td>End of the Bacteriology Module</td>
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<td>Dec 17</td>
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<td>END of COURSE</td>
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