STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

BIOL 315 Introduction to Immunology

CIP Code: 26.0507

Created by: Kristine D. Potter (Dec. 2024)
Updated by:

School of Science Health and Criminal Justice
Science Department
Fall 2025

A. TITLE: Introduction to Immunology

B. COURSE NUMBER: BIOL 315

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

 # Credit Hours: 3
 # Lecture Hours _3__ per Week
 # Lab Hours ___ Week
Other ___ per Week

Course Length (# of Weeks): 15

D. WRITING INTENSIVE COURSE: No

E. GER CATEGORY: 5, Natural Sciences and Scientific Reasoning (GENS)
Does course satisfy more than one GER category? No
If so, which one?

F. SEMESTER(S) OFFERED: Fall and Spring

G. COURSE DESCRIPTION:
This course will investigate basic concepts of immunology including innate and adaptive immunity, antigens, immunoglobulins, the major histocompatibility complex, cytokines, complement system, vaccines, and immune dysfunction. The course will culminate in a literature review on a current topic in immunology research.

H. PRE-REQUISITES: BIOL 150 College Biology I or BIOL 209 Microbiology or BIOL 217 Human Anatomy & Physiology I or VSCT 210 Veterinary Microbiology or permission of instructor.

CO-REQUISITES: No

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	***PSLO***	***GER***	***ISLO***
a. Students will differentiate between innate and adaptive immunity and humoral and cellular immunity.	1.		2. Critical thinking [CA] 5. Industry, Professional, Discipline-Specific Knowledge and Skills
b. Students will be able to define immunology vocabulary and concepts.			5. Industry, Professional, Discipline-Specific Knowledge and Skills

c. Students will demonstrate an understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of data analysis or mathematical modeling; and application of scientific data, concepts, and models in one of the natural sciences.		GER 5	5. Industry, Professional, Discipline-Specific Knowledge and Skills
d. Explain the methods used in various vaccination procedures and their importance for public health as well as the ongoing research involved in creating new vaccines.			5. Industry, Professional, Discipline-Specific Knowledge and Skills
e. Learn historical research that resulted in our current understanding of the function of the different parts of the immune system.			5. Industry, Professional, Discipline-Specific Knowledge and Skills
f. Demonstrate understanding of dysfunction and the resulting diseases that the dysfunction causes.			5. Industry, Professional, Discipline-Specific Knowledge and Skills

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

J. APPLIED LEARNING COMPONENT: **Yes_____ No___x____**

If Yes, select one or more of the following categories:

Classroom/Lab___
Internship___
Clinical Practicum___
Practicum___
Service Learning___
Community Service___
Civic Engagement___
Creative Works/Senior Project___
Research___
Entrepreneurship___
(program, class, project)

K. TEXTS:

Davis, Daniel M., (2018) The Beautiful Cure, The Revolution in Immunology and What it Means for Your Health.

Kaur, H., Toteja, R., Makhija, S., (2021) Textbook of Immunology.

L. REFERENCES:

The Journal of Immunology, https://journals.aai.org/jimmunol
International Journal of Immunology, https://www.sciencepublishinggroup.com/journal/115/home

M. EQUIPMENT: Students will need a computer and internet access.

N. GRADING METHOD: A-F

A = 90 – 100%
B+ = 85 – 89%
B = 80 – 84%
C+ = 75 – 79%
C = 70 – 74%
D+ = 65 – 69%
D = 60 – 64%
F = 59% and below

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Summative quizzes
Participation (discussion boards)
Written unit exams
Mid-term written exam
Final exam essay

P. DETAILED COURSE OUTLINE:

I. Overview of the Immune System
   A. Historical Perspective of Immunology
   B. Early Theories of Immunity
   C. Clonal Selection Theory: The Modern Concept
   D. Cardinal Features of Vertebrate Immune System
   E. Hematopoiesis
   F. Cells and Organs of the Immune System
II. Innate and Adaptive Immunity

A. Innate Immunity
B. Adaptive Immunity
C. Herd Immunity
D. Local Immunity
E. Immunological Tolerance

III. Antigens
A. Antigens and Immunogens
B. Antigenicity and Immunogenicity
C. Antigen Determination of Epitopes
D. Haptens, Adjuvants, Pattern Recognition Receptors, and Superantigens

IV. Immunoglobulins
A. Historical experimentation to determine structure
B. Structure and function of Immunoglobulin classes and subclasses
C. Antigen-Antibody Interactions
D. Polyclonal and Monoclonal Antibodies

V. Major Histocompatibility Complex
A. MHC Gene Location and Function
B. Organization of the Human HLA Complex
C. Antigen Presenting Cells and Presentation of Antigen

VI. Cytokines
A. Cytokine Families
B. Classification of Cytokines
C. Function and Mode of Action
D. Cytokine Receptors
E. Cytokine Diseases and Therapeutic Agents

VII. Complement System
A. Components of the System
B. Pathways of Activation
C. Biological Consequences

VIII. Vaccines
A. History of Vaccine Development
B. Principals of Vaccination
C. Types of Vaccines
D. Vaccines for Cancer
E. Vaccine Administration Routes
F. Challenges and Risks

IX. Immune Dysfunction
A. Hypersensitivity
B. Autoimmunity
C. Immunodeficiency

Q. LABORATORY OUTLINE: N/A

GER 5 Natural Sciences

Outcomes to be Assessed

Students will demonstrate:

1. an understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of data analysis or mathematical modeling; and

2. application of scientific data, concepts, and models in one of the natural sciences.

Method:

Assessment of Outcome #1 will be accomplished using a course-embedded 10-question instrument to be written by the instructors and submitted for initial approval to the GER 5 coordinator for review by the GER subcommittee of the Academic Assessment Committee.

Assessment of Outcome #2 will be course-embedded and will be based on either exam questions or laboratory assignments written by the instructor which require students to apply scientific data, concepts and models in one of the natural sciences. Thus, we consider an individual student's grade on a comprehensive final exam to be an accurate measure of the achievement of outcome #2.

The Office of Institutional Effectiveness selects a random 50% sample of GER 5 designated courses to undergo assessment for the fall semester during which GER 5 is up for review (once every three years). Faculty are notified of their course selection during the previous spring semester to allow time for planning assessment activities.

Instructors are responsible for entering their measures into Taskstream by the 4th week of fall semester and entering the findings for these measures into Taskstream by the end of the week following final grade submission. **In addition, instructors must supply at least 3 student artifacts (1 from each level of proficiency: exceeded, met, not met) as samples and attach them in Taskstream. Three artifacts must be provided for both objectives.**

Instructors are responsible for submitting the Data Collection Report (below) to the GER 5 coordinator by the end of the week following final grade submission.

Once all assessment is completed by the GER 5 Coordinator, they must prepare a summary of the results to be given to the General Education Assessment Committee Chair who will forward them to the GER committee for review.

<table>
<tr><th>Learning Objectives:</th><th>Assessment tools:</th><th colspan="6">Results/Findings:</th><th>Reflection/Use of Findings:</th></tr>
<tr><td>Below are the two objectives for GER 5: Natural Sciences. Faculty members are expected to record student proficiency in all areas</td><td>This list represents a variety of tools commonly used to assess this SLO. Please select the tool(s) you will be using for the GER assessment. Please highlight the tool(s) you are using, and add a brief description of the tool used (e.g., final exam essay #2) in the space to the right.</td><td colspan="6">Record the number and percentage of students achieving at the different levels for <u>each objective</u> (not each measure.) Percentages will be based on the number of students who participated in the assessment only (e.g., if your course has 10 students enroll, but only 8 take the assessment, those 8 represent the denominator.)</td><td>Based on these results, briefly address what changes you plan for improving student learning.</td></tr>
<tr><td rowspan="2">Students will demonstrate:</td><td rowspan="2"># of students participating in assessment:</td><td colspan="2">Exceeded</td><td colspan="2">Met</td><td colspan="2">Did not meet</td><td rowspan="2"><u>Please include planned changes to curriculum, teaching and assessment methods, and/or support services</u></td></tr>
<tr><td>N</td><td>%</td><td>N</td><td>%</td><td>N</td><td>%</td></tr>
<tr><td rowspan="9">1. An understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.</td><td>Assignment</td><td colspan="6" rowspan="9">Description of tool(s): Quiz will be used at the end of the course to reflect on the scientific method.</td><td rowspan="9"></td></tr>
<tr><td>Exam question(s)</td></tr>
<tr><td>Oral presentation</td></tr>
<tr><td>Project (group or individual)</td></tr>
<tr><td>Quiz</td></tr>
<tr><td>Research paper</td></tr>
<tr><td>Student Artifact</td></tr>
<tr><td>Student Portfolio</td></tr>
<tr><td>Other (Please specify):</td></tr>
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<tr><td rowspan="8">2. application of scientific data, concepts, and models in one of the natural sciences</td><td>Assignment</td><td colspan="6" rowspan="8">Description of tool(s): 50 multiple choice questions covering the entire semester timed at 60 minutes.</td><td rowspan="8"></td></tr>
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<tr><td>N</td><td>%</td><td>N</td><td>%</td><td>N</td><td>%</td></tr>
<tr><td>Student portfolio</td><td colspan="6" rowspan="2"></td></tr>
<tr><td></td><td>Other (Please specify):</td></tr>
</table>

GER Assessment Policies

Faculty and students will periodically be required to engage in assessment activities to ensure that the General Education learning outcomes are being met.

- GER student learning outcomes are assessed on a three year cycle through the courses designated as meeting that GER.
- Any instructor (full-time or adjunct) teaching any course with a GER designator (online or face-to-face) may be called to participate in GER assessment activities.
- A random sample of GER designated courses are selected by the Office of Institutional Effectiveness during the spring semester preceding the GER assessment year. If a faculty member is teaching two of the same course they have the option of choosing either section for assessment.

- **Timeline for GER Assessment:**
  - February (**Spring Semester**): Office of Institutional Effectiveness (OIE) notifies GER assessment coordinator of upcoming assessment and calls for methodology revisions (if any)
  - March 1: Methodology changes for upcoming assessment cycle must be submitted to GER Assessment Subgroup
  - Mid-April: OIE selects courses up for GER review the following fall and notifies faculty
  - 2nd week of classes (**Fall Semester**): OIE reminds faculty (and notifies new faculty) of GER assessment requirements
  - End of 4th week of classes: Faculty must enter their assessment measures of GER course SLOs into Task Stream.

- End of 5th week of classes: Faculty update GER coordinator on progress with measure entry in Task Stream.
- 1 week after final grade submission: Faculty must enter findings to Taskstream measures and submit Data Collection Reports to GER coordinator along with student artifacts.
- Friday before the first week of classes (**Spring Semester**): faculty will meet to discuss GER findings and strategic plan for improving student learning.
- March 1: GER Summary Report and GER Campus Report due to GER Assessment Subcommittee for review and recommendations.
- March 15: GER Assessment Subcommittee presents reports and recommendations to Academic Assessment Committee
- April 1: Academic Assessment Committee presents reports to Deans' Cabinet for inclusion in budget (if applicable.)

- **Protocol for creating a new course for GER approval:**
  - For a course to be accepted as a GER course, the GER assessment methodology must be attached to the course proposal as it moves forward to curriculum committee. GER mapping to course SLOs must be present in course proposal.
  - Course SLO's need to include the GER SLO's.

- **Protocol for Methodology Revision**
  - Faculty who wish to revise their GER methodology must submit proposed methodology to the GER committee by the fifth week of the semester before their assessment cycle begins.
  - The GER committee will review and provide feedback for revision, and if necessary request a meeting with the GER coordinator. They will provide feedback within six weeks.
  - Resubmission of the revised methodology must occur by the last day of the semester prior to the assessment cycle the methodology will be used in.
  - If the methodology does not comply with the needs of the campus and SUNY standards, the previous methodology will be employed for the assessment cycle.

General Education Requirement- Natural Sciences Scientific Method Evaluation

Science is a way of knowing. It seeks objective evidence that explains how nature works. Although there is no one single way in which all scientific inquiry is structured, all scientific investigation relies on a critical attitude about being shown rather than told, and taking a logical approach to problem solving. Much of scientific inquiry shares some common elements and procedures, which are referred to as the scientific method.

One of the goals of the General Education natural science component is an understanding of the methods scientists use to explore natural phenomena. Please answer the following questions based on your understanding of these methods.

Questions 1 – 7 are based on the following scenario:

Acid precipitation (rain, snow, fog) has an especially high concentration of hydrogen ions. In other words, it is acidic. Resulting mainly from the burning of fossil fuels (coal, oil, and gas), acid precipitation is a major environmental problem because it can kill aquatic organisms, destroy forests, and damage buildings.

Imagine that you are traveling through the mountains of the eastern U.S. You notice large areas of forest that are dead or dying. After obtaining some background information, you decide to do a research project on acid precipitation. In order to proceed with your project, you need to focus on a particular question.

1) Which of these questions most logically follows from your observations?
    a) Can the amount of acid precipitation be reduced by government regulations or energy conservation?
    b) Is it possible to reverse the effects of acid precipitation in the forests you visited?
    c) Has acid precipitation caused the destruction of forests in some areas of the eastern U.S.?
    d) Does acid precipitation have a negative impact on fishes and other aquatic life?

2) On a map showing the average acidity of precipitation in areas across the U.S., you mark sites with dying forests with red dots, and mark sites with healthy forests with blue dots. How can you best use this map (before you test a specific hypothesis) to obtain additional evidence that acid precipitation may have caused the forest destruction you observed?
    a) Check the map to determine if the sites with dying forests are in areas that receive acid precipitation.
    b) Search the map for areas of highest acidity. You should find some of the sites with dying forests in these areas.
    c) Compare the acidity of precipitation in areas where the forests were dying to the acidity of precipitation in areas where the forests were healthy.
    d) Check the map to determine if the sites with healthy forests are all in areas that do not receive acid precipitation.

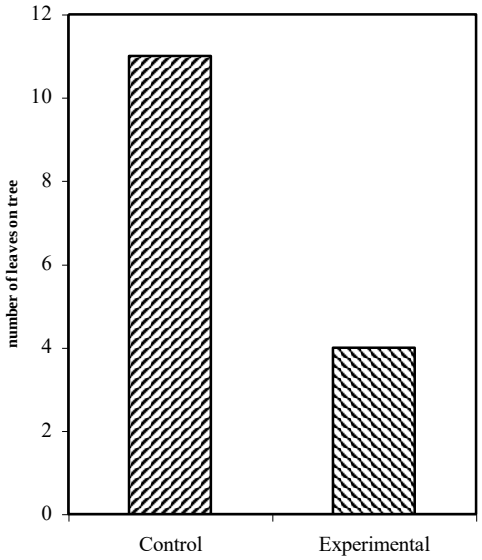
It is difficult to test directly a hypothesis that proposes an explanation for such a large-scale phenomenon as acid precipitation. Therefore, you decide to test one aspect relating to the large-scale hypothesis to support or disprove the hypothesis. You decide to test the following hypothesis: *Acid precipitation directly damages the leaves of young trees*.

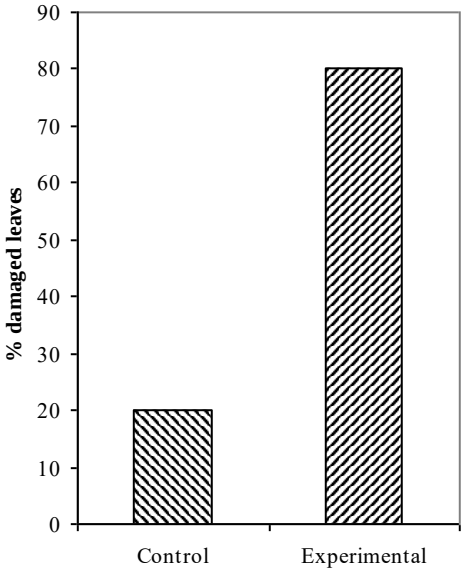
3) You notice that red oaks seem to be most affected. Which of the following is a reasonable prediction based on your hypothesis?
   a) *If the leaves of young oak trees are damaged by acid precipitation*, *then* young trees of other species (such as red maple) will also show such damage when exposed to acid precipitation.
   b) *If the leaves of young oak trees are damaged by acid precipitation, then* young oaks treated with acidic water (simulating acid precipitation) will show more leaf damage than those treated with water simulating normal precipitation.
   c) *If the leaves of young oak trees are damaged by acid precipitation, then* young oaks treated with acidic water (simulating acid precipitation) will grow more slowly than those treated with water simulating normal precipitation.
   d) *If the leaves of young oak trees are damaged by acid precipitation, then* mature oak trees treated with acidic water (simulating acid precipitation)will show more leaf damage than mature oak trees treated with water simulating normal precipitation.

You set up an experiment to test your hypothesis. You place 100 one-year-old red oaks in one-gallon pots, with equal amounts of soil in each. Once a month for a year, you will count the total number of leaves and then determine the percentage of damaged leaves found on each tree.

4) Which experimental design would be most appropriate to test the hypothesis that acid precipitation damages the leaves of young red oak trees?
   a) You water each tree daily with 100 ml of water, giving all 100 trees highly acidic water.
   b) You water each tree daily with 100 ml of water, giving 50 trees highly acidic water, and 50 trees water with neutral (not acidic) water.
   c) You water each tree daily with 100 ml of water, giving 50 trees highly acidic water, and 50 trees slightly acidic water.
   d) You water 50 trees daily with 100 ml of highly acidic water, and you water 50 trees once a week with 100 ml of water with neutral (not acidic) water.

You proceed with your experiment and collect data. These graphs summarize your data.





5) What can you conclude from these results?
   a) The simulated acidic precipitation had no effect.
   b) The simulated acid precipitation had a negative effect on the oak trees.
   c) The simulated acid precipitation had a positive effect on the oak trees.
   d) You probably cannot draw a valid conclusion from the results.

6) How can you determine beyond a reasonable doubt that your results were significant (actually caused by effects of simulated acid precipitation, and didn't just happen by chance?
   a) Analyze your data with an appropriate statistical/mathematical test.
   b) You don't have to, a difference that large couldn't happen by chance.
   c) Change the experimental procedure and get new data that agrees with this data.
   d) Repeat the experiment with half as many trees.

7) Based on your results, what can you say about the large-scale hypothesis that acid precipitation is causing the destruction of large areas of forest in the eastern U.S.?
   a) Your experiment most likely has no bearing on the role of acid precipitation in the destruction of forests.
   b) Your experiment proves the hypothesis that acid precipitation is causing the destruction of forests.
   c) Your experiment falsifies the hypothesis that acid precipitation is causing the destruction of forests.
   d) Your experiment supports the hypothesis that acid precipitation is causing the destruction of forests.

<u>For each of the following questions, choose the best answer from the choices provided</u>.

8) The most common form of the scientific method involves proposing and testing hypotheses. A hypothesis:

a) is an "educated guess" proposed as a tentative explanation for a specific phenomenon.
b) is an explanatory idea that is broad in scope and supported by a large body of evidence.
c) is a widely accepted idea about a phenomenon.
d) is a statement about what you already know to be true.

9) Which of the following represents a typical sequence of events in scientific investigation?

1. hypothesis/prediction
2. interpretation
3. observation leading to a question
4. conclusion
5. experimentation / data collection

a) 3 – 1 – 5 – 2 – 4
b) 1 – 5 – 3 – 2 – 4
c) 3 – 1 – 2 – 5 – 4
d) 1 – 5 – 2 – 3 – 4

10) The scientific method says that first you observe something, make a hypothesis of what might explain the observation, and then you test the hypothesis. Which of the following statements follows the scientific method?

a) Your car is driving along and the engine dies. You park it on the side of the road and walk to the nearest gas station.
b) Your car is driving along and the engine dies. You lift the trunk, get out the jack and change the front tire.
c) Your car is driving along and the engine dies. You lift the hood, wiggle the battery cables, and go in and try to restart the car.
d) Your car is driving along and the engine dies. You lift the hood, and observe that the radiator fluid is down so you call for help on your cell phone.

11) You go to your car and you see a puddle of fluid underneath your car where the engine is located. Which of the following statements follows the scientific method to attempt to explain this observation?

a) You add a quart of oil, get in, and drive away
b) You get in and start the car. It starts so you drive away
c) You add some antifreeze, move the car to a new spot and see if a "puddle of fluid" appears underneath your car again.
d) You ask somebody to drive you home.
e) You read your owners manual to see how many quarts of oil it should take, then add that many quarts of oil.

12) You want to test if one fertilizer is better than another for growing corn. You should:

a) Fertilize the whole field with equal portions of both fertilizers and compare your

production to last years production.

a) Fertilize the whole field with one of the fertilizers and compare your production to last years production.
c) Fertilize one half of a field with one fertilizer and half with another and compare the total amount with last years production
d) Fertilize one half of a field with one fertilizer and half with another and compare the production from the one half of the field to the other half of the field.

13) Maria and Bill go to a new restaurant and do not like the food they are served. Their hypothesis is that if they go to the same restaurant again, they will not like the food. Which of the following actions will best test their hypothesis?

a) Never go near the restaurant again and tell their friends not to try it.
b) Try some nearby restaurants instead.
c) Go back to the restaurant several times and order different items.
d) Get some friends to go to the restaurant and order what Bill and Maria didn't like.

14) Newton's Third Law of Motion is often summarized by the words "For every action, there is an equal and opposite reaction". This means that if object #1 puts a force on object #2, then object #2 puts a force of equal size, but opposite in direction, back on object #1,

Consider the case of a tractor pulling a wagon. If the tractor puts a force on the wagon, then according to Newton's Third Law, the wagon should put an equal force back on the tractor. However, we know that tractors can pull wagons. Therefore, which of the following conclusions can you make?

a) The tractor pulls with greater force.
b) The wagon pulls with greater force.
c) This is an exception to Newton's Third Law.
d) There are other sets of action-reaction forces involved in this situation.

15) As the size of objects gets smaller, the ratio of their surface area to their mass gets larger. If a person wanted to shorten the time that it takes for a pill to dissolve in their stomach, what could they do to have this happen?

a) Swallow more water with the pill.
b) Swallow two pills.
c) Cut the pill in half and swallow both halves.
d) There is nothing that they could do to make this happen.