Animal Physiology

Syllabus

Course Description. Lectures and laboratories are concerned with the mechanisms by which animals function. The prevailing theme is the biology of the whole animal. Regulative and integrative mechanisms in animal organ systems are examined. Students may receive Biology elective credit for this course or BIOL 365/366 but not both. Restricted to majors. Prerequisites: Proficiency in Basic Requirement and BIOL 300 or BIOL 335. Offered every spring. Credits: 0–4.

Course Meetings.

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<thead>
<tr>
<th>Day</th>
<th>Time</th>
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<tr>
<td>Monday, Wednesday, Friday</td>
<td>10:30 – 11:20 am</td>
<td>Newton 209</td>
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<tr>
<td>Thursday Morning Lab</td>
<td>10:00 am – 12:50 pm</td>
<td>ISC 203</td>
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<tr>
<td>Thursday Afternoon Lab</td>
<td>2:30 – 5:20 pm</td>
<td>ISC 203</td>
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Instructor. Dr. Mackenzie Gerringer  ISC 255  gerringer@geneseo.edu

Office Hours. Wed. and Fri.: 1:00 – 2:30 pm and By Appointment

Office hours are your time for getting questions answered, course expectations clarified, advice on pursuing opportunities or careers in science and more. Please email me (gerringer@geneseo.edu) or chat before/after class if you have questions or would like to set up a meeting outside of office hours.

Course Objectives. In our course, we will:

- Explore the basic physiological principles common to humans and other animals, relating structure to function.
- Compare physiological systems across the animal kingdom, including through in-depth topic presentations.
- Integrate our understanding of physiology across levels, from molecular to organismal, and understand interactions between different physiological systems.
• Gain hands-on experience in animal physiology, hypothesis formation, experimentation, and data analysis through both established protocols and independent research projects in the lab.
• Synthesize original data and evidence from the literature and communicate our findings in written, oral, and visual form, improving our science communication skills.

How this course fits into your biology education... This course serves the following Biology Program Learning Outcomes:

1. Students will have the knowledge base and intellectual (conceptual) framework to use reasoning and problem-solving skills to; (1) read critically, (2) evaluate support for competing hypotheses, and (3) critique experimental design. Level: Mastery.
2. Students will have the laboratory and inquiry skills and technical ability to formulate hypotheses, design and run experiments using instruments to test their hypotheses, and analyze and interpret the results. They will be able to build on earlier work to design further experiments. Level: Mastery.
3. Students will be able to communicate biological ideas from literature or their own laboratory investigations to audiences of biologists and non-biologists in a variety of formats including written reports, poster and oral presentations. Level: Reinforcement.
4. Students will recognize the importance of scientific integrity and ethical research and applications of biology to science policy. They will be able to work independently and in teams for life-long learning. Level: Reinforcement.
5. Students will be able to demonstrate a broad and diverse background in biology and related sciences and a strong foundation for graduate and professional programs of study or employment. Level: Reinforcement.

Course Expectations. Much of the value of this course will come from our in-class activities and discussions. Therefore, attendance is required and active participation will be part of your course grade. There are many ways to be an active participant in this course, including attending class, asking questions, contributing to class discussions in lecture and on Canvas, posting current research in Animal Physiology to our Canvas page, and coming to office hours. Lab attendance is required; missing more than one lab will result in a zero for the lab component of the course.

Course Materials. Our required textbook is Animal Physiology: From Genes to Organisms. Sherwood, Klandorf, & Yancey. An e-book version can be purchased from the bookstore and there is a copy available on four-hour course reserve.

Making the most of the textbook: Textbooks are a great resource, but highlighting every line and trying to memorize the book will only get us so far. Instead, try this approach: Before class, spend 10–15 minutes skimming through that day’s reading. Look for major themes, new
vocabulary words, and important figures. Ask yourself what questions you have from looking briefly at this section. Jot down a few notes. Then, attend class. After class, write the major takeaways from that day down for yourself. What questions do you still have? Now, read the textbook. Your familiarity with the topics should make it easier to follow and remember the reading. Write down the important notes from this section for your future reference. What questions do you still have? Bring them to class the next day. To check your understanding and prepare for exams, try teaching the material to someone else.

*Scientific Papers.* We will also explore current research in animal physiology. Four required readings from the primary literature are available on Canvas. Article response worksheets will help you develop strategies for reading scientific papers and serve as notes for future reference. Please submit these article responses for three of the four readings. For the other reading, we will have a mini-journal club to discuss the studies, questions we come across, and what we’d do next to advance the field. You may choose which reading you’d like to discuss in person. Sign up for these discussions in class the week of the article response.

*Course Technology.* Additional materials will always be available on Canvas for those looking to dive deeper into these topics. We have discussion threads and pages for questions about the course, material, or research opportunities. If you see internship opportunities or neat physiology news, please share! We will also be learning and using some common tools for analyzing physiological data, including R. All software will be freely available to download, with links provided on Canvas.

**Assignments & Assessment.**

Assessment in this course will be based on the following, out of a total of 500 points.

**Article Responses**  
10% of grade  
Four scientific journal articles will supplement the textbook reading and allow us to explore specific animal systems in detail. For three articles, write a short response on the worksheet provided (10 points each). Article responses must be written in your own words to receive credit. For one article, join the instructor in groups of three for a short (~25 min) journal club discussion on the reading (20 points). See schedule below for article due dates.

**Comparative Physiology Talks**  
15% of grade  
We have the opportunity to not only explore physiological systems, but to compare the physiology of multiple animals to gain insight into adaptation and evolution. In a well-researched and well-synthesized talk, you will dive into a specific system and compare the physiology of ~three related species
using the scientific literature. These 10-minute talks will take place throughout the semester, corresponding to our weekly themes. **At least** two weeks prior to your talk, please submit a topic and formatted sources for review. The earlier you submit a topic, the earlier you will get feedback. You will be assigned two talks to peer review. Reviews should be submitted to Canvas by the Monday after the talks.

**Sign-Ups**  
Jan 31<sup>st</sup>

**Topic Submission**  
Two Weeks before Talk  
15 points

**Talks**  
Throughout Semester  
50 points

**Talk Reviews**  
Monday after Talks  
10 points

**Adaptation Display**  
10% of grade

Create a beautiful and informative interpretive sign for a public audience that would appear at a national park, describing physiological adaptations of a species of your choice.

**Topic & Source Check**  
Feb 14<sup>th</sup>  
15 points

**Adaptation Displays**  
March 13<sup>th</sup>  
35 points

**Mid-Term Exam**  
March 4<sup>th</sup>  
10% of grade

Closed-book exam covering the first half of our semester (Ch. 1–6). A student-led review session will be held before the exam. Students requiring testing accommodations should consult with the instructor in the first two weeks of class.

**Final Exam**  
May 12<sup>th</sup>  
15% of grade

Closed-book exam synthesizing the content we’ve learned throughout our semester (Ch. 1–16). A student-led review session will be held before the exam. Students requiring testing accommodations should consult with the instructor in the first two weeks of class.

**Lab Assignments**  
8% of grade

To make the most of our lab time, please read the lab protocol thoroughly prior to our lab session. Each lab will have an accompanying worksheet (5 pts each) that should be submitted at the beginning of lab the following week.

**Lab Worksheets**  
Week Following Lab  
40 points total
Lab Research Projects

In our lab, we have the opportunity to conduct independent research projects in animal physiology. In small groups, you will develop hypotheses, devise and conduct an experiment, collect and analyze your data, and write up your findings. Our last lab will be a research symposium where we will share our results in 5-minute lightning talks.

- Research Proposal: March 30th, 15 points
- Research Update & Intro: April 9th, 10 points
- Research Paper: April 30th, 50 points
- Lightning Talk: April 30th, 35 points

Participation

Earn full credit for participation (50 pts) by attending both lecture and lab and engaging in discussions and activities. You will not be evaluated on whether your insights are "right" or "wrong" during discussions, think critically and be actively involved. Contributing to Canvas discussions is another way to earn participation credit.
Resources & Policies.

Lab Policies. Safety is our first priority. Close-toed shoes and long pants/skirt are required for participation in lab. Please be mindful of your own safety and the safety of your peers. Detailed lab policies will be discussed in class and available on Canvas and in the lab manuals.

Some lab activities involve measuring aspects of our own physiology, such as heart rate. These self-subject experiments are valuable learning opportunities, but are entirely voluntary. Students will not be penalized for electing not to participate. Please see the instructor for alternative activities the week before the lab. Note that all experiments are for educational, rather than medical, purposes. Please consult your primary care physician for health recommendations.

Late Work Policy. Talk deadlines will vary depending on which subject you sign up for. It is your responsibility to keep track of all deadlines. If you have questions, please don’t hesitate to ask. Late work will only be accepted with extenuating circumstances. All late work accommodations need to be discussed in advance of the due date. Any questions on assignment grades need to be submitted within two weeks of receiving feedback for grade revisions to be considered.

Library Research Help. The Milne Library staff can help you develop strategies for finding and citing good sources. They have created online research guides, self-help databases, and are available for individual consultation. Research Librarians are available for walk-in consultations and students may request appointments with staff experts in particular fields. Full information on Milne Library research resources, hours, and consultation options is available at www.geneseo.edu/library/ask-us.

Academic Integrity and Plagiarism. All work submitted in this class needs to be in your own words. This includes article responses and lab worksheets. For lab worksheets, you may discuss questions in groups, but each person needs to write their own original responses to questions. Submitting uncredited work in any form will result in a zero for the assignment. Milne Library offers online workshops to help students understand how to paraphrase, quote, and cite outside sources properly. These sessions are meant to educate about the importance of using original ideas and language, and how to incorporate paraphrases and quotes into writing. The complete list of library workshops can be found at:

www.geneseo.edu/library/library-workshops

Academic dishonesty includes cheating, knowingly providing false information, plagiarizing, and any other form of academic misrepresentation. Academic dishonesty will not be tolerated in this course. College policies and procedures regarding academic dishonesty are available at:

www.geneseo.edu/handbook/academic-dishonesty-policy

Computer and Technology Support. For assistance with your computer or mobile device, visit the CIT HelpDesk in Milne Library. CIT provides self-help guides on a range of computer issues, including access to the campus network, Canvas, printing, software guides, and other resources. The CIT Self Help Guides at wiki.geneseo.edu/display/cit/CIT+Self+Help can be helpful in finding quick solutions to basic technology issues. CIT also provides free access to over 7,500 online tutorials for software, digital tools, web development, programming, and design through linkedin.com/learning.
Course Accessibility. We will be more than happy to make reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities. Accommodations will be made for medical conditions related to pregnancy or parenting. Requests for accommodations including letters or review of existing accommodations should be directed to the Office of Disability Services in Erwin Hall 22 or disabilityservices@geneseo.edu or 585-245-5112. Students with letters of accommodations should submit a letter to each faculty member at the beginning of the semester and discuss specific arrangements. Additional information on the Office of Disability Services is available at www.geneseo.edu/dean_office/disability_services.

Roles & Responsibilities. **Student:** inform the instructor no later than the first week of the semester of any accommodation(s) you will or may potentially require.

**Instructor:** maintain strict confidentiality of any student’s disability and accommodations; support all students to meet the learning objectives of this course.

Student Well-Being is prioritized in this class, to support the achievement of academic goals and alleviate stress. Concerns about academic performance, health situations, family health and wellness (including the loss of a loved one), interpersonal relationships and commitments, and other factors can contribute to stress. Students are strongly encouraged to communicate their needs to faculty and staff and seek support if they are experiencing unmanageable stress or are having difficulties with daily functioning. Please feel free to reach out to me if you have questions or concerns. The Dean of Students (585-245-5706) can also assist and provide direction to appropriate campus resources. For more information, see www.geneseo.edu/dean_students.

Mental Health Resources. As a student, you may experience a range of challenges that can impact your mental health and thus impact your learning; common examples include increased anxiety, shifts in mood, strained relationships, difficulties related to substance use, trouble concentrating, and lack of motivation, among many others. These experiences may reduce your ability to participate fully in daily activities and affect your academic performance.

SUNY Geneseo offers free, confidential counseling for students at the Lauderdale Center for Student Health and Counseling, and seeking support for your mental health can be key to your success at college. You can learn more about the various mental health services available on campus at health.geneseo.edu.

Food Security. SUNY Geneseo students who find themselves in a position of food insecurity and do not have the financial resources to support their food and nutrition needs can access the Geneseo Groveland Food Pantry located at the First Presbyterian Church, 31 Center Street in Geneseo. Students can utilize the pantry once with no referral or contact with the College. At this visit they will be provided items that will address their basic needs for several days. If a student continues to face difficulties providing for their own nutritional needs beyond their first visit to the pantry they should connect with Susan Romano, Director of Financial Aid to receive a brief letter that they will present to the staff at the pantry that verifies their need. If students do not have a FAFSA on file for any reason they should contact Dr. Leonard Sancilio, Dean of Students, to discuss their particular situation and options. The Geneseo Groveland Food Pantry is open on the following days and times:
Tuesday: 10 AM – 2 PM  
Wednesday: 4 PM – 6:30 PM  
Thursday: 10 AM – 2 PM

If you have any questions please contact Dr. Leonard Sancilio, Dean of Students at: sancilio@geneseo.edu or 585-245-5706.

Information Regarding the Use of Animals for Teaching Purposes. This is an Animal Physiology course. The course attempts to introduce students to the discipline of physiology by examining physiological organ-systems, as well as the molecular principles that underlie higher level integrative bodily functions. The laboratory component of the course serves to emphasize and reinforce the topics discussed in lecture. Many of the laboratory exercises in this class use reductionist models, computer simulations, and/or use student subjects for non-invasive measurements of physiological parameters. In some cases, however, it is not possible to effectively teach physiological principles by these methods. Therefore, a few laboratory exercises use animal subjects to demonstrate the importance of the physiological principles being discussed. Every effort is made to ensure humane treatment of these animals. Disrespectful treatment of lab subjects will not be tolerated.

Some students find it difficult to take part in the experiments in which animals are used. These students should meet with the instructor as soon as possible. In cases in which the student does not wish to participate in these experiments, alternative exercises may be assigned instead. If you think that you may have difficulties with the animal experiments, please talk to me as soon as you can.

For information regarding responsible use of animals in teaching and biomedical research, please visit the web sites of the following societies/organizations:

- American Physiological Society (www.the-aps.org)
- Federation of American Societies for Experimental Biology (www.faseb.org)
- American Association for Laboratory Animal Science (www.aalas.org)
- Association for Assessment and Accreditation of Laboratory Animal Care International (www.aaalac.org)
- Institutional Animal Care and Use Committee (www.iacuc.org)
BIOL 364: ANIMAL PHYSIOLOGY

SCHEDULE

Week 1: Foundations of Physiology
- Jan. 22  Welcome to Animal Physiology
- Jan. 23  Lab 1: Lab Introduction, Equipment Tutorial
- Jan. 24  Foundations of Physiology

Week 2: Homeostasis & Feedback
- Jan. 27  Homeostasis & Feedback
- Jan. 29  Cellular & Molecular Physiology
- Jan. 30  Lab 2: Heat & Countercurrent Exchange Lab
- Jan. 31  Cellular & Molecular Physiology

Due: Sign up for a Comparative Physiology Talk
Complete Avoiding Plagiarism Tutorial on Canvas

Week 3: Cells, Molecules, & Membranes
- Feb. 3   Cellular & Molecular Physiology
- Feb. 5   Membrane Physiology
- Feb. 6   Lab 3: Metabolism Lab
- Feb. 7   Membrane Physiology Cuculescu et al. 1995

Due: Article Response, Cuculescu et al. 1995, Crab Membranes

Week 4: Neuronal Physiology
- Feb. 10  Neuronal Physiology
- Feb. 12  Neuronal Physiology
- Feb. 13  Lab 4: Physiological Genomics Lab
Feb. 14  Nervous Systems & Talks  5.1–5.3
          Due: Adaptation Display Topic & Source Check

Week 5: Nervous Systems
Feb. 17  Nervous Systems  5.4–5.7
Feb. 19  Nervous Systems  5.8–5.9
Feb. 20  Lab 5: Earthworm Action Potential Lab
Feb. 21  Nervous Systems & Talks  Yopak et al. 2019
          Due: Article Response: Yopak et al. 2019, Shark Brain Morphology

Week 6: Sensory Physiology
Feb. 24  Sensory Physiology  6.1–6.3
Feb. 26  Sensory Physiology  6.4–6.6
Feb. 27  Lab 6: Cockroach Sensing Lab
Feb. 28  Sensory Physiology & Talks  6.7–6.9

Week 7: Mid-Term Check-In
Mar. 2   Mid-Term Review  Ch 1–6 Summaries
Mar. 4   Mid-Term Exam
Mar. 5   Lab 7: Digestion Lab
Mar. 6   Endocrine Systems  7.1–7.4

Week 8: Endocrine & Muscle Systems
Mar. 9   Endocrine Systems  7.5–7.8
Mar. 11  Muscle Systems  8.1–8.2
Mar. 12  Lab 8: Thermoregulation Lab
Mar. 13  Muscle Systems & Talks  8.3–8.4
          Due: Adaptation Displays
Mar. 16–20 Spring Break

Week 9: Skeletomuscular Physiology
Mar. 23  Muscle Physiology  8.5–8.6
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<th>Date</th>
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<tbody>
<tr>
<td>Mar. 25</td>
<td>Muscle Physiology</td>
<td>8.7–8.8</td>
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<tr>
<td>Mar. 26</td>
<td>Lab 9: Muscle Contraction Lab</td>
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<td>Mar. 27</td>
<td>Skeletal Systems &amp; Talks</td>
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<td></td>
<td>Dacke et al. 1993</td>
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<td>Due: Article Response: Dacke et al. 1993, Calcium in Birds</td>
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**Week 10: Circulation**

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<tr>
<td>Mar. 30</td>
<td>Circulatory Systems</td>
<td>9.1–9.5</td>
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<td>Due: Lab Project Proposal</td>
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<td>Apr. 1</td>
<td>Circulatory Systems</td>
<td>9.6–9.10</td>
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<td>Apr. 2</td>
<td>Lab 10: Independent Research Projects</td>
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<td>Apr. 3</td>
<td>Circulatory Systems &amp; Talks</td>
<td>9.11–9.16</td>
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**Week 11: Defense & Respiration**

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<th>Section</th>
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<td>Apr. 6</td>
<td>Defense Systems</td>
<td>10.1–10.4</td>
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<td>Apr. 8</td>
<td>Defense Systems</td>
<td>10.5–10.8</td>
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<td>Apr. 9</td>
<td>Lab 11: Independent Research Projects</td>
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<td>Due: Lab Report Introduction &amp; Project Update</td>
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<tr>
<td>Apr. 10</td>
<td>Respiratory Systems &amp; Talks</td>
<td>11.1–11.5</td>
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**Week 12: Respiration & Excretion**

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<tr>
<td>Apr. 13</td>
<td>Respiratory Systems</td>
<td>11.6–11.10</td>
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<td>Apr. 15</td>
<td>Excretory Systems</td>
<td>12.1–12.10</td>
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<tr>
<td>Apr. 16</td>
<td>Lab 12: Independent Research Projects</td>
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<td>Apr. 17</td>
<td>Excretory Systems &amp; Talks</td>
<td>Farmer &amp; Sanders 2010</td>
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<td>Due: Article Response: Farmer &amp; Sanders 2010, Alligator Lungs</td>
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**Week 13: Fluid & Acid-Base Balance**

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<tr>
<td>Apr. 20</td>
<td>Fluid Balance</td>
<td>13.1–13.4</td>
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<td>Apr. 22</td>
<td>Great Day</td>
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<td>Apr. 23</td>
<td>Lab 13: Independent Research Projects</td>
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<tr>
<td>Apr. 24</td>
<td>Acid-Base Balance &amp; Talks</td>
<td>13.5–13.8</td>
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### Week 14: Digestion & Thermoregulation

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<tr>
<td>Apr. 27</td>
<td>Digestive Systems</td>
<td>14.1–14.10</td>
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<tr>
<td>Apr. 29</td>
<td>Thermal Physiology</td>
<td>15.1–15.4</td>
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<td>Apr. 30</td>
<td>Lab 14: Research Symposium</td>
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<td>Due: Final Lab Report, Lightning Talks</td>
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<tr>
<td>May 1</td>
<td>Thermal Physiology &amp; Talks</td>
<td>15.5–15.8</td>
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### Week 15: Putting it Together

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<th>Topic</th>
<th>Sections</th>
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<tr>
<td>May 4</td>
<td>Reproductive Physiology &amp; Talks</td>
<td>16.1–16.7</td>
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<tr>
<td>May 6</td>
<td>Putting it Together: Final Review</td>
<td>Ch 1–16 Summaries</td>
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<td>May 7</td>
<td>No Classes, Extended Office Hours</td>
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### Week 16: Final Exam

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<tr>
<td>May 13</td>
<td>Final Exam, 8 am – 11:20 am</td>
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