

Organisms in a Changing Environment

MSE 2207 - 001

Spring 2022

Instructor

Dr. Jerrod Hunter

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Office: Mendel G054

Student Hours: by appointment.

Texts (Required)

Inquiry into Life (Relevancy Update). 15.1 edition. 2017. by Sylvia Mader and Michael Windelspecht. McGraw-Hill.

either *The Sixth Extinction* or *Under a White Sky: The Nature of the Future* by Elizabeth Kolbert.

Additional Readings/References (see Blackboard and below for whether **required** (REQ), recommended (REC), or optional (OPT)). REQ and highly REC pieces listed on the calendar
Those referenced in discussions indicated with as **DISC**.

Intro to Course and Nature of Information

Johnson, Clay. 2012. *The Information Diet: The Case for Conscious Consumption*. O'Reilly Media.
(highly REC, **DISC**; excerpt on Blackboard)

World Economic Forum. 2020. Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy. (REQ, on Blackboard)

Ecosystems and Ecosystem Services (including valuation)

Melillo, Jerry and Osvaldo Sala. 2008. Chapter 3: *Ecosystem Services* in Chivian, Eric and Aaron Bernstein (eds). *Sustaining Life: How Human Health Depends on Biodiversity*. Oxford University Press. New York.
(REQ, on Blackboard)

Costanza, Robert, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naeem, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton, and Marjan van den Belt. 1997. The Value of the World's Ecosystem Services and Natural Capital. *Nature* 387:253-260.
(REC, **DISC**; on Blackboard)

Costanza, Robert, Rudolf de Groot, Paul Sutton, Sander van der Ploeg, Sharolyn J. Anderson, Ida Kubiszewski, Stephen Farber, R. Kerry Turner. 2014. Changes in the Global Value of Ecosystem Services. *Global Environmental Change* 26:152–158. (REQ, **DISC**; on Blackboard)

Ervin, D., S. Vickerman, S. Ngawhika, F. Beaudoin, S. Hamlin, E. Dietrich, P. Manson, J. Schoenen. 2014. Principles to Guide Assessments of Ecosystem Service Values. Cascadia Ecosystem Services Partnership, Institute for Sustainable Solutions, Portland State University.
(REQ, **DISC**; on Blackboard)

IPBES. 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (OPT, on Blackboard)

RadioLab piece on Ecosystem Services (22 Feb 2015) -
<https://www.wnyc.org/radio/#/ondemand/421631> (highly REC, link)

How Wolves Change Rivers – Nice piece for ecosystem services/ biodiversity: importance of wolves to many aspects of the ecosystem in Yellowstone:
https://www.youtube.com/embed/ysa5OBhXz-Q?feature=player_embedded (will be shown in lecture)

Smart Growth and Development

- Benfield, F. Kaid, Matthew D. Raimi, and Donald D.T. Chen. 1999. *Once There Were Greenfields*. NRDC, New York. (will be distributed if time)
- Benfield, F. Kaid, Jutka Terris, and Nancy Vorsanger. 2001. *Solving Sprawl: Models of Smart Growth in Communities Across America*. Island Press and NRDC, New York.
- Calthorpe, Peter. 2017. 7 Principles for Building Better Cities. TED Talk: https://www.ted.com/talks/peter_calthorpe_7_principles_for_building_better_cities?language=en (REQ, DISC; link)
- IUCN resources – Business and Ecosystems 2007 [Business and Ecosystems](https://www.iucn.org/theme/business-and-biodiversity) (link) and Business and Biodiversity <https://www.iucn.org/theme/business-and-biodiversity> (highly REC, DISC, links)
- This-is-Smart-Growth. 2006. Smart Growth Network (if time, DISC; on Blackboard)

Climate Change – Science, Impacts, and Solutions

- IPCC 5th Assessment. 2013. Technical Summaries of Working Group (WG) I and WG II (OPT, recommend at least skimming!) and the WGII Summary for Policy Makers (REQ, DISC) (<http://www.ipcc.ch/report/ar5/>; all on Blackboard)
- Cassidy, John. Can we have prosperity without growth? (the critique of economic growth, once a fringe position, is gaining widespread attention in the face of the climate crisis). *The New Yorker*. February 3, 2020. (REQ, DISC; on Blackboard)

Cell and Tissue Biology – Biomimicry

- an excellent website with a description, examples, and ties to business (includes a description of awards available) <https://biomimicry.org/> (REQ, DISC; link)
- Gunderson, Jeff. 2014. Biomimetic Membranes: Nature Inspires Next Generation of Water Filtration Technology. *Water World*. (highly REC, DISC; on Blackboard)
- McNulty, T., D. Bhate, A. Zhang, M. A. Kiser, L. Ferry, A. Suder, S. Bhattacharya, and P. Boradkar. 2017. A Framework for the Design of Biomimetic Cellular Materials for Additive Manufacturing. *Proceedings of the 28th Annual International Solid Freeform Fabrication Symposium*. (OPT)

Exercise Physiology and Training

- Burton, Deborah A., Keith Stokes, and George M. Hall. 2004. Physiological Effects of Exercise. *Continuing Education in Anaesthesia, Critical Care & Pain* 4: 185-188. (REC, on Blackboard)
- Pollock, Michael, Glenn Gaesser, Janus Butcher, Jean-Pierre Despres, Rod Dishman, Barry Franklin, and Carol Garber. 1998. ACSM Position Stand: The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness, and Flexibility in Healthy Adults. *Medicine & Science in Sports & Exercise* 30(6):975-991. (REC, on Blackboard)

Genetically Engineered (Modified) Organisms

- Brody, J. 2018. Are GMO Foods Safe? *New York Times* (REQ, DISC, on Blackboard)
- ProCon 2020 GMOs – Top 3 Pros and Cons (REQ, DISC, on Blackboard)
- Snow, A.A., D.A. Andow, P. Gepts, E.M. Hallerman, A. Power, J.M. Tiedje, and L.L. Wolfenbarger. 2005. Genetically Engineered Organisms and the Environment: Current Status and Recommendations. *Ecological Applications*, 15(2), 2005, pp. 377–404. (OPT, on Blackboard)

Endocrine Disruption

- Diamanti-Kandarakis, Evanthia, Jean-Pierre Bourguignon, Linda C. Giudice, Russ Hauser, Gail S. Prins, Ana M. Soto, R. Thomas Zoeller, and Andrea C. Gore. 2009. Endocrine-Disrupting

- Chemicals: An Endocrine Society Scientific Statement. *Endocrine Reviews* 30(4):293–342.
(OPT, on Blackboard)
- Gore, A. C., V. A. Chappell, S. E. Fenton, J. A. Flaws, A. Nadal, G. S. Prins, J. Toppari, and R. T. Zoeller. 2015. EDC-2: The Endocrine Society's Second Scientific Statement on Endocrine-Disrupting Chemicals *Endocrine Reviews*. (OPT, on Blackboard)
- National Institute of Environmental Health Sciences. Endocrine Disruptors
(REQ, on Blackboard)
- Wikipedia. Endocrine Disruption (accessed 7 November 2018).
(highly REC, on Blackboard)

Overview and Course Objectives:

An introduction to Biology, with special reference to its relevance in society. Our coverage of the topics is broadly based and far-ranging in its scope, and includes cellular to organismal to ecological biology, and a variety of topics important for human health and environmental sustainability. This course is designed to be a combination of lecture and discussion. Please see the schedule at the end for the list of topics covered this semester.

Among the primary course objectives are to:

- ❖ learn about the nature of information and the filters that we create and sometimes are created for us
- ❖ consider biology (and science in general) as a way of knowing and to understand the scientific method/approach
- ❖ learn central scientific information about biology, including covering several levels of organization of life
- ❖ emphasize the relevance of this material to our lives as US/global citizens
- ❖ discuss the relevance of some of the topics to you as important stakeholders and change makers
- ❖ gain an understanding of and appreciation for the connection between biology and health, physical well-being, and prosperity
- ❖ actively engage all members in presentations, debates, and discussions

I am excited to join you in covering these important topics!

Academic Integrity

The College of Liberal Arts and Sciences has adopted a standard policy for matters of academic integrity. All students in this course should carefully read the ACADEMIC INTEGRITY policy and associated explanatory statements. You will find both in the Enchiridion published by the Dean's office and the annual Blue Book and posted on the web: www.vpaa.villanova.edu/academicintegrity/code.html.

We take issues of academic integrity very seriously. One of the academic requirements of this course is that any student who has knowledge of any violation of the code must bring that violation to the attention of the instructors (failure to do so will result in one letter grade reduction for the final grade). Examples of such violations include but are not limited to: cheating on an exam, providing another student with answers to or information about an exam, allowing another student to copy from your examination or assignment, falsification of data, submission of someone else's work, and any form of plagiarism including copying and pasting sentences found on websites or from another student.

During the next two semesters you will be asked to write up several laboratory assignments. Because you will be working in groups or may often use data from the entire class, there will be obvious similarities with your write up and that of your lab partner or other classmate. However, the write-up you submit must be your own;

it must reflect **your** understanding of the material in **your** words. While we understand that presenting the same data set to the same computer program will result in the independent generation of possibly identical graphs, no such process applies to the actual words or formatting in a lab report. Make sure that when you are doing your assignments, you work ON YOUR OWN when researching, working on, and writing them.

If you have any questions about matters of academic integrity, please ask one of us immediately.

Students are responsible for understanding how the academic integrity code applies to their conduct in this class. Any violation of the code of academic integrity will result in a severe penalty assessed on the final grade. This penalty will range from a minimum of a full letter grade reduction to an F for the course. All academic integrity violations will be reported to the Chair of the Biology Department, the Dean of Arts and Sciences, and the Chair of the Academic Integrity Board.

Questions

We provide you with many opportunities to ask questions, both in and out of class. If there are more ways we can help you get your questions answered, please let us know. We welcome and encourage your questions about the material. We are particularly delighted by questions that make it clear you've been thinking about the material. And little could make us happier than hearing questions that make us think hard, or even make us appeal to other resources for an answer. We *love good* questions.

Animals in the Lab

Many people, including students and professional biologists, share a concern for the use to which animals are put in the context of teaching. In this course it will be necessary to carry out one or more exercises that make use of preserved or living animals. Such use of animals in teaching is an integral part of the biology experience and as such has been designed to fit in with the overall aims and goals of the course. For this reason, students generally will not be excused from participating in those laboratories involving the study of living or preserved animals. If you object to these types of exercises, please see the Chairman of the Department of Biology immediately to discuss your concerns and be prepared to consider other course options. The primary reason for using animals in the lab is related to their value in experiential learning. The structure and function of tissues, organs and systems of organs within animal bodies are extremely complex. Without the firsthand experience of locating and manipulating muscles, bones, and organs within the three-dimensional framework of the real organism it is impossible to fully appreciate the complexities of animal form and function. Since attaining a knowledge of the way in which animals "work" is one of goals of the laboratory, your instructors believe that the use of preserved and/or fresh specimens is imperative to your learning and appreciating the material dealt with in this course. Diagrams and other materials are also used in the course and are useful adjuncts to real animals, but they cannot substitute for them. By analogy, someone can tell you the rules of chess or baseball, but without the experience of watching a game, the rules are abstract concepts and without playing yourself it is difficult to appreciate the game or to truly understand its intricacies.

Technology Policy

No phones

Please don't use your phone at all in class, and always turn off the ringer/sound before class begins. To avoid the temptation to look at your phone, it's best to turn it off completely or put it in airplane mode and place it in your bag.

Laptops

We strongly discourage the use of laptops for note taking in this course. Ideally, you should be taking notes by hand, preferably on paper. Studies have shown that taking notes by hand is more effective for learning than

typing on a laptop because it allows you to summarize and synthesize information as you write it down instead of just typing every word you hear. In addition to the learning benefits of taking notes by hand, the use of laptops for anything other than typing notes (like email, Facebook, or YouTube) is extremely distracting for many students in the class. Taking notes on a tablet with a stylus is fine but be sure to turn off WiFi and set it to silent mode.

Lecture Recordings

You are welcome to record the lectures, but if you are using your phone, be sure the phone is in airplane mode.

Attendance

Attendance in lectures and discussions is required. In addition, exams will be given using Blackboard. Thus, a computer and reliable internet connection is essential for the course. Based on experience, attending the lectures is crucial for the successful completion of this course. At the very least, regular attendance will ensure that you have been exposed to the material on the exams. But it is so much more! Evidence exists that success in courses is strongly linked to good attendance (a great example of "Evidence-Based Practice"!). An article on this strong link can be found at

<http://sites.arbor.edu/studentsuccess/files/2011/11/Class-attendance-article1.pdf>.

An excerpt from the concluding section:

Research indicates that attendance is statistically significant in explaining class grade and overall performance of students.

Students who miss class frequently significantly increase their odds of a poor grade in each course.

A case can be made that requiring attendance can be a successful means of improving the value added of any course.

Along the lines of the last bullet point, your attendance and participation in class discussions will enhance the value of the course for all involved, including me! The success of this course is in part dependent upon participation by all of us. Everyone has something to offer. In discussions, I am less concerned with your always having the "correct" answer (indeed if there even is one!) than with your willingness to explore the topic. For the discussions to go well, please read the assigned materials and look over any discussion questions distributed earlier in advance of class time.

Attendance at exams is especially crucial. In order to be excused for a missed exam, inform me BEFORE the session or as soon as possible (I may require a written explanation for the absence and, if requested, supportive evidence will be needed). Given the size of this course, it is difficult to schedule make-ups. Note that if the absence is not excused, you will receive a 0 on the exam.

The format of the make-up exams may be different from that of the regularly scheduled exams (e.g., entirely or partially essay questions and/or given orally).

Many students find it useful to print 2, 3, or 4 slides per page before lecture and then use these to take notes during lecture.

SPECIAL NOTE: Travel plans are not an acceptable excuse unless it is for a university-supported event (e.g., athletic competition). In such cases, a supporting letter will be required. Please consult the course schedule before making your travel plans for all breaks.

Cleanliness & Organization

Leave the lab cleaner than you found it! Be sure to return all equipment and materials to their proper places when you are finished. Discard materials in the proper place: you'll get special instructions about disposal of glass, certain chemicals, and other items. In addition to returning all reusable materials and discarding others, you will be responsible for wiping down the lab bench where you worked just before you leave the laboratory. Consistent failure to clean up after yourself in lab may result in points being deducted from your lab grade.

Lab safety

The laboratory can be a fun place; it can also be dangerous. Observe all cautions regarding hazardous material carefully. Your teaching assistant will alert you to possible dangers, and you should always be thinking about safety. Food and drink are never permitted in the laboratory. Smoking is prohibited in all classrooms.

You should dress appropriately for lab. Remember that we will be working with some modestly dangerous stuff. Wear clothing that affords a moderate degree of protection in the event of a spill. Remember that as far as safety is concerned, lab is a PLACE, not a time – if you are in the lab room, lab rules must be followed, even if you're only giving a presentation. During some laboratories we will require that you wear goggles to protect your eyes and gloves to protect your hands in addition to your lab coat. We'll give you more details in class. Laboratories with an asterisk (*) in the listing require eye and/or glove protection.

As part of your training in laboratory safety, prior to Lab 2 students are expected to complete computer based laboratory safety training, available for self-enrollment via Canvas or Blackboard. The training consists of three modules, and all together will take less than 2 hours to view and complete the activities (and you can stop and resume later at any time). When you finished each module, you will see an "Achievement Screen" – take a screen capture ("print screen") of each one, and upload the images to the designated spot in Canvas to receive credit for completion of the modules. You must complete all three modules in order to be allowed to attend Lab 2 and all subsequent labs. More information and directions to the on-line training modules can be found on Canvas, and the safety training information will be gone over during Lab 1 as well.

A few highlights about lab safety that pertain to our labs in particular are:

1. **No food or drink in the lab** (this includes water and gum!) – this is very strictly enforced!
2. Dress Code:
 - a. **Long pants** or skirts only – the hem must reach your ankle. Students may opt to bring a pair of sweat pants to wear over shorter pants/skirts if they wish, but you must change into this before you enter the lab.
 - b. **No open-toed shoes** – any shoes where we can see your toes are considered open-toed. No bare or stocking feet allowed ever.
 - c. For wet labs, your **lab coat** MUST be worn at all times while you are in the lab, regardless of what part of the experiments you are doing.
 - d. For all labs, you must wear clothing that **covers the midriff area** – no short shirts or low-rise jeans that leave the stomach/back area exposed. This is for your own safety, as that is the area that will potentially come into contact with the lab bench while you are seated. If your TA decides that your clothing is not appropriate in this regard you will be asked to wear a lab coat for the duration of the lab, even if it is a "dry" lab that day.
 - e. Confine long hair and loose clothing when working with lab equipment and chemicals.
 - f. Failure to follow the dress code will result in your TA sending you back to your room to change before lab – this may mean that you miss the quiz – and it will NOT be excused!
3. Chemicals:

- a. You must wear safety **goggles** and **gloves** for any labs that use potentially hazardous chemicals, in addition to your lab coat. You are required to wear these safety items for the entire time that those chemicals are in use during that lab (we will let you know which labs/parts of labs these are). These items will be provided for you in lab.
 - b. Know and understand the chemicals you are using. Material Safety Data Sheets (MSDS) can be found in the General Biology prep room (M184) and the Biology storeroom (MG7). They can also be accessed on-line.
4. Emergencies:
- a. Know where the emergency exits and evacuation routes are.
 - b. In case of fire and/or fire alarms, evacuate the lab immediately and go out to the library loading dock area, well away from the building. Once there please check in with your TA and stay with your lab group until you are told otherwise.
 - c. Know the location and proper use of fire extinguishers, eyewash stations, and safety showers.
 - d. Notify your TA immediately of any injuries or other accidents, no matter how small. Know where the nearest first aid kit is located. All injuries, however minor, are to be reported to Public Safety (94444) for a medical evaluation.
5. Waste Disposal:
- a. Any biohazardous waste should be placed in biohazard waste containers.
 - b. Chemical waste must be placed into the appropriate chemical waste container. Never pour anything down the sink without the express permission of your TA!
 - c. Dispose of broken glassware in appropriate containers.
6. Upon leaving the lab, please:
- a. Make sure you leave the lab cleaner than you found it. Please clean and straighten up your work area on the lab bench, and check with your TA before leaving.
 - b. Always wash your hands before leaving the laboratory.
 - c. Push in your chairs before you leave the laboratory. (Please! It really helps! ☺)

Grading

Communication: Check your Email account and Blackboard regularly.

Lectures will be given in person. Not only is attendance important for picking up the concepts in lecture, we will also have several discussions, some in breakout groups, and thus attendance is crucial. Please keep your cameras on during the lecture; seeing each other helps reduce the disadvantages with physical distancing. Thank you!

Grading

The grade in this course will be based on your performance on exams, quizzes, a Special Topic assignment, and “subjective” for participation. A total of 350 points will be awarded.

EXAMS

240 points

Exam	Day	Points
1	R	80
2	T	80
3	R	80

QUIZZES

20 points

Three 10-point quizzes will be given over the course of the term. These are based on the readings and/or previous lecture(s). All will be announced one or two lectures beforehand only in lecture, and thus attending lecture is the best way to know about them. You will be able to drop your lowest quiz grade.

SUBJECTIVE

30 points

This grade will be based on your attendance and participation in lecture, including actively engaging in discussions and answering questions throughout the term (on slides/handouts, in the discussion sessions, and in **Discussion Forums** on Blackboard), and possibly presenting a summary of an article. These points are a way to reward you for engaging.

SPECIAL TOPIC/CRITICAL ANALYSIS PAPER

60 points

Pick one chapter from either *The Sixth Extinction* or *Under a White Sky: The Nature of the Future* by Elizabeth Kolbert.

*summarize the most pertinent **scientific** background related to your chapter's topic as a whole, referring to lectures and the textbook/other assigned readings, and also any additional references that you want to consult/include. Include some detail in this section, and any uncertainties in the scientific references. Most of this will be from lectures. Begin with a *brief* definition of the topic. Present as succinct sentences; I am more interested in content than language usage in this section. Subdivide into subheadings as appropriate for your topic. Cite and give proper credit to all authors at the end of this section, including for figures and pictures. This section likely will be the largest of your submission. (1-2 pages)*

*find and include as a link (preferred) or as a cut-and-paste at the end of your paper at least two articles on the topic from the **popular or scientific** literature or a website, and both summarize what it presents and discuss/critique it in a paragraph or two. Include whether it has a hidden – or obvious – bias? Does it sensationalize and/or distort the factual information available on the topic, or is it a useful contribution? Does it add value to the topic writ large? If so, how? If not, what would make it better? Please include the citation for the article at the beginning of this section and then include the link (preferred) or a copy of the article at the end of your paper (~1/2–1 page(s))*

discuss local or governmental policy, and/or ethical aspects of your general major topic (not just the topic of your paper). Depending on the topic, this could incorporate (a) what is(are) the implication(s) for and opportunities available to businesses; (b) who should bear the burden of testing the technology used – government or businesses? (c) how proactive should the government be in regulating and safeguarding the public and/or in offering subsidies to develop technologies? and/or (d) what is the best approach with issues that have significant impacts on our health but for which there exists uncertainty about the impacts– precautionary principle, weight of evidence, and/or burden of proof? (~1–2 paragraphs)

state your position based on your critical evaluation of the topic as a whole. Include a scientific basis for your conclusions. (<1½ page)

discuss whether or not (and if so how) the lectures/class discussions and this analysis influenced your thoughts on the topic. (paragraph)

Grade scale

The following scale will be used for determining letter grades in the course, though I am prepared to curve if necessary:

93% and higher	A	73% - 76.9%	C
90% - 92.9%	A-	70% - 72.9%	C-
87% - 89.9%	B+	67% - 69.9%	D+
83% - 86.9%	B	63% - 66.9%	D
80% - 82.9%	B-	60% - 62.9%	D-
77% - 79.9%	C+	less than 60%	F

Additional services/policies

Office of Disabilities (ODS) and Learning Support Services (LSS)

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. Students with disabilities who require reasonable academic accommodations should schedule an appointment to discuss specifics with me. Go to the Learning Support Services website (<http://learningsupportservices.villanova.edu>) for registration guidelines and instructions. For physical access or temporarily disabling conditions, please contact the Office of Disability Services at 610-519-4095 or email Stephen.McWilliams@villanova.edu. Registration is needed in order to receive accommodations.

Academic integrity statement with link

All students are expected to uphold Villanova's Academic Integrity Policy and Code. Any incident of academic dishonesty will be reported to the Dean of the College of Liberal Arts and Sciences for disciplinary action. For the College's statement on Academic Integrity, consult the The CLAS Academic Handbook. You may view the university's Academic Integrity Policy and Code, as well as other useful information related to writing papers, at the Academic Integrity Gateway web site:

<https://library.villanova.edu/research/subject-guides/academicintegrity>

Absences for Religious Holidays

Villanova University makes every reasonable effort to allow members of the community to observe their religious holidays, consistent with the University's obligations, responsibilities, and policies. Students who expect to miss a class or assignment due to the observance of a religious holiday should discuss the matter with their professors as soon as possible, normally at least two weeks in advance. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the absence.

<https://www1.villanova.edu/villanova/provost/resources/student/policies/religiousholidays.html>

LECTURE SCHEDULE

Day	Date	Topic	Read
M	1/10	INTRO / Syllabus	
W	1/12	Unit I: Intro to Course Course Info & Policies; The Study of Life	OPT: M&W Ch I
F	1/14	The Study of Life (cont.) Nature of Information	M&W Ch I REC: <i>The Information Diet</i> (especially pp 19-73)
M	1/17	MLK	
W	1/19	Nature of Information (cont.); Science as a "way of knowing"; Pasteur's Quadrant; Discussion: how information is presented and how we process it	<i>The Information Diet</i> (cont.)
F	1/21	Unit II: Ecosystems-Value and Threats Intro to Ecosystems	OPT: M&W Ch 35+36
M	1/24	Ecosystems (cont.)	
W	1/26	Ecosystem Services	Melillo & Salo Ecosystem Services- Ch 3 in Sustaining Life
F	1/28	Ecosystem Services (cont.)	"

M	1/31	Ecosystem Services (end) Discussion: Valuation	Costanza <i>et al.</i> 2014, Ervin <i>et al.</i> 2014; REC: RadioLab piece https://www.wnyc.org/radio/#ondemand/421631
W	2/2	FLEX	
F	2/4	Exam 1	
M	2/7	Global Climate Change- WGI: Science	OPT as ref.: IPCC WGI Technical Summary
W	2/9	Global Climate Change- WGI: Science (cont.)	“
F	2/11	Global Climate Change- WGI: Science (end) Discussion and Review	“
M	2/14	Global Climate Change- WGII: Impacts on Ecosystems and Human Societies and Health	IPCC WGII Summary for Policy Makers (SPM); OPT as ref.: IPCC WGII Technical Summary
W	2/16	Global Climate Change- WGII: Impacts (cont.) Global Climate Change- Solutions Discussion: Climate solutions and adaptation	Cassidy New Yorker article (see Readings)
F	2/18	Unit III: Human Health – Cell Biology Cell Structure and Function; Membranes	OPT: M&W Ch 2, 3, 4
M	2/21	Cell Structure and Function; Membranes (cont.) Discussion: Biomimicry and Business Energy Budgets; Metabolism and Cellular Respiration	OPT: M&W Ch 6, 7; Biomimicry Institute website Gunderson 2014 Biomimetic membranes
W	2/23	Cell Structure and Function; Membranes	“
F	2/25	FLEX	
M	2/28	Break	
W	3/2	Break	
F	3/4	Break	
M	3/7	Cell Structure and Function; Membranes (cont.) Discussion: Biomimicry and Business Energy Budgets; Metabolism and Cellular Respiration	OPT: M&W Ch 2, 3, 4
W	3/9	Metabolism and Cellular Respiration (cont.)	OPT: M&W Ch 6, 7; Biomimicry Institute website Gunderson 2014 Biomimetic membranes
F	3/11	Metabolism and Cellular Respiration (cont.)	“
M	3/14	Exam 2	
W	3/16	Unit IV: Human Health–Organ Systems Cardiovascular System (begin)	OPT: M&W Ch 12 REC: Burton, et al. 2004. Physiological Effects of Exercise
F	3/18	Cardiovascular System	
M	3/21	Cardiovascular System (end);	
W	3/23	Respiratory System (begin)	OPT: M&W Ch 12, 15

F	3/25	Respiratory System	OPT: M&W Ch 15
M	3/28	Respiratory System (end)	
W	3/30	Unit V: Biotechnology and Exposome Biotechnology- Genetically Engineered (Modified) Organisms (GEOs/GMOs)	Brody, 2018. <i>Are GMOs safe?</i> ProCon 2020. <i>GMOs-Top 3 Pros and Cons</i>
F	4/1	Genetically Modified Organisms (cont.) Discussion	OPT: M&W Ch 26 OPT: Snow <i>et al.</i> 2005
M	4/4	Biotechnology- Immunotherapy & Gene Therapy Discussion: IVF, Designer Babies	
W	4/7	Exposome (incl. stress, infectious diseases, drugs, endocrine disrupting chemicals [EDCs], pollution)	NIEHS 2010-<i>Endocrine Disruptors</i>; REC-<i>Endocrine disruptor</i>-Wikipedia; OPT as ref.: Gore <i>et al.</i> 2014
F	4/9	Exposome (cont.)	“ and NASA hyperwall
M	4/12	Exposome– (finish if needed) Global Health Discussion; Review (if time)	
W	4/14	Easter	
M	4/18	Biotechnology- GMO	
W	4/20	Biotechnology- GMO	
F	4/22	Biotechnology- GMO	
M	4/25	Biotechnology- GMO	

Lab Schedule

Lab	Week of:	Topic	Additional Notes	Due Dates
0	1/10	LAB SAFETY & techniques	Microscopy – skill must be taught in order to observe Daphnia (heart rate) Micropipetting – skill must be taught for successful completion of DNA extraction, PCR, gels	
1	1/17	Water Quality Testing III (Edvotek #953) *2 PART LAB SEQUENCE* https://www.edvotek.com/953	(1) DNA Extraction & PCR from water samples	

1	1/24	Use Multiplex PCR technique to detect several waterborne microorganism contaminants simultaneously; 2 PARTS:	(2) Separation of DNA products using Agarose Gel Electrophoresis.	
2	1/31	Environmental Toxicity Responses in <i>C. elegans</i> (Edvotek # 856) https://www.edvotek.com/856	Bioassay that tests the impacts of heavy metals on <i>C. elegans</i> ; students can also examine RNA editing and genotype – environmental interactions by comparing the reactions of wild-type and mutant strains.	Lab 1 due
2	2/7			
3	2/14	Changing Ecosystems (Carolina 187222) https://www.carolina.com/carolina-ecokits/changing-ecosystems/FAM_187222.pr?question=187222 Camouflage lab/xeno species lab	Through a card game, students model the population changes of 9 species in a temperate forest community. They explore how changes in ecosystems due to factors such as habitat loss, pollution, overharvesting, climate change, and the establishment of an invasive species can lead to a loss of biodiversity. Next, with the freedom to change any aspect of the previous model, students design a new version of the card game using a different community. Then they exchange, play, and critique each other's games. Over the course of this lab students collect evidence on their way to finding answers to the driving question, "What factors result in ecosystem change?"	Lab 2 due
4	2/21	"Can of Bull?" Biochemical Assay of proteins, carbohydrates, lipids, amino acids, plus case study on difference between ATP and "energy"	Objectives: assess components of "energy drinks" and other beverages for various compounds; fun discussion of ENERGY vs. ATP vs. SIMULANTS	Lab 3 due
	2/28	break		
5	3/7	Effects on the Heart Rate of <i>Daphnia magna</i> – test various concentrations of CAFFEINE & ETHANOL (read associated paper re: potential range of [doses])	Objectives: scientific method, test various [caffeine] + /or [ethanol] to determine significance of change in heart rate; data collection, graph results.	Lab 4 due

6	3/14	Blinded by the Light: UV Rays and DNA Damage (Edvotek #957)	Observe the effects of UV light on DNA. 2 PARTS: (1) Students will run a time series test comparing UV exposed plasmid samples and their results	Lab 5 due
6	3/21	*2 PART LAB SEQUENCE* https://www.edvotek.com/957	using (2) electrophoresis. Students may also test the ability of different sunscreens to prevent DNA damage – hypothesis testing! Discussion on health benefits of SUN vs. DNA damage & aging.	
7	3/28	Detection of Genetically Modified Organisms (Edvotek #121) *Ready-to-Load DNA* - 1 Lab https://www.edvotek.com/121	Students will use agarose gel electrophoresis to explore the molecular methods used by scientists to identify genetically modified organisms, GMOs; test +/- control DNA and compare to corn, wheat, and soy sample DNA (plant chloroplast, CaMV & Nos); use to facilitate discussion/debate regarding Genetically Modified Food Items.	Lab 6 due
8	4/4	BioBuilder: Golden Bread Transformation Kit (Carolina 217006P) https://www.carolina.com/gene-expression-advanced-topics/biobuilder-golden-bread-transformation-kit-with-perishables/217006P.pr?question=217006p	Objectives: Introduce students to bio-engineering concepts, teach synthetic and microbiology techniques, allow students to experience real-world connections. This lab focuses on a strain of baker's yeast, modified to produce Beta-carotene (VitaYeast), a nutrient we naturally obtain from eating specific vegetables. B-carotene is converted to Vitamin A, which is crucial for vision, the immune system, and other biological functions – students can investigate how one can possibly substitute standard baker's yeast, making it possible to bake vitamin A-enriched loaves of bread (Golden Bread); manipulate <i>Saccharomyces cerevisiae</i> and its metabolic pathway, and understand the importance of genetic redundancy when engineering a synthetic system.	Lab 7 due
9	4/11	Independent projects		Lab 8 due