

Biology 115.04: Energy in Living Systems

Instructor: Chris Gillen

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Office hours: Reserve an office hour meeting by following the link on Moodle or my e-mail signature or send an e-mail to arrange an alternative time.

Course Description: Energy flow is a unifying principle across a range of living systems, from cells to ecosystems. With energy flow as a major theme, this course covers macromolecules, cells, respiration and photosynthesis, physiology and homeostasis, population and community interactions, and ecosystems. Throughout the course, the diversity of life is explored. The course also introduces students to the process of scientific thinking through discussion of research methodology and approaches.

Goals and objectives: Energy in Living Systems (BIOL 115) is a course designed to cover fundamental features of life that scale from cellular to global levels, concentrating on the flow of energy and materials through biotic and abiotic systems. The course will introduce students to:

- The process of science and scientific thinking
- Principles of biochemistry, cell biology, physiology, and ecology
- Applying biological concepts and skills learned in course to basic and applied problems

BIOL 115 is one of the foundation courses in Biology, the others being BIOL 109 -110 (Introduction to Experimental Biology) and BIOL 116 (Information in Living Systems). There are no prerequisites, and enrollment is open to both majors and nonmajors.

Class structure: The more you engage with the material, the more you will learn. To facilitate this, the course has three components that will be visited daily throughout the semester:

- Watch one or two short videos prior to each class to familiarize yourself with the topic.
- Actively read and annotate the textbook (or other assigned reading) using Perusall.
- Attend a synchronous session during which you will engage in active learning, explore extensions of the material covered in the videos, collaborate with your peers, and have the chance to ask questions.

Readings and text: Biological Science by Scott Freeman and colleagues. 6th edition. Students will read and annotate the text and interact with each other using Perusall. Please follow our instructions to purchase a version of the text that works with Perusall.

Reserve reading: Articles and other readings found on class Moodle site.

Classroom etiquette and electronics: No electronic devices – including (but not limited to) phones, laptops, and tablets – may be used in class without my prior permission. Computers and other electronic devices may be allowed during some portions of some class sessions. However, you

absolutely may not use electronic devices for activities that are not associated with the class. This includes sending texts, surfing websites, watching YouTube, doing work for another class, or anything else. Doing so not only prevents you from attending to the classwork, but also is distracting to other students. If you require a computer for note-taking other video or audio recordings of the class may only be made with permission of the instructor.

Community and inclusion: We adhere in this class to the following principles articulated in the Kenyon mission statement. Embracing Differences: We commit to engaging a wide range of viewpoints, developing compassionate thinkers who value and embrace diverse cultures and identities. We believe equitable access to opportunity is essential to fostering a community in which every person has a sense of full belonging and the tools to reach their full potential. Kindness, Respect, and Integrity: We treat one another with respect and kindness, speaking with sincerity and acting with integrity, for we recognize the fundamental dignity of all. This unifies us across our backgrounds, identities, and positions. Practicing these challenging ideals connects us to the best parts of what makes us human. We support a culture in which we contribute to the well-being of others while we also care for ourselves.

How to do well in this class:

- **Stay in contact with me.** If you have a question, problem, or are concerned with how you are doing in this course, contact me by e-mail, phone, during office hours or in class. If at any time, you feel that you do not have the proper background to understand the material that is being presented, please let me know.
- **Attend class.** Exams are based on the material we cover in lecture. Lectures will cover some material not contained in the readings.
- **Complete your Perusall reading assignments *before* each class meeting.** Take notes while you are reading, and review your class notes and reading notes while working through problems as you prepare for exams and quizzes.
- **Ask questions.** If something is unclear, ask me in class, email me or visit with me during office hours to discuss your problem. Please know that you do not need a specific question to come to office hours, often these one-on-one discussions clarify concepts and problems well beyond the original intent of the student.
- **Work together** to review material outside of class. While this is challenging in the current environment, setting a regular Google Meet with a study partner to review concepts and teach someone else the material will reinforce your own understanding.
- **Practice.** Learning biology is like learning an instrument or sport. It requires active practice. You can practice by answering questions in the book. The blue *Check Your Understanding* questions are a very good study guide, and will let you know if you understood the material in the previous section adequately or if further review is needed. At the end of each chapter the *Test Your Understanding* and *Test Your Problem-Solving Skills* are good questions to work on. Relying solely on the *Test Your Knowledge* questions will not sufficiently prepare you for the exams. Answer these questions on paper first, then check answers with your peers or MSSC tutors.
- **Go to the Math and Science Skills Center.** The MSSC is designed to provide assistance with math and the sciences. It is available for your use during the semester from 7-10 PM on Sunday, Tuesday and Thursday evenings.

Communication: Check your Kenyon e-mail daily. I will send the class notices via e-mail. Please contact me if you have any questions or concerns. Office hours and e-mail are the best ways to make contact with me. I check my e-mail routinely during the normal working day. E-mail is also a good first contact to make; we can arrange an in-person meeting if necessary. Please note that I generally will not check my e-mail in the evening; please do not expect rapid responses to e-mails sent in the evening.

Office hours. Office hours will be held remotely in two formats: individual and group. Group office hours will give you a chance to have your questions answered and to hear your peer's questions and answers. If you have general questions about the course material, we encourage you to attend these sessions. Individual office hours allow you to meet individually with the instructor. These are good for questions about the course material that don't get answered in the group sessions, conversations about how to study effectively, and more general conversations about your interests in biology and beyond. You don't need a specific reason to attend an office hour meeting – feel free to drop in to introduce yourself and say hi.

Grading distribution: The student's numerical grade will be transformed to a letter grade in accordance with this schedule: A (90-100%), B (80-89%), C (70-79%), D (60-69%), F (<60%). In converting percentage grades to letter grades, any amounts less than 0.50 will be rounded down, and amounts equal to or greater than 0.50 will be rounded up, e.g. 69.49 = D and 69.50 = C-. Grade weighting may be adjusted on an individual basis under special circumstances, but never to decrease an individual's grade.

- 48% - Four scheduled exams
- 12% - Cumulative final exam
- Flexible distribution (40% total)
 - 10% - Quizzes and other assignments
 - 10% - Creative connections
 - 10% - Perusall annotations
 - 10% - Participation and attendance

To allow you to focus on aspects of the course that best suit your interests and abilities, a flexible point distribution system will be applied to the non-exam assignment: 20% of the total class grade can be applied to one of the non-exam categories, with the remaining 20% split among the other non-exam categories. Improvement across the semester will be reflected in increased weight given to later exams and assignments.

Class attendance: Class attendance is an important part of the learning in this course. COVID-19 could disrupt the semester for individuals or for the entire class. Thus, it is especially important that you do not miss class unnecessarily. On the other hand, please do not attend class if you are not feeling well. If you cannot attend class or complete work due to illness or COVID-19 related circumstances contact the appropriate college officials and let me know of the disruption to your academic work as soon as possible. Note that you are not obligated to disclose any specific health or private information. Please be assured that I will work with you and college officials to determine needed adjustments.

Class participation and Perusall: To participate fully in class, you must thoughtfully read the assigned material before each meeting; the Perusall assignments will help you engage with the material before

each class. Students are expected to come to class prepared to actively engage the material. There are many ways to participate in class: ask for clarification, pose a question, link disparate ideas together, draw on your own experience. Raise your hand – it's clear that students in all classes do better when they are engaged in the material. I will call on people randomly and also in response to raised hands. Your participation will count toward your final grade.

Exams and quizzes: Exams will generally be a combination of multiple choice, short answer and essay questions. Please note that the exams will cover material presented **in lecture** and not necessarily in the textbook.

Exam schedules are listed on the course Moodle site. Please note that exam dates are subject to change depending upon how the course progresses. Changes to the schedule will be announced at least one week prior to the exam. If you anticipate missing an exam due to illness, contact me as soon as possible and before the exam is administered. During exams, you will not be permitted to use textbooks, notes, calculators, text messaging devices or any other source materials *unless otherwise noted*.

Quizzes will be distributed throughout the semester and will be based on recent lecture material or the assigned reading. The goal of these quizzes is to give students an opportunity to assess their understanding of the material as the course progresses. Quizzes may be administered in-class or asynchronously via Moodle.

Creative connections: One way to better understand material is to make it your own by doing something creative with it or by connecting it to something else in your life. You must submit at least 4 across the semester to receive full credit. At least one should be submitted during each exam interval. You may submit up to 8 across the semester. If you submit more than 4, I will apply the best four grades to your creative connection grade and apply the rest to your participation grade. Only one may be submitted per week. If you submit more than one in a week, I will only count the first submission. Weeks are Monday - Sunday. Details on these assignments can be found in the document "Creative Connections Assignment" posted on the course Moodle page.

Academic Honesty: Kenyon College is, at the core, an intellectual community of scholars – students and faculty – engaged in the free and open exchange of ideas. Critical to this lively exchange and deep engagement with ideas is the academic integrity of our work, both inside and outside the classroom.

Please read carefully Kenyon College's statement regarding Academic Honesty: <http://www.kenyon.edu/directories/offices-services/registrar/course-catalog-2/administrative-matters/academic-honesty-and-questions-of-plagiarism/> Plagiarism, cheating, or academic dishonesty of any kind will not be tolerated. You are strongly encouraged to review these policies thoroughly. If you have any questions about what constitutes dishonesty in the context of this course, please ask.

Academic accommodations: Students who anticipate they may need accommodations in this course because of the impact of a learning, physical, or psychological disability are encouraged to meet with me privately early in the semester to discuss their concerns. In addition, students must contact Erin Salva, Director of Student Accessibility and Support Services (740-427-5453 or salvae@kenyon.edu), as soon as

possible, to verify their eligibility for reasonable academic accommodations. Early contact will help to avoid unnecessary inconvenience and delays.

Non-discrimination and responsible employee: As a faculty member, I am deeply invested in the well-being of each student I teach. I am here to assist you with your work in this course. If you come to me with non-course-related concerns, I will do my best to help. It is important for you to know that all faculty members are mandated reporters of any incident of harassment, discrimination, and/or intimate partner violence and stalking. Meaning, I must report any such discussion to the Civil Rights/Title IX Coordinator. I cannot keep information involving sexual harassment, sexual misconduct, interpersonal violence, or any other form of harassment or discrimination based on a protected characteristic, confidential. The Health and Counseling Center, the College chaplains, and the staff at New Directions Domestic Abuse Shelter & Rape Crisis Center are confidential resources.

For further information, please refer to the following Kenyon College policies:

- Sexual Misconduct & Harassment: Title IX, VAWA, Title VII:
<https://www.kenyon.edu/directories/offices-services/ocr/title-ix-vawa/kenyon-policies/title-ix-policy/>
- Discrimination & Discriminatory Harassment Policy (non sex or gender):
<https://www.kenyon.edu/directories/offices-services/ocr/discrimination/>
- ADA & Section 504:
<https://www.kenyon.edu/directories/offices-services/ocr/discrimination/504-ada-grievance/student-grievance-procedure-resolving-complaints-under-ada-section-504/>

Copyright of Course Materials: Copyright law protects course materials created by the faculty instructor, such as slide presentations, handouts, assignments, and videos. You may share these materials with other students enrolled in the course. You may not reproduce, distribute, or display course materials for anyone outside of the class without the faculty member's explicit, written consent. I may record or live-stream class sessions. Students are not permitted to record class sessions without the permission of the instructor.

Covid 19 contingency: The structure of this course is well suited to responding to Covid-19 related complications:

- Individual students who must quarantine but are able to continue doing work can continue to watch pre-class videos and annotate the textbook. Those who are available at 11:10 can attend the remote section (please e-mail Prof. Gillen - gillenc@kenyon.edu - for permission to attend and the videoconference link.) Those who are not available to attend at 11:10 should contact their instructor.
- In the case that we need to go fully remote, synchronous sections will be held by videoconference.
- There are three instructors teaching four sections. If one of us gets sick, the others will try to cover.

Lecture Schedule: The course schedule of reading assignments and a brief description of the subject to be discussed in each class are posted on the course Moodle site and will be updated there, as needed.

Date	Topic	Reading (Freeman 6th section #s)
8/31	What is Life? What is energy?	1.1, 1.2, 1.3, 1.4, 2.3
9/2	History of Life: Prokaryotic and eukaryotic cells	1.5, 7.1, 7.2, 7.3
9/4	History of Life: Capturing energy and increasing complexity	Judson paper, 5.3, 9.1
9/7	Gases and animals - respiratory systems	39.3, 42.1, 42.2, 42.3
9/9	Gases and animals - hemoglobin (proteins)	42.4
9/11	Gases and animals - circulatory systems	42.5
9/14	Water and plants - vascular tissue, transpiration	34.2, 35.1, 35.2
9/16	Plant sugar transport	35.4
9/18	Exam 1	
9/21	ST: The limits to tree height?	Koch et al. 2004
9/23	Plant-microbial nitrogen fixation	36.4, p 1101-1103
9/25	Species interactions	1093-1100
9/28	Trophic Cascades	52.2
9/30	Community Structure	52.4, 53.1
10/2	Population Biology	51.3
10/5	Climate change / carbon cycle	2.1, 53.3
10/7	Climate change / biomolecules	2.2, 6.1
10/9	Climate change / biomolecules	6.2, 6.3
10/12	Membrane transport - glucose uptake by secondary active	6.4
10/14	Cytoskeleton	7.6, 3.1, 3.2
10/16	Exam 2	
10/19	Gallery Day 1	
10/21	Lysosomes / phagocytosis	7.5
10/23	Carbohydrate digestion, absorption	5.1, 5.2, 5.3, 41.3
10/26	Glucose regulation, insulin	39.4, 41.4
10/28	Gallery Day 2	
10/30	Overview of cell respiration	8.1, 8.2
11/2	Metabolic pathways and enzyme kinetics	8.3, 8.4, 8.5
11/4	Glycolysis and fermentation	9.1, 9.2, 9.3, 9.6
11/6	Special topic - Anoxia	research article
11/9	Mitochondria and endosymbiosis	27.3
11/11	Citric acid cycle	9.4
11/13	Oxidative phosphorylation	9.5
11/16	Thermoregulation - (thermogenesis, uncouplers)	39.5
11/18	Exam 3	
11/20	Photosynthesis - overview and evolution	10.1, 10.2, p 547-548
11/23	Photosynthesis - light reactions	10.3
	Thanksgiving	
11/30	Photosynthesis – calvin	10.4
12/2	CO ₂ and plants - C ₃ , C ₄ and CAM	10.4
12/4	Synthesis - TBD	
12/7	Synthesis - TBD	
12/9	TBD	