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BIOM 227.01: Vectors and Parasites

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Syllabus

BIOM 227: Vectors and Parasites

I. COURSE INFORMATION:

1. CRN: 73222
2. Credits: 3
3. Term: Fall 2021
4. Day/time: Tuesday, Thursday / 2:00PM-3:30PM
5. Building/room: Health Science 207
6. Zoom link (UM login required):

<https://umontana.zoom.us/j/96299751019?pwd=SUFwTUc5L1pydm5OTEVVWkY5OVBYZz09>

II. INSTRUCTOR CONTACT INFORMATION:

1. Brent Ryckman
2. Department: Division of Biological Sciences
3. Office: Interdisciplinary Science Building (ISB) 215
4. Phone (Lab): 406-243-6948
5. Email (preferred): brent.ryckman@mso.umt.edu
6. Office hours: By appointment.

III. COURSE SUMMARY

A. Course Description:

1. This course will present a survey of the biology, transmission dynamics, prevention and control of a selection of medically significant pathogens (bacterial, viruses, and protozoans) that are transmitted by arthropod vectors.
2. Basic overview information for each unit topic will be given by the instructor in lecture format. The students will then elaborate on the material by formulating discussion questions, independently exploring these questions outside of class time using internet or other resources, and then participating in class discussions.
3. Beyond familiarizing students with topics relating to vector-borne infectious diseases, this class will encourage students to practice critical and creative thinking skills with regard to modes of investigation, inquiry, questioning and the nature of scientific knowledge and so called "facts."
4. Students enrolled in BIOM 227 have a wide range of backgrounds and are on many different scholastic and career paths. Thus, the course designed to allow each student to pursue their own interests and bring their unique perspectives to the discussion of the topic of vector borne diseases. The overarching goal is to provide all students with useful intellectual tools of scientific inquiry that will benefit them no matter what their future holds.

B. Prerequisite knowledge:

1. College-level general biology is recommended, but not required.

C. Textbook and other informational resources:

1. No textbook required.
2. Basic, overview information will be presented in unit lectures, and associated slideshows will be posted on Moodle for reference.
3. Students will be expected to regularly use the internet to access primary research articles, news stories, public health data repositories (e.g., CDC or WHO websites) etc.

D. Attendance:

1. Given the discussion nature of the course, will be almost impossible to do well without regular attendance. In the event of unavoidable, long-term absences, contact the instructor to find a solution.

E. Basic Course Design:

1. Overview unit lectures will be delivered by instructor.
2. For each unit, students will.
 - a) formulate their own “principles and questions” based on the lecture material.
 - b) engage in independent investigation of those questions.
 - c) provide a short written analysis.
 - d) participate in class discussion.
3. Note that this course design will result in overlap of units. I.e., while students are exploring principles, questions and research articles pertaining to one unit, lectures will move onto the next unit.

IV. ON SCIENTIFIC PRINCIPLES AND QUESTIONS (and COURSE PHILOSOPHY)

A. On inquiry, questions and the nature of advancing knowledge

1. On human resistance to new scientific ideas and questions.

- a) *Max Plank (1853-1947; Scientific Autobiography and Other Papers.): "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it."*
- b) *Enrico Fermi (1901-1954; quantum physicist; source unclear): "Never underestimate the joy people derive from hearing something they already know."*

2. On being open to new ideas and new questions

- a) *Albert Einstein; (source unclear): "It's not that I'm so smart, it's that I stay with problems longer"*
- b) *Rainer Maria Rilke (ca. 1905; Letters to a Young Poet): "Be patient toward all that is unsolved in your heart and try to love the questions themselves..."*
- c) *Kwai Chang Caine (main character from 1972-75 TV series "Kung Fu"): "I seek not to know all the answers, but to understand the questions."*

3. On truth, facts, and advancing knowledge.

- a) *Pierre Teilhard de Chardin; from "The Phenomenon of Man" (1955): "...the history of the living world can be summarized as the elaboration of ever more perfect eyes within a cosmos in which there is always something more to be seen."*
- b) *Albert Einstein; (source unclear): "Creating a new theory is not like destroying an old barn and erecting a skyscraper in its place. It is rather like climbing a mountain, gaining new and wider views, discovering unexpected connections between our starting points and its rich environment. But the point from which we started out still exists and can be seen, although it appears smaller and forms a tiny part of our broad view gained by the mastery of the obstacles on our adventurous way up."*
- c) *Immanuel Kant. 1783 "Prolegomena zu einer jeden künftigen Metaphysik, die als Wissenschaft wird auftreten können" ("Prolegomena to Any Future Metaphysics That Will Be Able to Present Itself as a Science": "...every answer given on principles of experience begets a fresh question..."*
- d) *Common colloquialism: "science just raises more questions than it answers."*

B. On the nature of questions in science.

1. Discrete questions

- a) Answer seeking
- b) Can bring clarity to a subject
- c) Generally narrows the askers viewpoint and therefore can restrict creativity
- d) Generally constricted by the asker's viewpoint (assumptions and beliefs)
- e) Types of discrete questions.
 - (1) Clarification
 - (2) Informational/factual
 - (3) Logical next step
 - (4) More detail or depth

2. Abstract questions
 - a) Not intended to elicit a clear answer
 - b) Can expand the asker's viewpoint and promote creativity
 - c) Can move beyond the askers preexisting viewpoint (assumptions and beliefs).
 - d) Types of abstract questions.
 - (1) Rhetorical
 - (2) Exploratory
 - (3) Leading
 - (4) Heretical (i.e., challenging the current paradigms and beliefs)
3. No "hard line" between types of questions.
 - a) What may begin as a discrete question might proliferate towards abstraction as the investigation proceeds.
 - b) To be of practical use, abstract questions must precipitate discrete questions that can be more directly investigated
 - c) Continuous flow back and forth between types of questions
 - d) Example.
 - (1) Discrete question: "How many strains of SARS -CoV2 are there?"
 - (2) Abstract questions: "How do we define 'strains'?"
 - (3) Many possible discrete questions:
 - (a) "How many SNPs among the CoV2 genomes sampled from:
 - (i) One person?"
 - (ii) A cohort of people from one community?"
 - (iii) Cohorts of people from different geographic regions?"
 - (b) "Do any of the detected SNP's "meaningfully affect the virus biology/disease.?"
 - (4) Abstract question: "What kinds of effects on virus biology would be "meaningful?"

C. On the nature of "scientific truths."

1. Terms we give to our "scientific truths".
 - a) Principle
 - b) Law
 - c) Theory
 - d) Model
 - e) Fact
2. The varying foundations of what we hold as scientific truth.
 - a) Based on observations and empirical data
 - (1) Example: "...The smaller creatures are, the more they swarm." (de Chardin; The Phenomena of Man.)
 - (2) May be clearly observed, but does this mean such principles are universally "true"?
 - b) Based purely on abstract thought.

- (1) Example: Newton's First Law of Motion; " "Objects at rest tend to stay at rest, and bodies in motion stay in motion in a straight line unless acted on by an external force."
 - (2) May not be observable anywhere in the universe, but does this mean such principles are not really "true"?
3. If not statements of universal "truth", of what use are scientific principles, laws, theories, models etc.?
- a) Tools for making predictions (e.g., engineering applications).
 - b) Tools for the formulation of new questions
 - c) Tools for making new observations, and making sense of them.
 - (1) *Charles Darwin_ from; The Life and Letters of Charles Darwin, 1898*
 - (a) "...without the making of theories, I am convinced there would be no observation"
 - (2) *Ca. 1660: Ruben de la Vialle "graffiti'ed" his name over prehistoric cave paintings in a Pyrenees mountain cave now called "Niaux".*
 - (a) In the 1600's there was no coherent, widely accepted concept of the existence of prehistoric hominids, much less that they might paint images of animals on the walls of caves.
 - (b) Perhaps de la Vialle, believing himself to be the only human ever to access that cave, he was not intellectually open to actually "seeing" the prehistoric paintings for what they really were..

V. ASSIGNMENTS, ASSESSMENTS AND GRADING:

- A. Unit Assignment: "Principles and Questions" (6 units, 10 points each)
1. For each lecture unit, students will independently
 - a) Formulate **TWO** distinct "principles" relevant to that unit material. (2 pts)
 - b) Formulate **TWO** questions based on **ONE** of the principles. (2 pts)
 - c) Investigate the question using internet resources; e.g., primary research articles, news stories, public health data repositories (e.g., CDC or WHO websites) etc. (6 pts)
 - d) Note the expectation is to "investigate" the question, not necessarily to "answer" the question. Your investigation should lead to new questions. (*See section above, IV.A.3. "On truth, facts, and advancing knowledge".*)
 - e) For full credit:
 - (1) Written assignments must be uploaded by due date indicated on Moodle assignment module (Word document preferred, PDF Pages, text edit accepted)
 - (2) Formatted clearly with subheadings
 - (a) Two Principles
 - (i) Must be clearly distinct, not just different ways of stating the same idea or principles that are contingent or dependent on each other.
 - (ii) Must be a "principle" as described in Section IV.C. above. I.e., not a specific, detailed "fact."
 - (b) Two questions addressing the ONE selected principle.

(i) Indicate which of your two principles informs your questions

(ii) Link between selected principle and questions must be clear and logical.

(c) Summary of your investigation

(i) Include citations of the resources used.

(ii) Recommended length 300-750 words (not including the (a) Principles and (b) Questions).

B. Participation in class discussions (30 points total)

1. Approximately one week will be given for students to complete and upload their “principles to questions” assignments.
2. Students will informally present their assignment in class in the form of discussion.
 - a) Instructor will go down the class list to call on students to present.
 - b) Students will briefly summarize their assignment followed by open class discussion. Approximately 5-10 minutes per student.
 - c) Each student may “pass” on ONE unit during the semester and still receive full credit for this learning activity.

C. Final presentation/project “Vector borne disease and climate change” (50 points total)

1. Students will research and prepare a short presentation (10 min) on a topic that creatively relates vector-borne diseases to global climate changes
 - a) *Note: due to uncertainties pertaining to the instructor’s schedule at the end of semester Fall 2021, the final project assignment might be modified to a written format. Will be explained in class.*
2. Students are encouraged to draw on their individual backgrounds and interested to explore links between vector-borne diseases and climate change beyond the typically acknowledged links such as shifting habitat ranges of vector species.
3. See provided scoring rubric for more details on expectations and evaluation criteria.
4. This project will come in the last month of semester. Class meeting times will be used for students to report their progress and ideas and receive feedback from their peers and the instructor.
5. Grading
 - a) Attendance/participation in preparative discussion/feedback sessions
 - b) Peer evaluation of presentations (evaluation rubric provided by instructor)
 - c) Final presentation: Aggregate score of peer evaluations, weighted towards the instructor’s evaluation.

D. Exams (70 pts total)

1. 2 Exams; approximately 35 pts each.
2. Dates to be determined.
3. Exam scope and format
 - a) Delivered on Moodle; to be completed on own time
 - b) Combination of multiple choice, true/false, matching, fill in the blank and short answer/essay questions.

E. Learning Outcomes. Students should be able to:

1. Independently formulate their own “principles” of vector-borne diseases.
2. Formulate discrete and abstract questions based on individually formulated “principles”.
3. Perform independent research of information sources such as the internet to explore individually formulated questions.
4. Describe their logic flow from principles -to- questions-to-investigations in written and in class discussion formats.
5. List and distinguish the major human diseases transmitted by arthropod vectors
6. Distinguish the vector-borne human diseases that are caused by viruses, bacterial and protozoan pathogens
7. List the major arthropods that serve as vectors of human disease pathogens for humans and animals.
8. Compare and contrast intervention approaches that target the vector, the pathogen, and the disease host.
9. Discuss the implications of climate change on vector-borne diseases (and/or vice versa)

F. Grading (approximate, subject to change)

Assessment tool	Semester total per assessment tool	Percent of final grade
Unit Principles and Questions, written assignments	60	28.6
Discussion participation	30	14.3
Final Presentation/Project	50	23.8
Exams	70	33.3
Semester Total	210	100

Final grade	Final Score	Percentage
A	195.3 – 210	93-100
A-	189 – 193.2	90-92
B+	182.7 – 186.9	87-89
B	174.3 – 180.6	83-86
B-	168 – 172.2	80-82
C+	161.7 – 165.9	77-79
C	153.3 – 159.6	73-76
C-	147 – 151.2	70-72
D+	140.7 – 144.9	67-69
D	132.3 – 138.6	63-66
D-	126 – 130.2	60-62
F	<126	< 60

VI. ACCESSIBILITY

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity (ODE). If you anticipate or experience barriers based on disability, please contact the ODE at: (406) 243-2243, ode@umontana.edu, or visit www.umt.edu/disability for more information. Retroactive accommodation requests will not be honored, so please, do not delay. As your instructor, I will work with you and the ODE to implement an effective accommodation, and you are welcome to contact me privately if you wish.

VII. UM CULTURAL LEAVE POLICY

Cultural or ceremonial leave allows excused absences for cultural, religious, and ceremonial purposes to meet the student's customs and traditions or to participate in related activities. To receive an authorized absence for a cultural, religious or ceremonial event the student or their advisor (proxy) must submit a formal written request to the instructor. This must include a brief description (with inclusive dates) of the cultural event or ceremony and the importance of the student's attendance or participation. Authorization for the absence is subject to approval by the instructor. Appeals may be made to the Chair, Dean or Provost. The excused absence or leave may not exceed five academic calendar days (not including weekends or holidays). Students remain responsible for completion or make-up of assignments as defined in the syllabus, at the discretion of the instructor.