Mechanisms of Microbial Pathogenesis

COURSE DESCRIPTION
This course will be an introduction to molecular and cellular basis of microbial disease and the host response. Students will be given a comprehensive overview of representative model microbial systems to illustrate the mechanisms of disease pathogenesis and the influence of environment (i.e. host or ambient). Research papers on mechanisms of pathogenesis and host immune response will be discussed to provide awareness of scientific approaches used to investigate these processes.

LEARNING OBJECTIVES
Upon completion of this course the student should be able to:

1. Utilize specialized language relevant to pathogenic microbiology
2. Compare and contrast different microbial diseases, based on specific pathogenic properties utilized by microorganisms
3. Identify the roles of ecology and evolution in the spread of infectious diseases
4. Identify the roles that the host plays within an infectious disease. (i.e. innate and acquired immunity)
5. Describe microbial strategies to evade the immune response
6. Describe strategies microorganisms use to attach, invade and multiply in a host.
7. Understand the toxins and enzymes produced which contribute to pathogenesis
8. Critically analyze current literature relating to pathogenic microbiology.
9. Evaluate case studies describing specific host-pathogen interactions.
10. Critically evaluate current strategies in impeding microbial pathogenesis
Major Course Requirements

Tentative Lecture Topics

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Topic</th>
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<tr>
<td>1-2</td>
<td>Introduction &amp; Immunology Overview</td>
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<td>Microbiology Overview &amp; Mechanisms Overview</td>
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<td><strong>Bacterial: Entry and Establishment in Host</strong></td>
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<td>4</td>
<td>Identifying Portals &amp; Strength in Numbers</td>
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<td>Adherence</td>
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<td><strong>Bacterial: Evasion of Host Defenses</strong></td>
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<td>6</td>
<td>Capsule</td>
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<td>7</td>
<td>Cell Wall Components</td>
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<td>8</td>
<td>Enzymes</td>
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<td>9</td>
<td>Antigenic Variation</td>
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<td>10</td>
<td>Penetration into host cytoskeleton</td>
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<td><strong>Bacterial: Damage to Host</strong></td>
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<td>11</td>
<td>Host cell lysis and nutrient trapping</td>
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<td>12</td>
<td>Toxin Production</td>
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<td>13</td>
<td>Plasmids and Lysogeny</td>
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<td>Viral Mechanisms</td>
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<td>15</td>
<td>Eukaryotic Pathogen Mechanisms</td>
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<td></td>
<td>Pathogenic Microbe Project Oral Presentations</td>
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<td>Final Report</td>
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Tentative Evaluation: Your final grade will be based on the percentage you earn out of the total possible points. Individual extra credit is not possible, but bonus points may be built into exams or other assignments. Statistical manipulations, if used (at the Instructor’s discretion), will be performed only once, at the end of the semester. A 10-point grading scale will be used:

\[
\begin{align*}
A & = 90 - 100 \% \\
B & = 80 - 89.9 \% \\
C & = 70 - 79.9 \% \\
D & = 60 - 69.9 \% \\
F & = 0 - 59.9 \% 
\end{align*}
\]

Components of Course Grade (Tentative)

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tr>
<td>Attendance</td>
<td>50</td>
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<tr>
<td>In Class Discussion</td>
<td>100</td>
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<tr>
<td>Pathogenic Microbe Project</td>
<td>150</td>
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<tr>
<td>Reading Report</td>
<td>100</td>
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<tr>
<td>Quizzes/Homeworks/Other Assignments</td>
<td>as assigned</td>
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<tr>
<td>Final Exam: Individual Report</td>
<td>200</td>
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<td>------------------------------------------------</td>
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<td>TENTATIVE TOTAL</td>
<td>600</td>
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The time schedule may require adjustment. Should this be the case, the assignments and weighting may change. Additional assignments may or may not be provided at the Instructor’s discretion and depending upon opportunities. Such assignments might include seminar attendance, homeworks, group projects, reading assignments, quizzes, etc.
An assignment will likely be due during the last week of class.

Every attempt will be made to follow the time and evaluation schedules shown here. It is the student’s duty to attend each class session and be aware of all assignments, deadlines, changes, etc.

Student Led Discussion of Topics and Journals: Students will be expected to lead the discussion on primary journals and reviewed topics.

Quizzes may be given at any time in class. There will be no makeups. Homeworks and other assignments may be given in class. The other assignments may include seminar attendance, data interpretation, experimental design, calculations, opinion papers, research article summaries, etc. They will generally be due at the start of lecture class the following week. You are encouraged to get together and work on them as a group. However, unless specified otherwise, the assignments must be turned in individually and be written in your own words, NOT COPIED. An assignment grade of ZERO will be given if the work is not in your own words.

Final: Students will be required to write an independent report describing four mechanisms of pathogenesis by including examples of microorganism that utilize that mechanism.

Attendance to class is required. Each student will be given a 2-absence grace allowance before losing attendance points.

RECOMMENDED TEXT

REQUIRED READINGS
Much of the lecture will be derived from assigned published manuscripts and the recommended text. Each of the papers that you will need for this class will be available for you to print from Blackboard. Be sure that you print the needed paper(s) and read them prior to the lecture for which it was assigned. You must bring a copy of these papers to class. Quizzes/Homework/Assignments will be derived from these papers and the lecture material. Recommended text will help you in understanding the concepts that will be highlighted

PATHOGENIC MICROBE PROJECT
(Work will be graded by your group partners, your class peers, and by me)
1. Each of you will be assigned to a group of three or four. This group will be assigned a pathogen listed in the syllabus schedule below. As a group you are responsible for identifying a recent (last 4 years) review on the pathogenesis of the assigned microorganism. This should be emailed to me before class by July 10th.
2. Each student in the group should provide a complete (1 page) description of their assigned organism. This should include identifying characteristics, such as gram reaction, specific nutritional requirements, shape, etc., as well as a picture of the organism. I strongly suggest you utilize Bergey’s Manual (There is a copy in the library). This should be emailed to me before class by July 14th.
3. The group must then find a recent (2 years) primary research article on this particular organism and submit the abstract to me for verification. Once you have the okay, complete a reading report on a recent primary journal that will be used as one of your references.

4. Finally, each group will develop a PowerPoint presentation in IMRaD format. The presentation should include background information collected in step 2 and the information gathered for step 3.

**READING REPORTS**

**Part 1**

1. Provide the title, author(s), date and source of each reading.
2. Indicate the senior author's affiliation (e.g. Department of Microbiology and Molecular Genetics, Michigan State University).
3. Observation that led to research (look in abstract and introduction)
   a. Describe 2–3 observations.
4. Question (try rewording the title)
   a. Identify the model organism/system.
   b. State why the model is an appropriate choice.
   c. State why the question is important (what did the authors hope to learn about the field?).
5. Hypotheses (usually not stated but implied in abstract or introduction; look for phrases like “this research shows…”)
   a. Explain why these hypotheses make sense based on current knowledge (introduction).
6. Experiment (look at the figures to determine what they did)
   a. Choose 2–3 key figures that directly address the hypotheses.
   b. Restate the model organism/system (figure legend).
   c. Describe general experimental design; what was measured/compared and how?
   d. Describe the methods and controls (draw a flow diagram on the board when presenting).
   e. Explain why the choice of controls was appropriate.

**Part 2.**

7. Results (look at the figures first)
   a. Explain figures clearly; restate what is being compared to what for each one.
   b. Look for trends; e.g., What is increased over what?
   c. Identify the controls and how they validate the trends.
   d. Look for statistical analyses (figure legend or results) that validate the data.
8. Conclusion (based on the data, not on the discussion)
   a. Does the data support the hypotheses?
   b. Are there other possible explanations for the data?
   c. Is the data convincing (stats)?
   d. How could the experiment be improved?
   e. Why is the data interesting; how does it contribute to our understanding of the field?

**Preferred methods of scholarly citations** (Format from Microbiology journal)

CLASS POLICIES
Attendance: Students are expected to attend every scheduled class and laboratory meeting. It is the responsibility of the student to obtain any material missed during an absence from his/her classmates. Power Points are not placed in the library, and only Power Points from certain sections will be placed on Blackboard™ 9.1, or on a website. For labs, the instructor (TA) should be notified PRIOR to lab if the student will be absent (except in emergency situations). Students must attend the laboratory section for which they originally registered. “Make-up” by attending other lab sections is NOT permitted except in emergencies, only with prior approval.

Professional Courtesy: DO NOT USE CAMERA PHONES IN LECTURE OR LAB. DO NOT SEND TEXT MESSAGES DURING CLASS. Please turn off all cell phones, beepers, Bluetooth devices, Palm Pilots, Black Berries, etc., before entering the classroom or laboratory, or at least place them on silent mode. I would prefer that earpieces not be worn in lecture or laboratory. DO NOT TAKE PHOTOS of Power Point slides or videos with your cell phone camera unless otherwise instructed. Recording of lectures with tape recorders can only be done with permission of instructor.

COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin,
religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

**Deadline for Dropping a Course with a Grade of W (University)**
The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation **WILL NOT** automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that **must** submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.

**Grade Appeals (College of Science and Engineering)**
As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

**Disability Services**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

[http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

**Statement of Academic Continuity**
In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of
the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

OTHER INFORMATION

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.