ILLINOIS MATHEMATICS AND SCIENCE ACADEMY

igniting and nurturing creative, ethical scientific minds that advance the human condition

Course Title

Microbes and Disease

Course Description:

This is a one-semester integrated course that explores topics related to microbes and the relationship between infection and human physiology. Topics include the germ theory, microbial structure and function, invasiveness and pathogenicity, the human immune system, epidemiology, and emerging infectious diseases. The course ends with students conducting case studies in infectious disease. Microbial life will be studied in the laboratory setting by using non-pathogenic microbes so that students attain the appropriate laboratory skills.

Instructor(s):

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Office hours Monday through Friday 12pm-1:30pm

Meeting Days, Time and Room(s)

A/C 1-2

Text(s) / Materials:

There are no textbooks used for this course. Various and assorted reading will be provided to concur with topics. Students will be instructed to use internet sources as appropriate for individual topics.

Essential Content:

This course will have three major content foci. The first will address bacterial structure and growth parameters. Included in this focus is an in-depth treatment of central metabolic pathways. The second focus examines a sampling of genetic systems that different organisms employ as virulence factors. Both bacterial and viral systems will be discussed. The third focus highlights the human immune response to infections.

Concurrent with and complementing the course discussions, laboratory activities will be used to help novices gain skills and confidence in the lab setting. Students will learn how to work with bacterial cultures safely as well as identify bacterial by their metabolic capacity.

In addition to the above course work, students will engage in individual and group research activities. Students, through practice and instruction will improve their communication through writing.

SSLs and Science Standards:

The Microbes and Disease course represents an integration of a variety of topics in Biology and an extension of many concepts from Scientific Inquiries – Biology or Advanced Biological Systems. This course focuses on the often messy and ambiguous subject of infectious disease. Understanding of information and processes, as described

in IMSA Science Standards E1 through E3 and F2 through F4 (see below) will support and extend student learning.

> **E. Students studying science at IMSA demonstrate understanding of cellular structure and function by:**
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> E.1 explaining how organelles perform essential functions in the cell.
> E.2 explaining metabolic processes.
> E.3 describing cellular reproduction.
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> **F. Students studying science at IMSA demonstrate understanding of the explanatory power of evolution and its genetic basis by:**
>
> F.2 understanding the evidence of evolution.
> F.3 examining patterns by which traits are passed on through generations.
> F.4 exploring the molecular basis of heredity.

A major theme in this course is to have students work with course knowledge gained in the context of infectious disease. In this way, students will employ creative applications of their knowledge and develop critical and scientific habits in thinking about novel situations. This will be accomplished primarily through the writing of a research paper. Standards of Significant Learning most appropriately meaningful to this work are:

I. **Developing the Tools of Thought**

B. Construct questions which further understanding, forge connections, and deepen meaning.
D. Evaluate the soundness and relevance of information and reasoning.

II. **Thinking About Thinking**

A. Identify unexamined cultural, historical, and personal assumptions and misconceptions that impede and skew inquiry.
B. Find and analyze ambiguities inherent within any set of textual, social, physical, or theoretical circumstances.

III. **Extending and Integrating Thought**

B. Recognize, pursue, and explain substantive connections within and among areas of knowledge.

IV. **Expressing and Evaluating Constructs**

A. Construct and support judgments based on evidence.
B. Write and speak with power, economy, and elegance.
C. Identify and characterize the composing elements of dynamic and organic wholes, structures, and systems.

This course is designed to have a significant laboratory component, and it will support student growth in the science and inquiry skills as defined IMSA Science Standards, A1 through A9 (written as refinements of pertinent SSLs).

A. Students studying science at IMSA engage in the process of scientific inquiry by:
A.1 applying the skills of observation (describe, compare, and contrast characteristics; identify parameters, precisely observe phenomena).
A.2 designing and planning investigations and constructing questions which further understanding, forge connections, and deepen meaning.
A.3 carrying out investigations that develop skills, concepts, and processes that support and enable complex thought.
A.4 using appropriate technologies to collect, analyze and present information.
A.5 accurately recording findings.
A.6 analyzing data to find ambiguities inherent within any set of textual, social, physical, or theoretical circumstances.
A.7 employing scientific reasoning to evaluate the soundness and relevance of information.
A.8 constructing and supporting judgments based on evidence.
A.9 sharing results by communicating orally, in writing, and through display with power, economy, and elegance.

Instructional Design and Approach:
Instructional design will change as is appropriate for daily topics. Instructor lectures, student presentations, small and large group discussions, and problem solving will all be employed where deemed most effective. As the material explored in this course is visual in nature, a heavy reliance on tablet use is expected.

The early laboratory activities are designed to provide skills improvement and will be guided. Skills will be applied to open-ended projects toward the end of the semester.

Application of course learning to actual infectious diseases will be gained through a presentation on a single disease and agent that causes that disease at the end of the semester.

Student Expectations:
Students encounter the material and concepts of this course through selected readings or from problem-centered activities created by the instructor. These activities require students to construct understanding as they strive to answer focusing questions. Class discussions are integral to answer these questions. The teacher guides students to forge the solutions to problems through debate and discussion. Students play an important part in disseminating information to other students informally in discussions and through formal presentations. In conducting laboratory experiments, students will enter the lab with an understanding the important topics as well as the laboratory procedures. These include safe handling of bacteria and sterile technique.

The students will 1) complete all assigned readings, 2) participate in each class discussion session by asking or answering questions or sharing relevant comments, 3) submit written reports for selected activities or experiments, 4) complete all assigned work within specified deadlines, 5) follow all safety procedures and guidelines, and 6) arrive to class on time prepared for each day's activities.

1) Late work:

With prior approval, students may submit work late with a penalty of 10% each day the assignment is late up to 3 calendar days maximum. Once any assignments are returned to students with grades/comments, this late work will not be accepted. Once the deadline has passed, a zero will be assigned.

Computer problems of any kind (including document corruption, hard drive failure, problems with uploading to classroom) will not be treated as acceptable excuses for submitting late work. This being the case, it would be wise to make a backup copy of any computer work that you do for this course, and we suggest ensuring that you've received return receipts in your email from Turnitin. However, if you are having problems getting your work in, it is recommended that you talk with your teacher.

2) Attendance and Missed work:

See the IMSA handbook for official attendance policy. If you have a counselor excused absence, or an unexcused absence, you will not be able to make up the missed work. This includes earning a zero on any tests or quizzes given during the missed period.

If you have an excused absence, be sure to contact your teacher to find out what you will miss. If that is not possible, you should see your teacher as soon as possible to discuss your absence. It is **your responsibility** to follow up on what you missed in class.

3) Plagiarism:

Plagiarism is unacceptable and will be dealt with as per IMSA policy on academic dishonesty. Plagiarism includes, but is not limited to, knowingly using another person's work – whether it is from a student or professional source – as your own, improper citations and bibliographic information, improper use of secondary sources, or any other behavior that is deemed dishonest.

Assessment Practices, Procedures, and Processes:

Each student's performance and learning in this course will be measured by assessing the following: 1) the extent to which students contributed to class discussions; 2) the quality of written assignments; 3) the scores on exams and quizzes; and 4) the quality of formal presentations. Assessed assignments will focus on gauging student learning with respect to both content standards and the IMSA Standards for Significant Learning (SSLs).

Assessments may include quizzes, tests, presentations, projects, writing assignments, and homework. We will also be gauging student progress with respect to both learning skills and mindset, as highlighted in the Standards of Significant Learning.

Tests are used to examine factual knowledge and problem solving. Also, students will be asked to apply knowledge gained in class to address novel situations (approximately 40% of any individual test grade). We call this ability 'transfer' and tests generally prompt a developing skill over the course of time.

Written reports are used to examine both communication and critical thinking skills in students. Students will be asked to forge connections between the lab activities or literature research and a broader context in the field of Biology. This sort of work mimics science practice and expands student thinking in science.

Projects and Presentation: This category of student work examines model building and critical thought. This complements reports as students must draw upon various activities and knowledge to construct holistic models that represent their understanding.

Various categories of work are not weighted to calculate the student grades in this course. Instead, a running total of all work is maintained to reflect on student grades. An approximate contribution percentage of categories of assessment toward the final grade is:

- Formative assessment: projects, reports, presentations: 25%
- Summative assessments: tests and major projects: 75%

Grading generally follows the scale:

90% and above = A
80-89% = B
70-79% = C
Below 70% = D

Major assessments will be graded and returned to students for review as soon as possible. This will usually be seven to ten days for tests, major projects and reports. Formative work that demands quick turnaround time to support continued student progress will be given priority in grading.

We expect that students will be capable of the levels of assessment commonly used in the Biology program. Students who are at risk of failing (<73%) will be required to meet with one of the ABS teachers until such time that the grade issue is resolved. If a student has a failing grade at the end of the first semester, they will be permitted to complete the entire year-long sequence. The recorded grade will be a running total of the entire year.

Members of the Biology team will not entertain any request for a grade change at the end of a grading period. If any grading questions arise per assignment, please approach your teacher soon after receiving the assignment grade.

Topic and major assessment calendar (approx.)

Topics	Dates
Bacterial cell structures test	February 5
Lab skills practical test	February 9
Bacterial metabolism and genetics, antibiotic actions	March 7
Bacterial identification lab	March 9
Pathogenesis test	April 1
Immunology test	May 5
Infection and immunity; follow one disease (20x20)	May 15