If you strive to think and communicate like a scientist in your work throughout the semester, in the end, you will be a scientist and really know biology (Think like a serious scientist, not like a pretend one).

LECTURER
Douglas B. Luckie, Ph.D., Associate Professor, Lyman Briggs College / Department of Physiology
Holmes Hall Office: W-26D, Phone: 353-4606, E-mail: luckie@msu.edu

LEARNING ASSISTANTS
Ashley Hare (hareashl@msu.edu)
Alisha Ungkuldee (ungkuld1@msu.edu)
Jad Mourad (mouradj1@msu.edu)

COURSE WEBSITE
http://msu.edu/course/lb/144/

TEXTBOOK

COURSE PACK
"LB-144 Course Pack," Fall 2019 (Dr. Luckie) at Collegeville Textbook Company, E Lansing.

LB-144 = LB-144 (LECTURE) & LB-144L (LAB) OVERVIEW OF CLASSES
There are two overreaching goals in these two connected classes.

1.) To gain a fundamental comprehension of the cellular & organismal processes of life and an appreciation why it is important to understand these processes.

2.) To learn how to think like a scientist and be able to adaptively negotiate a question or problem.

The Cell & Organismal Biology course (lecture and lab combined) is an exploration of life at all levels. It examines the interplay of genes, cells, and chemistry allowing organisms to live, survive, and interact with each other and the environment, all within a scientific framework. Specifically, we will study genes (molecular biology) and the chemistry of living cells inside organisms (cell biology), organisms and their environments (ecology), genetic variation and inheritance (genetics), and the interactions of the environment, ecology, and genetics over time (evolution) that led to the diversity of life observed on the planet today. Our lecture meets twice a week as two 80-minute class meetings. In this class, you will have daily homework yet lecture will not "cover" all of it. In lecture we will review some of the readings and examine how the scientists performed their work. This approach is aimed at mentoring you so you master the ability to Think like a serious scientist, not like a pretend one.

WORKLOAD
The first semester of Biology is a 4-credit course (LB144) that consists of two connected classes (lecture 3 credits, laboratory 1 credit) and because it is two classes it requires twice as many hours of work as one class. For any university-level course, for each credit, you are expected to spend 2-3 hours/week outside of class studying and working on homework assignments. There will be a certain amount of preparation that you, and your group, will need to do before each lab and readings that you will need to complete (with notes taken) before each lecture. You will be expected to master quite a bit of new material to expand your knowledge of life and science. Come to lecture and lab well-prepared, or mastering the new material may take much longer and may be far more difficult than you expect, or is necessary.
SCHEDULE
Both the lecture schedule and the lab schedule are found in the syllabi pages. We reserve the right to modify the schedule if necessary. You will be given advance warning if the schedule needs changed.

OFFICE HOURS
Prof. Douglas Luckie: Tues/Thurs. 5-6pm office W-26D Holmes, as well as appointments. Note: If there is a line of people waiting, each person will be limited to 10min. with Prof. (yet you can rejoin line).

ACADEMIC HONESTY
Turnitin.com will allow you to review assignments prior to submission. If you are caught cheating you will be assigned a “0” for the assignment or the entire course. The policy for academic honesty at LBC is http://www.lymanbriggs.msu.edu/current_students/academics/AcademicPolicies.cfm

GRADING
Your grade in this course (LB144) is based on the total number of points earned in the both the lecture portion and the laboratory portion of the course. The course will be graded on a flat scale.

4.0= 90-100%  3.5= 85-89.9%  3.0= 80-84.9%  2.5= 75-79.9%  2.0= 70-74.9%  1.5= 65-69.9%  1.0= 60-64.9%  0.0= <60

A “3.0” score is considered Excellent. It is impressive work, top of the class, and the work was done extremely well but nothing beyond what was expected.
A “3.5” is Most Excellent. Every detail of the work was done extremely well, and they found additional papers and evidence beyond what they were told.
A “4.0” is Outstanding. It has the 3.0, 3.5-level elements + student impresses instructor with how much/well they did the work. They taught Prof something.

Late Policy: Assignments are due in lab/lecture at the beginning of the session indicated (at time of entering room) unless otherwise specified. If an assignment is 1 day late, 1 point will be deducted from the final score. After this 24 hr grace period, the penalty becomes more severe: 20% off for two days late, 30% off for three days and so on. After 5 days, you will receive a “0” for the assignment.

Rejected Manuscripts/Reports: Each time a paper/film is “rejected”, because it did not follow the Instructions to Authors, 1 point is deducted. This is independent of the Late Policy, both can occur.

Blind grading: Whenever possible we will score assignments "blind" and ask you not indicate your name but just list your PID. This enables grading to be more fair and not be impacted by subjectivity etc.

*Formal written grade appeal process: If you feel that your assignment was not graded properly, you must submit your concern via appeal in writing (on paper, not via email). You must concisely explain why you object to the assigned grade and what elements of your work in fact demonstrate you mastered the material. Please be advised that if you submit a formal grade appeal about one element of an assignment, we always re-grade your entire exam, paper or quiz and the score may increase, decrease or stay the same. For group assignments, all authors must sign the written request since re-grading may impact all. How well you provide your claim, evidence and reasoning will be assessed, and students who provide good logical arguments supported well by solid relevant evidence will earn approval (you may cite pages of textbooks, or even better, published research papers). Avoid emotional arguments that blame others or arguments based on hearsay, e.g. “I heard from a student” “A TA told me this was correct.” If you neither make logical arguments or provide thoughtful evidence to support them, your appeal will not gain traction or be approved. All discussion concerning score changes must be completed within 7 days from the date the grade was officially posted (on the returned assignment or online). No grade changes will be considered after this time. If illness or other emergency prevents you from completing assignments on time, you must make arrangements with your instructor before the due date (example appeal provided in course pack).
LB144 Biology Learning Goals

1. (Short version): **Get practice at doing science.** Apply the process of science to answer questions about nature.

Longer version of the same thing: **"skills"** goals are for you to gain practice & excel in these scientific practices:

a) **Design:** Develop a hypothesis, make predictions, and design experiments to test them (e.g. design an experiment to determine whether it's change in temperature or sunlight that causes leaves to turn red in Fall).

b) **Analyze:** Interpret evidence collected during experiments, look for patterns and different ways to represent data, and use logical and/or quantitative reasoning to defend or reject hypotheses (claims).

c) **Collaborate:** Confidently cooperate in teamwork, and practice team building, communication and leadership. (e.g. use techniques like "that's a good idea, OK, how can we improve it?" "Jon, you haven't spoken much, what do you think?")

d) **Communicate:** Converse to a variety of audiences important for scientists: (Ben says: "Their data predicts squirrels will hit light speed!" Jen responds: "But they have zero data at that part of the graph.")

1. **Speaking:** practice speaking and listening to others in large & small groups.

2. **Reading:** practice careful and critical reading of text, identification of important points & ideas, as well as slow deliberate reading and interpretation of figures and graphs.

3. **Writing:** practice composition of text, writing manuscripts, building figures and graphs.

4. **Thinking:** practice identifying data and evaluating author's evidence-based arguments.

e) **Code:** Read & manually write hypertext markup language (html) software code to author online manuscripts (use <tags> to build a html based report of research findings with hyperlinked text and image/video figures)

f) **Reflect:** Develop personal learning goals and regularly reflect on your progress during the semester. (e.g. regularly consider "OK, what I am supposed to be learning here? Have I mastered that topic? What next?")

2. (Short version): **Study Biological forms of "Information".** Learn mechanisms to store/transmit information at molecular, cell, organismal, population levels.

Longer version of the same thing: **"content"** goals are for you to understand, describe, and give examples of how:

a) Heritable information (like DNA/genes) provides for continuity of life and non-heritable information (like talking) is also transmitted within and between biological systems.

b) Imperfect information transfer, like during reproduction of cells, chromosomes, and genes, leads to variation of traits among individuals. (e.g., How beach mice have light colored fur because a mutation in the melanocortin receptor gene makes it difficult for them to make dark hair pigment)

c) Interactions among organisms and the environment determine individual survival and reproduction. (e.g., How and why do Anolis lizards choose their mates?)

d) Selection (and other mechanisms) acts on individuals and leads to the evolution of populations. (e.g., Why can human misuse of antibiotics result in new species of bacteria?)

e) Information in DNA (and mutations) -> becomes (transcribed) information as RNA -> becomes (translated) information as proteins (e.g. How does a cell make insulin? Transcription make mRNA?)

f) The information in a molecule (like amino acid sequence) determine structure and the 3D structure of a molecule determines its function (and influence its evolution). (e.g. the CFTR protein looks like a roll of toilet paper in the cell membrane, turns out it's an ion channel)

g) Small organic molecules (nucleotides, amino acids, lipids, carbohydrates) when built into polymers can associate to create large cellular surfaces and compartments to perform biochemical processes (called life).

3. (Critical): Transfer of Learning: Be able to use or apply your skills and/or knowledge learned in one situation to another new situation or context.
Integrating Concepts in Biology (ICB): What is so insanely great about this textbook?

Over the past 50 years, research in biology has become more quantitative and interdisciplinary, relying more heavily on other sciences. To understand large, rapidly changing ecosystems, or to make sense of massive amounts of data from the Human Genome Project, today's biologists must be able to use modern mathematical, statistical, computational, and technological tools.

Biology instruction has not kept pace with research into how people learn. Studies on learning reveal that: students learn best if they are actively engaged working both individually and in groups together constructing their own knowledge [this is also how scientists work]. The textbook Integrating Concepts in Biology takes advantage of these insights and enables you to better achieve your full learning potential by directly involving you in your own learning¹.

You will be asked to construct your own knowledge by analyzing and interpreting published data. As you gain knowledge, you will find you can learn more and retain new information more easily. Our classroom discussions will help you learn how to read text and scientific figures. The case study (scientific stories) approach in the textbook provides a context in which you can connect new information. You will be able to learn major concepts by reading about several examples in more depth. The textbook readings, online homework and in class discussions will guide you in interpretation, analysis and will help you build your new skills and knowledge.

The textbook does five things that experts² have always said “should be done” in biology textbooks:

1. **Historical (HPS) data**: You are presented with questions and the published historical research data used to answer the questions. You interpret historical data that were analyzed by biologists in the context of answering each framing question.

2. **Hierarchy/Scale**: BIG biology (organismal) and little biology (molecular/cellular) is addressed together, integrated. The text integrates across the biological size hierarchy and scale.

3. **Big Ideas**: The text focuses on five big ideas, so that you learn that these big ideas of biology and levels do not exist in isolation.
   - 1) **INFORMATION**: Living system's mechanisms to store, retrieve, and transmit information.
   - 2) **EVOLUTION**: The diversity and unity of life can be explained by the process of evolution.
   - 3) **CELLS**: Cells are a fundamental structural and functional unit of life.
   - 4) **EMERGENT PROPERTIES**: Interdependent relationships give rise to emergent properties.
   - 5) **HOMESTASIS**: Biological systems maintain energy and matter homeostasis.

4. **Math**: Mathematics is used as an important tool and is intimately associated with each case. Self-contained Bio-Math Explorations (BMEs) help you understand how math is applied to answer questions and improve comprehension of biology. The math is readily accessible, ranging from simple arithmetic, algebra, and geometry, to more challenging examples in probability, statistics and modeling.

5. **HPS ethics**: Finally, the text raises your awareness about ELSI (ethical, legal, and social implications) topics your HPS instructors and Lyman Briggs College want you to consider. You engage with case studies of ethics and real-world implications of the biology you are learning.


**THE LECTURE**

**ASSIGNMENT SCHEDULE**

**SHORT READINGS, QUIZZES & MISCELLANEOUS EXERCISES:**
Researchers have found increased structure and active learning increase everyone's ability to learn in introductory biology courses. In addition, every student in our course really does want to slowly carefully read the textbook, learn new information and enjoy mastering topics in biology. Traditional university science courses often require students to read numerous pages in the textbook before each lecture. But since people are busy the reading occurs at the very last minute, and it's not effective to learn material by reading 20+ pages of a science textbook in one sitting. Given we believe the textbook we are using is outstanding, we are structuring short readings with integrating question in the course so you more carefully read each section and reflect upon it.

A quiz or exercise based on the reading may be given each lecture. These quizzes/exercises are designed to help you assess your own learning before and between exams. They provide you with regular feedback as to how well you are mastering each topic. Quizzes may be written multiple choice or essay-style. You will write answers in your carbonless paper notebook so you can turn in your answer and keep a copy. Take-home written exercises may be given as a homework assignment. They are designed to improve your skills and test your ability to apply new concepts.

**ATTENDANCE AND PARTICIPATION:**
It is essential that you not only come to class but also actively participate in order to construct your own knowledge. While attendance is being "present", participation includes reading and preparing well for class, answering questions verbally (via microphone), and by clicker questions.

**EXAMS:**
There will be two midterm exams in the lecture course, each may be comprehensive of prior material. Midterm exams may use traditional multiple-choice format or may be essay-style (even take-home). If take-home exams are used, answers must be submitted online to [http://turnitin.com/](http://turnitin.com/) and as a hard copy at the start of lecture. Because MSU requires final course grades to be submitted 48hrs after the final exam, on the final exam we often must use multiple-choice format.

**Assignments (pts):**

<table>
<thead>
<tr>
<th>Week</th>
<th>Assignment</th>
<th>@Lecture</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(all)</td>
<td>Attendance, Participation, Homework, Quizzes</td>
<td>X</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Exam I <em>(Multiple choice or Essay)</em></td>
<td>X</td>
<td>75</td>
</tr>
<tr>
<td>10</td>
<td>Exam II <em>(Multiple choice or Essay)</em></td>
<td>X</td>
<td>75</td>
</tr>
<tr>
<td>15</td>
<td>Final Exam <em>(Multiple choice)</em></td>
<td>X</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Total 300 pts

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## CELL AND ORGANISMAL BIOLOGY (LECTURE), FALL 2019

**SCHEDULE:** Lecture meets Tuesday & Thursdays 10:20-11:40pm in C-106 Holmes Hall

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Readings in lecture (emphasis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug.  Th, 29</td>
<td>Information &amp; Evolution at all levels</td>
<td>Chapter 18 (18.1 crickets call)</td>
</tr>
<tr>
<td>Sep.  T, 3</td>
<td>Info/Evol at Ecological System Level</td>
<td>Chapter 18 (18.1 frogs sing)</td>
</tr>
<tr>
<td>Th, 5</td>
<td>Info/Evol at Ecological System Level</td>
<td>Chapter 18 (18.3 corals settle)</td>
</tr>
<tr>
<td>T, 10</td>
<td>Info/Evolution at Population Level</td>
<td>Chapter 17 (17.1, 17.2 fireflies)</td>
</tr>
<tr>
<td>Th, 12</td>
<td>Info/Evolution at Population Level</td>
<td>Chapter 17 (17.2 storm petrels)</td>
</tr>
<tr>
<td>T, 17</td>
<td>Info/Evolution at Population Level</td>
<td>Chapter 17 (17.3 meerkats)</td>
</tr>
<tr>
<td>Th, 19</td>
<td>Info/Evolution at Population Level</td>
<td>Chapter 17 (17.3 cont.)</td>
</tr>
<tr>
<td>T, 24</td>
<td><strong>EXAM I</strong></td>
<td></td>
</tr>
<tr>
<td>Th, 26</td>
<td>Information at Organismal Level II</td>
<td>Chapter 16 (16.1 blood pressure)</td>
</tr>
<tr>
<td>Oct.  T, 1</td>
<td>Info/Evolution at Organismal Level II</td>
<td>Chapter 16 (16.1 sandworts &amp; barnacles)</td>
</tr>
<tr>
<td>Th, 3</td>
<td>Info/Evolution at Organismal Level II</td>
<td>Chapter 16 (16.3 flu vaccines)</td>
</tr>
<tr>
<td>T, 8</td>
<td>Info/Evolution at Organismal Level I</td>
<td>Chapter 3 (3.1 Gregor Mendel)</td>
</tr>
<tr>
<td>Th, 10</td>
<td>Info/Evolution at Organismal Level I</td>
<td>Chapter 3 (3.1 Mendel &amp; SBE1 case)</td>
</tr>
<tr>
<td>T, 15</td>
<td>Information at Organismal Level I</td>
<td>Chapter 3 (3.3 <em>E.coli</em> cell division)</td>
</tr>
<tr>
<td>Th, 17</td>
<td>Information at Organismal Level I</td>
<td>Chapter 3 (3.4 kangaroo mitosis)</td>
</tr>
<tr>
<td>T, 22</td>
<td>Info/Evolution at Organismal Level I</td>
<td>Chapter 3 (3.5 mitosis &amp; meiosis)</td>
</tr>
<tr>
<td>Th, 24</td>
<td>Info/Evolution at Organismal Level I</td>
<td>Chapter 3 (3.5 meiosis &amp; ELSI 3.2)</td>
</tr>
<tr>
<td>T, 29</td>
<td><strong>EXAM II</strong></td>
<td></td>
</tr>
<tr>
<td>Th, 31</td>
<td>Information at Cellular Level</td>
<td>Chapter 2 (2.1 RNA types)</td>
</tr>
<tr>
<td>Nov.  T, 5</td>
<td>Information at Cellular Level</td>
<td>Chapter 2 (2.3 RNA translation)</td>
</tr>
<tr>
<td>Th, 7</td>
<td>Information at Cellular Level</td>
<td>Chapter 2 (2.4 insulin &amp; NCBI)</td>
</tr>
<tr>
<td>T, 12</td>
<td>Info/Evolution at Molecular Level</td>
<td>Chapter 1 (1.1, 1.2 Griffith &amp; Avery)</td>
</tr>
<tr>
<td>Th, 14</td>
<td>Info/Evolution at Molecular Level</td>
<td>Chapter 1 (1.4 DNA structure)</td>
</tr>
<tr>
<td>T, 19</td>
<td>Information at Molecular Level</td>
<td>Chapter 1 (1.5 HELLO epigenetics)</td>
</tr>
<tr>
<td>Th, 21</td>
<td>Evolution at Molecular Level</td>
<td>Chapter 4 (4.1, ELSI 4.1 evolution)</td>
</tr>
<tr>
<td>T, 26</td>
<td>Evol/Origin of Life at Molecular Level</td>
<td>Chapter 4 (4.2 Miller, origin of life)</td>
</tr>
<tr>
<td>Thanksgiving Break, Nov. 28-29</td>
<td></td>
<td></td>
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</tbody>
</table>

| Dec.  T, 3  | Evol/Origin of Life at Molecular Level           | Chapter 4 (4.3 vesicles & energy) |
|           Th, 5  | Evol/Origin of Life at Molecular Level           | Chapter 4 (4.4 vesicles & energy) |

**Th, 12** (tentative time/date) **FINAL EXAM** finals week, 10am-12noon, C-106 Holmes Hall
LB-144L: CELL & ORGANISMLAL BIOLOGY I (LAB), FALL 2019

LECTURER
Douglas B. Luckie, Ph.D., Associate Professor, Lyman Briggs College & Dept. Physiology

TEXTBOOK

COURSE PACKET

COURSE WEBSITE
http://www.msu.edu/course/lb/144

UNDERGRADUATE LEARNING ASSISTANTS:
Ali Kadouh (kadouhal@msu.edu)
Huda Warsame (warsameh@msu.edu)
Maggie Leff (leffmagg@msu.edu)

RESEARCH TEAM RATIONALE
Student groups are intended to be research & learning teams. Work with other students to study and discuss biology topics in lecture, as well as share your ideas and research predictions in lab. Teams are better learning environments but also, they are REAL LIFE. While scientists do some things on their own, they more often work in groups to solve problems because a well-functioning team is the most efficient way to work. Working in the same group in both laboratory and lecture will allow you to become more familiar with each other so you will feel comfortable enough to discuss your biology questions. Although it is easier for an instructor to run a class or lab without group work, numerous research studies have shown that working in groups and discussing science with your peers can increase your learning considerably (if strive to be a cooperative group). By pooling your knowledge, your group will get “stuck” less often and be able to go far beyond what any individual could do.

RESEARCH PROJECT
You will document your research in writing and film. Your group will create: (1) an online research paper with figures that include graphs, photos, short clips of audio/video, and (2) a short (10min) documentary film that disseminates your research to increase public understanding of science.

<table>
<thead>
<tr>
<th>Week</th>
<th>Laboratory Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orientation to modern biology and project intro (catme.org).</td>
</tr>
<tr>
<td>2</td>
<td>Form Groups, Scientists, Innate techniques at field site</td>
</tr>
<tr>
<td>3-4</td>
<td>Proposal due (2§ Intro/Methods paper), Proposal Talks</td>
</tr>
<tr>
<td>5-6</td>
<td>Interviews: In-lab &quot;LA Interviews&quot;</td>
</tr>
<tr>
<td>7</td>
<td>Half-Draft due (2§+ Results/Figs paper)</td>
</tr>
</tbody>
</table>
| 7-13 | Interviews: Inside & outside-lab "Prof Interviews"
| 8    | Final film (documentary) due |
| 9-12 | Independent Investigations (continued until complete) |
| 13   | Final paper (DRAFT 1) due |
| 14-15| Final Findings Presented: Final Talks |
THE LABORATORY

This semester, you will design and pursue one experiment all semester long. You will find an interesting animal behavior related to communication that has been studied and published in the literature (like a mating display) and attempt to document it when observing animals on campus (like squirrels & humans). 4.0-seeking students will also connect the behavior to a gene. Your group will capture your observations with still photographs and digital video from your smartphones. Ultimately, you’ll generate a short 5-minute documentary film showing the results of your research, as well as write a formal research manuscript. Each week, inside and outside of lab, you will examine and practice the methods of a scientist in performing your research. This approach is aimed at mentoring you, so you master the ability to think and work like a serious scientist.

1. You will need the Laboratory Guide resources provided in the Course Pack. Review the lab guide materials required for each week during the semester.

2. Make plans and read the appropriate section(s) in your lab guide or research literature before you go to lab. Get an idea what the lab will be about as well as what your group would like to do this week. Be prepared to printout and bring hardcopies of any extra materials you are asked to bring to lab. Your lab class meets once a week for 3-hours in room C-4 Holmes Hall.

ASSIGNMENT SCHEDULE

<table>
<thead>
<tr>
<th>Speaking (points)</th>
<th>Writing (points)</th>
<th>Discussing/Demonstrating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal Presentation= 11</td>
<td>Proposal Paper= 13</td>
<td>LA interview= 20</td>
</tr>
<tr>
<td>Final Presentation= 20</td>
<td>Half-Draft Paper= 36</td>
<td>Prof interview= 50</td>
</tr>
<tr>
<td>Documentary Film=up to 40ec</td>
<td>Final DRAFT1 Paper=60</td>
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</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Assignment(s) Due</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4</td>
<td>Proposal paper &amp; Presentation</td>
<td>13, 11</td>
</tr>
<tr>
<td>5-6</td>
<td>LA Interview in lab (group, provided questions)</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Half-Draft Paper</td>
<td>36 (rubric x2)</td>
</tr>
<tr>
<td>7-13</td>
<td>Prof Interview outside lab (individual, provided questions)</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>Documentary Film (group, optional, extra credit)</td>
<td>40 (100% ec)</td>
</tr>
<tr>
<td>13</td>
<td>Final Paper (Draft1)</td>
<td>60 (rubric x2)</td>
</tr>
<tr>
<td>14-15</td>
<td>Final Presentation</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>200 pts</td>
</tr>
</tbody>
</table>
The "Honors Option" and extra opportunities for learning (optional)

*Note: The Honors Option for LB144 this semester is presenting your group’s research findings as a talk at the UURAF during the Spring Semester. This is required to be an individual assignment (not as a group) and a talk (not a poster) if you seek individual credit for your Honors Option. Be aware the UURAF application deadline(s) are often in January.

FYI: All students who find themselves interested in research as a potential career path can take advantage of the REU programs (http://www.nsf.gov/crssprgm/reu/) mentioned in class and listed online, as well as these opportunities (below).

Check out this info and ask Dr. Luckie and LAs for more information on these topics if they are of interest to you.

1. UNDERGRADUATE RESEARCH WORKSHOPS
   Workshops with topics that usually include strategies for pursuing research opportunities on campus, preparing oral and poster presentations, abstract writing, and graduate school. Visit urca.msu.edu/event for an up to date listing

2. RESEARCH SEMINARS
   Every week a variety of research seminars occur on campus on cutting edge topics (viruses, stem cells, climate change, gene mapping, diseases caused by mutant genes etc).

3. UNIVERSITY UNDERGRADUATE RESEARCH AND ARTS FORUM (UURAF)
   UURAF provides MSU undergraduates with an opportunity to showcase their scholarship and creative activity. UURAF brings together an intellectual community of highly motivated students to share their work with faculty, peers, and external audiences. Registration opens in January and closes mid-February. For more information, visit http://urca.msu.edu/uuraf.

4. LYMAN BRIGGS RESEARCH SYMPOSIUM
   Every Spring Semester Lyman Briggs College holds a research forum of its own.

5. FUNDING FOR STUDENT CONFERENCE TRAVEL
   The MSU undergraduate research office can provide additional funding to support students who are presenting research at a conference or meeting. Visit urca.msu.edu/faculty/funding for details on how to apply for this money. Funds are also available from Lyman Briggs.
Owner's Manual
(with lots of ideas and text stolen from great authors, Drs. Alice Dreger and Tanya Noel)

Why is this an "owner's manual" instead of a syllabus?
Most syllabi contain only class schedule information. By contrast, this is more like an "owner's manual" like the sort that comes with a new car. If you read and use this manual, you will understand how this course works, and you will be able to keep the course running smoothly, and do the regular maintenance required to avoid breakdowns. Of course, this course isn’t a car. It’s more like a bus tour. I believe that a university course is in its essence not a number, and not a topic, but a group of people who share a common goal of learning about some particular thing. In this sense, a course is like a bus tour, a tour to a place which is unfamiliar to most of us. As the teacher, I am the bus driver and chief tour guide. Each member of the course starts off at “home” intellectually and emotionally and comes to the bus station which is the classroom. We agree to “take the tour” together, to get on the bus and travel together for the length of the course even though many of us may never have met before. Together we visit a number of different "places."

So why is this "owner's manual" so long?
I've discovered that the more information I give students, the more comfortable and in control they feel, and the better they learn. This packet contains lots of information. Besides telling you about the mechanics of the course, this packet tells you a lot about my teaching style. I used to provide my students with a separate "statement of teaching philosophy." It now occurs to me it is weird to separate that teaching philosophy from my teaching materials. So now my philosophy is embedded throughout this packet. My teaching style, methods, and philosophy change over time, thanks to students who tell me what works and what doesn't work. I'm counting on you to give me lots of feedback about what is working for you and what is not, and most importantly why. It is very important to me to do a good job for you. In addition to the LB145 course learning objectives provided earlier, be aware this course aligns with the following MSU Undergraduate Learning Goals:

Analytical Thinking
A successful student uses ways of knowing from mathematics, natural sciences, social sciences, humanities, and arts to access information and critically analyzes complex material in order to evaluate evidence, construct reasoned arguments, and communicate inferences and conclusions.
- Acquires, analyzes, and evaluates information from multiple sources.
- Synthesizes and applies the information within and across disciplines.
- Identifies and applies, as appropriate, quantitative methods for defining and responding to problems.
- Identifies the credibility, use and misuse of scientific, humanistic and artistic methods.

Effective Communication
A successful student uses a variety of media to communicate effectively with diverse audiences.
- Identifies how contexts affect communication strategies and practices.
- Engages in effective communication practices in a variety of situations and with a variety of media.

Integrated Reasoning
A successful student integrates discipline-based knowledge to make informed decisions that reflect humane social, ethical, and aesthetic values.
- Critically applies liberal arts knowledge in disciplinary contexts and disciplinary knowledge in liberal arts contexts.
- Uses a variety of inquiry strategies incorporating multiple views to make value judgments, solve problems, answer questions, and generate new understandings.
**How does this course work in terms of the day-to-day?**

We will meet two times a week for the lecture class and our meetings will consist of discussions of the readings and activities related to the topics we are investigating. Do the readings assigned for the day *before* you come to class and spend enough time thinking about the readings before class. You should come to class ready to summarize the readings and to ask and answer questions about them. Homework or quizzes will often be given on the readings.

Always give yourself plenty of time to do your work, and feel free to contact me whenever you need help or clarification. I like teaching and not only do I feel good when you learn, often when you learn something new, I learn, too.

Generally, we will stick very closely to the attached schedule, however, the point of this class is for you to learn, so if we need to change our scheduled plans to achieve that goal, we will do so. If you feel that you need things to be done somewhat differently in class in order for you to learn better, please let me know and I will work to adjust our schedule or classroom dynamics so that we can maximize learning.

**So what’s my feeling about teaching?**

I love it! And I think it shows – my students have voted me “honorary member of the graduating class of Lyman Briggs” (“teacher of the year”) about five times in the last fifteen years, I was given the Teacher-Scholar Award of MSU, and most recently the 2015 MSU Alumni Club of Mid-Michigan Quality in Undergraduate Teaching Award (nominated by MSU faculty and alumni for teaching) and the 2017 Outstanding Faculty Award by the ASMSU Senior Class Council (nominated by MSU graduating seniors for teaching). If you hear that I am tough, I am, but that’s because I care about your learning. If I didn’t care about your learning, I would have stayed at Stanford University.

I am delighted to have recruited amazing LAs to help you do well in the course. You will find that our LAs share my love of teaching, of biology and dedication to helping you learn. But they are tough too because they want you to learn, lots. They are trained to answer your questions with responses in the form of guiding questions. Why? because it helps you learn and *remember*, and they know your next class (and career) will be far more difficult and demanding than this course, you know this too.

**What else besides being in class will be required of you?**

Note that this course uses a wider range of assignments than just several exams. This spreads out risk and stress so it's lower level, day to day, and allows you to assess your own learning with lower-stake quizzes to avoid any surprises when facing the bigger exams. All points are weighted equally, and, in that sense, grades are pretty simple – and you can always check your total on the online D2L gradebook – but be sure to keep your own spreadsheet and alert me if my grade data has an error.

- **Quizzes on readings:** I will frequently give short quizzes on a day’s assigned reading at the beginning of the class meeting. These quizzes accomplish two things: (1) reward you for keeping up-to-date on the readings; (2) reward you for spending enough time on the readings to really understand them. If you read carefully, you should have little problem with the quizzes. If you have a lot of trouble with short, fast quizzes, remember
there are lots of bonus options in this class you can use as substitutions. If you miss a quiz because you are late or absent, you will receive a "0". These cannot be made up.

- **In-class "carbonless" papers:** A number of times this semester I will ask you in class to write a relatively short essay response to a specific question related to the course. These assignments are designed to help you reflect on the course material and to provide me with some feedback on your thinking process. If you are absent, you will receive a "0" on the "carbonless" paper. These cannot be made up.

**A note on grades & FERPA:**
To support blind-grading we will often request that you not list your actual name but just provide your PID. Privacy, as required by MSU FERPA regulation, will be maintained by utilizing a code that is NOT your real A-PID, so we'll call it your B-PID. Your B-PID will be listed on D2L in your personal gradebook.

Backstory: In recent years universities have become very afraid of getting in trouble for breaking the law called FERPA (Family Educational Rights and Privacy Act). The law was created back in 1974 to protect the privacy of students and their grades. In response to it all universities created student ID numbers so instead of placing a grade next to a person's name, instructors could place it next to a student number to maintain privacy. Many universities chose to use a student's social security number to also be their student number. When identity theft became a big problem, universities then changed all their student ID numbers from social security to become some number randomly generated in house. In recent years now the student ID number itself has become protected. In fact, while other people are permitted to know your name, and even say it aloud and post it publicly, the student ID number is super protected. Thus, instead of using your officially MSU-issued A-PID, in this course MSU requires that we issue a new temporary student ID. We will call these the B-PID, since they are for "who you be" and it's for blind grading.

Professors can use grades in two ways: they can use grades to "sort" students into "A" students, "B" students, etc.; or they can use grades as learning incentives and rewards. Unfortunately, the sorting system generally sorts according to "talents" students either have or don't have before they ever reach a particular classroom, e.g., the talent of being able to memorize and recall a lot of things. I would rather use grades to encourage students to develop their skills, to expand their minds and interests. While students are often only familiar with positive curving (sometime called a mother's curve) a number of university classes use an actual curve that raises or lowers the grading scale with the goals to only permits a few students (like just 10 in a class of 100) to earn a 4.0 and then only a few (perhaps 20) are permitted to have a 3.5 etc. Even if everyone in the class got above a 90% on an exam the grade scale would shift up until only the prescribed number of students got a 4.0 grade. This is a real "curve" and, I will never grade on a curve like this. Our grading scale with stay exactly as stated in the syllabus and each student will get whatever grade she or he has earned by the end of the semester. Nothing would make me happier than if everyone worked hard and learned a lot and got 4.0’s. I would feel that we had achieved something great if everyone got a 4.0.
Table 1- University-level grading system: The table below describes the relationships between grades, percent, and performance in the University-level grading system used in the LB-145 lab and lecture courses. The first column describes the letter/number grade. The second column describes the percentage associated with that grade. The third column describes the performance-level required to earn that grade.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percentage</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (4.0)</td>
<td>90 to 100%</td>
<td>Outstanding Work - A “4.0” is Outstanding. It literally stands out. It has the characteristics described for 3.0 and 3.5-level elements but in addition, the work by itself impressed with how much &amp; well it was done. The student taught Prof something original.</td>
</tr>
<tr>
<td>B+ (3.5)</td>
<td>85 to 89.9%</td>
<td>Most Excellent Work - A “3.5” is Most Excellent. Every detail of the work was done extremely well and they found additional papers and evidence beyond what they were told.</td>
</tr>
<tr>
<td>B (3.0)</td>
<td>80 to 84.9%</td>
<td>Excellent Work - A “3.0” score is considered Excellent. It is impressive work, top of the class, and the work was done extremely well but nothing beyond what was expected.</td>
</tr>
<tr>
<td>C+ (2.5)</td>
<td>75 to 79.9%</td>
<td>Pretty Good Work - A “2.5” is Pretty Good, the student did the minimum work required and did a pretty good job, this is expected at the university level and near average for the class.</td>
</tr>
<tr>
<td>C (2.0)</td>
<td>70 to 74.9%</td>
<td>Average Work - A “2.0” is average, the student did the minimum work required.</td>
</tr>
<tr>
<td>D+ (1.5)</td>
<td>65 to 69.9%</td>
<td>Below Average Work - the student did less than minimum work required.</td>
</tr>
<tr>
<td>D (1.0)</td>
<td>60 to 64.9%</td>
<td>Poor Work - the student did less than minimum work required and of poor quality.</td>
</tr>
<tr>
<td>F (0.0)</td>
<td>0 to 59.9%</td>
<td>Failing Work - the student did far less than minimum work required and very poor quality.</td>
</tr>
</tbody>
</table>

Remember, if at any point you feel confused or distressed about your grades, carefully review the syllabus and then please come and talk to me.

Course Structure
This course will use a public website and online tools like Turnitin, CATME, Desire2Learn, and Top Hat. The course website may include online lessons, course materials, and additional resources. Activities may consist of readings, discussion forums, email, journaling, wikis, and other online activities. You will need your MSU NetID to login to the course to access the grades on D2L (http://d2l.msu.edu).

Technical Assistance
If you need technical assistance at any time during the course you can:
- Visit the Desire2Learn Help Site (http://help.d2l.msu.edu/)
- Visit the TopHat Support Site (https://success.tophat.com/s/)

Resource Persons with Disabilities (RCPD)
- To make an appointment with a specialist, contact: (517) 353-9642
  Or TTY: (517) 355-1293
- Web site for RCPD: http://MYProfile.rcpd.msu.edu
Definitions, terms, transparency

Admission: I believe caffeine and sugar increase attention and learning but have no empirical data to support this, except for eating donuts, that is documented to work, but just for 15 minutes post-eating. I like the drink called the Cortado (it’s coffee, like a tiny latte) but particularly enjoy the moment I pour cane sugar out of the brown paper packet on top of the frothed milk and watch it sink into the drink. When you come to office hours, unless there’s a rush, I’ll likely offer you an espresso. Just sayin’.

Attendance: Student learning is impacted by many things, yet education research has robustly shown it is significantly impacted by these three things: class size, teacher quality and attendance. You are, of course, permitted to skip any class meeting you wish but often a single clicker point is made available to you, to encourage attendance since it correlates with learning. Attendance at the meeting of a class will be defined as being physically present in the room for the full time period of the class meeting. Thus be present, in your seat with you notebook open and pen in hand, at the very beginning when the clock in room strikes the hour and class begins, still there during/throughout the entire duration of the class, as well as at the very end of the official time period (feel free to come and go to visit the restroom, just not off vacationing elsewhere). It’s only fair to treat students who arrive late exactly the same as those who depart early. We will often reward students for attendance by using technology to record your presence. If you fail at using your device to click-in for attendance at the beginning middle or end of class, due to whatever reason, be aware we do not micromanage the attendance data (no appeals). Making the choice to schedule another course that has a start or finish time that is proximal or even overlaps with this class is, of course, your choice and entirely acceptable. Yet this will not change the definition of attendance or waive it. University students are adults and literally everything in a course is optional, yet if you want points, in this case for attendance (and more importantly to learn) you have to be there.

Belong: Lyman Briggs College is dedicated to promoting inclusion and fostering diversity. Let’s make our classroom comfortable and welcoming for everybody. Let’s strive to treat everyone with respect, civility, and empathy and rather than avoid new things to learn from others about different beliefs, practices, and lives. You are all super wonderful smart people, and all belong here.

Blind grading: When a computer scores a scantron bubble sheet from a multiple-choice exam, it is objective, it doesn’t have a pre-conception as to which students are smart, or are nice to it, so it treats everyone the same and just rewards correct answers. Unfortunately, human graders are less objective. LAs, GTAs, and Profs, are all unable to be perfectly objective when they have already had interactions with the person whose work they are grading. While they try hard to be so, education research shows that even knowing what the person’s name is will impact the grader and grade (even if they never met the person). Thus, imagine if they know the person reasonably well. If they have read prior papers, knew the person’s prior grades, or had a number of positive (or negative) conversations with them. Wow, that will cause major problems when trying to be objective while grading, even for the best teacher ever, unless the grader is blind to the identity of the author. Professional journals and grant review panels use single blind or double-blind systems to avoid subjective evaluation. We will use this in our class too.
Opera: Do you like the Opera? I am sucker for a good Italian opera with tenors belting out classic arias. Yet, related to attendance, while strolling into class 3, 5, 7, 15 minutes late may feel like a choice, e.g. “I’m an adult”, sure, but distracting the learning of other students in the room, who paid thousands of dollars for the class, is a problem and it does impact their learning. Part of my job is to protect student learning from distraction. If ten students turn up late to a class each day it meets, and they arrive at different moments, e.g. 3, 5, 7, 15 minutes late, the students in the room are distracted regularly and significantly. Consider how distracting that is when people come in when you’re trying to watch a movie at the cinema. Thus, please avoid trickling in and instead gather with other late arrivers and usher yourselves in all at one moment whenever possible.

Participation: It turns out participation is different than attendance. It refers to a student who is actively working to learn the materials discussed in the course. Students who are active participants do not merely talk during class but also prepare in advance for class. This means carefully completing the readings, taking notes on them (best for learning, do this by handwritten notes on paper) and preparing for the upcoming class meeting by reviewing notes and highlighting any questions you thought of while preparing for class. To reward this behavior, which enhances learning, often there will be a pop quiz or problem or writing exercise during class which is scored. Also, there are clicker questions during lecture, and you earn a point each time you chose a correct answer. You only need to get half of all clicker points to earn a perfect 100% score for participation. And, if you go above that level, all those extra clicker points become extra credit for you to use to help fill in for any points you lost on other assignment in the course. If you prepare for class, you’ll get lots of points and if you don’t you get less. This helps increase the number of people that ultimately decide they need to study the material prior to class and as a result also learn more when discussing the material again in class. If you prepare, class is fun and interesting. If you don’t it becomes confusing and frustrating, as it feels like everyone else seems to know all the answers while you don’t even understand the questions.

Random calling in lecture: How often have you been in a big lecture class that has maybe 8 students who are the only people who ever are called upon to answer the professor’s questions in lecture? The other 100+ students throughout the entire semester will generally never speak aloud during lecture. After a while you get used to it. Everyone knows that “those students” answer the questions, so we don’t have to, cool. Yet, deep down you also know, while it’s comfortable to never have to answer a question, it likely reduces your learning, heck some folks fall asleep. My wife tells a story about a small class where the Professor always asked these incredibly difficult questions that nobody ever even understood. Then one day, near the end of the semester, she did the reading prior to class and during class realized that ever single question the instructor asked was directly out of the reading. She was embarrassed because she realized they must know nobody does the reading, given no student ever understood the questions he asked even though they were right out of the first pages of each reading. Because our goal in this class is learning we will use random calling in lecture to help “everyone” increase their learning and gain skills at communication/public speaking.

Viewing Star Wars & The Matrix on your laptop during class: I was a youngster in 1977 when the first Star Wars film came out and really enjoyed it. Also really thought The Matrix was fantastic back when it came out. Yet, even though I love those films, I am aware it is incredibly distracting to other students when someone near them in class has their laptop’s massive vivid screen open displaying films or email or Instagram or Twitter
or working on finishing a paper due in their next class, or all of the above simultaneously. Thus while you can temporarily open a laptop to use it as a clicker or check the textbook for a few minutes, if you feel you must just leave it open for long periods of time, watch movies or other, wear headphones and sit in a seat where no students can be behind you. Similar to sitting in class and opening a big old-fashioned newspaper, opening a big screen that is like a vivid active billboard is not permitted if it distracts others. On the other hand, small tablets that lay flat in front of you, like a notebook, may be used whenever and wherever you like, since they are not as “in your face” as a near vertical screen can be. But don’t prop up your tablet like a laptop. You are allowed to distract yourself but not others (Glass, A. L., & Kang, M. (2019). Dividing attention in the classroom reduces exam performance. Educational Psychology. VOL. 39, 3, 395–408).

---"Tips from Tanya": Some points for students about technology in the classroom

**Author:** Dr. Tanya Noel

Almost everyone has a smartphone, laptop, tablet, or combination of these devices with them during their waking hours (and beyond, in some cases). There is huge potential for distraction using these devices – which is fine if you’re waiting in a long, boring line or on the bus, but can be problematic in the classroom. Be aware of:

- There have been studies that have shown **“multi-tasking” in class is detrimental to learning.** (Actually, the evidence overwhelmingly suggests humans can’t really multi-task … or, at least, can’t multi-task well!) If you’re trying to go back and forth between course-related stuff and other websites (or assignments for other courses, etc.), this will affect how well you’re learning/working.

- **Notifications (e.g., beeps/vibrations for new emails, text messages, etc.) are highly distracting,** and feed into “reward systems” in the brain that can reinforce behaviors like frequently checking your phone, Facebook, etc. (You know that uncomfortable feeling that makes you check your phone/email? Your brain gets a dopamine hit when you give into that urge … and makes it more likely to continue the behavior leading to the reward.) **Consider turning off these notifications,** at least during class and other times when you want to be able to focus uninterrupted. (Some people have found turning off notifications altogether has helped them not only focus, but reduced their stress levels!)

- **Online videos are highly distracting in class to students nearby.** (They’re obviously distracting to the person with the device, but they chose to be distracted!) If you really have to watch video in class, please make sure the sound is off (or you’re wearing headphones), and sit somewhere out of sight of others (e.g., back corner of room).

- **Note-taking on computers (vs. by hand) is associated with lower-quality learning/test scores.** Results from some recent studies support the idea that writing notes by hand on paper is superior to taking notes on the computer. There are a number of hypotheses about this, but many experts agree that taking notes by hand involves more thinking about what’s important and worth writing down (as you can’t transcribe every word spoken by the professor). On the computer, it is tempting to try to record everything verbatim, with the brain not processing much of the information.
References:


Chapter Checklists for each lecture

I strongly suggest attaching each sheet for the current week to your “work wall” (e.g. bulletin board) in your room where you can see it at a glance and literally check-off items as you complete them.

Before first day of class:

**Obtain supplies for course:** online textbook, course pack, carbonless-paper notebook, lecture notebook and TopHat online homework system. *See course website for more details ([msu.edu/course/lb/144/](http://msu.edu/course/lb/144/))

1. _______ **Buy** ($13) the **LB144 Lecture & Lab Course Packet** (for students in Luckie’s sections) at the Collegeville Textbook Store at 321 E. Grand River Ave in East Lansing ([ctcmsu.com](http://ctcmsu.com), 517-922-0013). This Course Pack contains the syllabus, lecture handouts, learning objectives, lab manual, lab notebook, scientific papers and more. A pdf of the Course Pack is also available on the course website for easy 24/7 access.

2. _______ **Buy** ($26) our online **Integrating Concepts in Biology (ICB) textbook**. Do **not** buy an expensive $259 Biology textbook! Please just buy this $26 online textbook. **Note:** this textbook is custom-assembled just for this class, so be sure to buy Luckie's version of the ICB textbook ([http://trunity.org/textbooks/](http://trunity.org/textbooks/)).

3. _______ **Buy** (~$7) a **Carbonless-Paper Notebook** for in-class writing exercises (you write, it also makes a copy, you can turn in one copy and keep the other): Buy this cheap online (like at [Amazon](http://amazon.com)), or you can always find one at the SBS bookstore at 421 E. Grand River Ave in East Lansing, in the "Lab Notebook" section ([sbsmsu.com](http://sbsmsu.com), (517) 351-4210).

4. _______ **Buy** ($24) access to **TopHat online homework & clicker system**. Do **not** spend $100+ for an online homework system like Mastering Chemistry/Biology and then also buy a $50 clicker you might break or lose. Please just buy the $24 TopHat online homework system for the semester, which also permits you to use your phone/tablet/laptop as a clicker. Click the TopHat.com link on course website.

5. _______ **Buy** ($5) a traditional paper **Lecture Notebook**. Can be spiral bound or 3-ring bound as long as there is real paper that you'll write on lots (mostly for taking notes when doing the readings prior to lecture). Be sure to **write all notes by hand** because it greatly increases your learning.¹

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Week 1

(Preparing for the first day of class)

Thursday’s lecture:

Budgeting homework time (50 min): Ch. 18, section 18.1 (the first half on crickets) is approximately 1775 words in length. At what’s considered slow reading speed, 200 words per minute, reading the first half of section 18.1 should take 9 minutes. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, if you focus (avoid distraction) it should take you approx. 50 minutes.

1. _______ For the first lecture, read the 1-page Foreword at the beginning of the textbook written by the very famous Dr. Bruce Alberts, review the Student Resources in Chapter 0, and then begin reading Chapter 18: Information in the Environment of our book, Integrating Concepts in Biology (ICB). Read the single Introduction page. You do not need to take notes on any of these pages.

2. _______ Then slowly read the section we will discuss most during lecture, section 18.1 “Have organisms evolved to exploit communication between individuals of other species?” As you read section 18.1 (the part on crickets, not frogs) on your computer be sure to take handwritten notes on paper in your lecture notebook. Handwritten notes lead to much greater learning.

3. _______ Try to answer at least one Integrating Question (IQ) in each set. As you read the ICB textbook always attempt to answer at least one of the yellow Integrating Questions each time you get to a set of them. It will help you test yourself to determine if you got the meaning, or not, while reading the last few paragraphs. Just like taking handwritten notes, this too will greatly increase your learning. If you desire a high grade in the course, try to answer more IQs.

   NOTE: Assume you will be asked a question in lecture which is directly from one of the IQs.

4. _______ Trifecta: Prepare to explain (aloud) Figures 18.2, 18.3, 18.4 and Table 18.1 in class. As you read a section from the ICB textbook always attempt to pause and study each figure/drawing/table that is discussed. Some of them are just pictures or drawings and may not require lots of thinking, but others are graphs or tables that contain actual data from research experiments. Spend more time looking at these. In class, during lecture, students will be randomly chosen to explain a Figure or Table aloud (LA will hand you a microphone) so prepare for when your name is called to be sure you are ready. Some students avoid stress by just writing out in their notebook an explanation of the Purpose, Methods and Findings of each data figure (we call these three things the Trifecta). If it's already written down then you can just read aloud what you wrote, like: "Purpose: Dr. Griffith wanted to determine..., Methods: his group worked with mice and pneumonia bacteria called..., Findings: in the end they found evidence that ...".

5. _______ Advanced TIP reported from prior student: "The way the textbook explained this figure did not make sense to me, so I scrolled down to the bottom of the page and clicked on link to the original paper and read about the same figure in that. The way the paper explained it made so much more sense and cleared up what I was confused about. Tell other students about this!"

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Week 2

(Preparing for) Tuesday's lecture:

**Budgeting homework time (45 min):** Ch. 18, section 18.1 (the second half on frogs) is 2166 words in length. At what’s considered slow reading speed, 200 words per minute, reading the second half of section 18.1 should take 11 minutes. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, if you focus (avoid distraction) it should take you approx. 45 minutes.

1. _______ For the second lecture, slowly read the second half of section 18.1 "Frog choruses attract predators." As you read it on your computer or tablet, please be sure to take handwritten notes on paper in your lecture notebook (handwritten notes lead to far greater learning).

2. _______ Try to answer some Integrating Question and Review Questions. As you read the ICB textbook always attempt to answer at least one of the yellow Integrating Questions each time you get to a set of them. Also try to answer the green Review questions.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 18.6 and Table 18.2 in class. As you read a section from the ICB textbook always attempt to pause and study each figure/drawing/table that is discussed. In class, during lecture, you may be randomly chosen to explain these aloud (the LA will hand you a microphone so everyone can hear you in lecture) so prepare well.

4. _______ Advanced TIP: scroll down to the bottom of the page, in the Bibliography, and click on the link to an original paper by Dr. Rachel Ryan to see which data was used to make figure 18.6 and Table 18.2, and look at Ulagaraj’s research paper on crickets to get used to, and in a habit of, checking original papers.

(Preparing for) Thursday's lecture:

**Budgeting homework time (60 min):** In Ch. 18, section 18.3 (the second half of on coral reefs) is 1932 words in length which should take 10 minutes if you just read it. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, this homework assignment should take you more like 60 minutes (and that’s if you are not distracted).

1. _______ For the third lecture of the semester, read the second half of section 18.3, after the blue header titled "Information is used by corals during settlement" and as you read it on your computer be sure to take handwritten notes*. You should focus and take detailed notes for everything about coral. Don’t worry about the first part of 18.3 where the reading is about moths.

2. _______ Try to answer some Integrating Question and Review Questions. As you read the ICB textbook always attempt to answer at least one of the yellow Integrating Questions each time you get to a set of them. Also try to answer the green Review questions on coral reefs.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 18.18, 18.19, and 18.20 in class (Purpose, Methods, Findings)

4. _______ Advanced: Click on the last reference in the Bibliography at the bottom of the page and try to find Figure 1 (not Plate 1) in Dr. Lindsay Harrington's research paper published in the journal Ecology in 2004. Just take a peek, read the abstract and in her paper where they talk about Figure 1.
Chapter Checklists

Week 3

(Preparing for) Tuesday's lecture:

Budgeting homework time (70 min): In Ch. 17, section 17.1 is 262 words, and section 17.2 (the first half on fireflies), is 2569 words in length, together totaling almost 2900 words. This should take 15-20 minutes if you just read it. But when done properly, when you pause to watch the three short movies, and then review a few data figures, read and think about a few of the Integrating Questions, and take careful notes, this assignment should take you 70 minutes (if you are focused).

1. ________ For Tuesday's lecture first read Chapter 17's, very short, section 17.1.

2. ________ Then slowly carefully read the first half of section 17.2 "How is information transmitted between members of animal species?" For section 17.2 you only need to carefully take handwritten notes in the section "Simple communication in a firefly". Be sure to watch the three short movies about the research of Dr. Sara Lewis.

3. ________ Try to answer some Integrating Question. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

4. ________ (Trifecta): Prepare to explain (aloud) Figures 17.3, 17.4, and 17.5 in class.

(Preparing for) Thursday's lecture:

Budgeting homework time (70 min): In Ch. 17, section 17.2 (the second half of on birds) is 2378 words in length. Technically this should take 12 minutes if you just read it. But when done properly, when you pause to review all of the data figures and tables, read and think about a few of the Integrating & Review Questions, and take careful notes, this assignment should take you more like 70 minutes (if you are focused). Special Allowance: Your group can divide up the Trifectas for this lecture.

1. ________ For Thursday's lecture, slowly read the second half of section 17.2 titled "More complex communication in a bird" (on storm petrels) and take handwritten notes.

2. ________ Answer some Integrating Question and Review Questions. As you read the ICB textbook always attempt to answer at least one of the yellow Integrating Questions each time you get to a set of them. Also try to answer the green Review questions.

3. ________ (Trifecta): Prepare to explain (aloud) Figures 17.6, 17.7 and Tables 17.1, 17.2, 17.3 in class (Purpose, Methods, Findings)

* Special Allowance today*: If you wish, your group can designate who will be responsible for each figure or table and thus split up the responsibility and reduce the load.
Week 4

(Preparing for) Tuesday's lecture:

Budgeting homework time (50 min): In Ch. 17, section 17.3 (the first half on meerkats) is 1547 words in length. At 200 words/min this would take less than 10 minutes if you just quickly read it. But when done properly, when you pause to watch the two short movies, and then review several figures, read and think about a few of the Integrating Questions, and take careful notes, this assignment should take you 50 minutes (but longer if you are distracted by texts, friends, email etc).

1. ______ For Tuesday's lecture, slowly read the first half of section 17.3 on meerkats that asks the question: "Does group living require more derived mechanisms of information transfer?". You can stop reading when you finishing reviewing Integrating Questions 25-27. Please carefully take written notes on this reading in your lecture notebook.

2. ______ Try to answer some Integrating Question. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. ______ (Trifecta): Prepare to explain (aloud) Figures 17.9, 17.10, and 17.11 in class.

4. ______ Advanced: Read on further, about Dr. Martha Manser's research on meerkats and check the Bibliography to look at one of her papers.

(Preparing for) Thursday's lecture:

Budgeting homework time (50 min): In Ch. 17, section 17.3 (the second half on meerkats) is 1180 words in length. This should take 6 minutes if you just read it. But when done properly, when you pause to watch one short movie and then review three figures, read and think about a few of the Integrating Questions, and take careful notes, this assignment should take you 50 minutes (if you are focused).

1. ______ For Thursday's lecture, read and take handwritten notes on the second half of section 17.3 on meerkats (start after Integrating Question 27).

2. ______ (Trifecta): Prepare to explain (aloud) Figures 17.12, 17.13, and 17.14 in class.

3. ______ Advanced: Read on further, about Dr. Martha Manser's research on meerkats by looking at one of her papers in the Bibliography.
Week 5

Tuesday lecture:

EXAM I

(Preparing for) Thursday's lecture:

Budgeting homework time (70 min): Read the start of Chapter 16 and the first half of section 16.1. This is 2559 words with 6 figures; and 4 are data figures that require thinking and notetaking. Just reading the text will take 12 minutes. Yet the data figures are important. Of course, when done properly, when you pause to decipher each figure, try Integrating Questions, and take notes, this assignment will take you more like 70 minutes. Special Allowance: Your group can divide up the Trifectas for this lecture.

1. _______ For Tuesday's lecture, first read the first cover page of Chapter 16. Look at the Chapter location in the textbook and the Learning Objectives. No notes are necessary here.

2. _______ Then, slowly read the first half of section 16.1 on genes & blood pressure that asks the question: What causes individual variation? You can stop reading when you get to the blue box with the title "Variation caused by the environment". Please carefully take written notes on this reading in your lecture notebook.

3. _______ Try to answer at least one Integrating Question in each set. As you read the ICB textbook always attempt to test yourself a little, answer at least one IQ in each set.

4. _______ (Trifecta): Prepare to explain (aloud) Figures 16.2, 16.3, 16.4 and 16.5 in class.
   *Special Allowance today*: If you wish your group can designate who will be responsible for each figure and thus split up the responsibility and reduce the load (Purpose, Methods, Findings).

5. _______ Advanced: Try to make sense of Table 16.1.
Week 6

(Preparing for) **Tuesday's lecture:**

**Budgeting homework time (50 min):** Read the second half of section 16.1 titled "Variation caused by the environment". This is just 1337 words with 3 figures. Just reading the text will take 8 minutes. Yet the figures contain data, thus, when done properly, when you pause to decipher each figure, try Integrating Questions, and take notes, this assignment will take you more like 50 minutes.

1. _______ For Tuesday's lecture, read the second half of section 16.1 titled "Variation caused by the environment".

2. _______ Try to answer some [Integrating Questions](#) and [Review Questions](#). As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 16.6, 16.7, and 16.8 in class. (Purpose, Methods, Findings).

4. _______ Advanced: Use the papers in the Bibliography to learn more, particularly if you don't quite understand something in the figures. Find out where the figure came from and go see how the author explains the results. Maybe their explanation will make more sense to you.

(Preparing for) **Thursday's lecture:**

**Budgeting homework time (40 min):** Read section 16.3 " Non-Mendelian genetics: Why do we need annual flu vaccines?". This is just 1889 words with 3 figures. Just reading the text will take 8 minutes. The figures do not contain data, thus, when done properly, when you pause to decipher each figure, try Integrating Questions, and take notes, this assignment will take you more like 40 minutes.

1. _______ For Thursday's lecture, slowly read section 16.3 " Non-Mendelian genetics: Why do we need annual flu vaccines?". And please take handwritten notes.

2. _______ Try to answer some [Integrating Questions](#) and [Review Questions](#). As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ Prepare to explain (aloud) Figures 16.12, 16.13, 16.14 in class.

4. _______ Advanced: Check the CDC website and determine the strains of flu we currently face.
Week 7

(Preparing for) Tuesday's lecture:

Budgeting homework time (60 min): Chapter 3, first half of section 3.1 is 2160 words in length with 7 figures that require thinking and notetaking. Reading at 200 words per minute would mean the section might take just 12 minutes to read. Of course, when done properly, when you pause to review figures, try Integrating Questions, and take notes, this assignment will take you more like 60 minutes. It could be shorter if you have been doing homework regularly, ie. training like an athlete, and getting stronger, better, faster at this now that it is week 7. Special Allowance today*: If you wish your group can designate who will be responsible for each figure.

1. _______ For Tuesday's lecture, read section 3.1 on Gregor Mendel titled "How can traits disappear and reappear in a later generation?" Take careful notes by hand.

2. _______ Try to answer some Integrating Questions and Review Questions. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 3.3, 3.4, 3.6 and 3.7 in class. *Special Allowance today*: If you wish your group can designate who will be responsible for each figure and thus split up the responsibility and reduce the load (Purpose, Methods, Findings).

4. _______ Advanced: Review how to use Punnett squares to predict the outcome of crosses.

(Preparing for) Thursday's lecture:

Budgeting homework time (60 min): Read and prepare for a case study on the SBE1 gene (evo-ed.org).

SBE1 case:

Use that website as well as section 3.1 on Mendel in your textbook as resources to answer these questions. Write out your answers in your carbonless paper notebook (or just bring two hard copies) so when you arrive to class you can immediately turn in one copy, but keep the second one for class.

Integrating Questions
1. What are Mendel’s two fundamental rules of inheritance?
2. What is an allele? How do the two alleles that determine pea seed shape/taste function?
3. Why do both the RR and Rr genotypes produce round peas?
4. We call some traits dominant and others recessive, and we relate this to their respective alleles. Explain, in terms of protein function, why some traits are expressed when alleles are heterozygous.
5. Synthesis question: Does the rr genotype result in a gain or loss of function? How could either a loss or gain of function be evolutionarily important?
6. Synthesis question: Mendel and Darwin were contemporaries, although they did not know one another. How might the principles of Mendel’s laws of inheritance overlap with Darwin’s theory of evolution?
Week 8

(Preparing for) Tuesday's lecture:

Budgeting homework time (60 min): Chapter 3, section 3.3 (bacterial cell division) is 2519 words in length with four figures that require thinking and notetaking for the Trifecta. Reading at 200 words per minute would mean the section might take 13 minutes to read. Of course, when done properly, when you pause to review figures, try Integrating Questions, and take notes, this assignment will take you more like 60 minutes.

1. _______ For Tuesday's lecture, read Chapter 3, section 3.3 and as you read it be sure to take handwritten notes.

2. _______ Try to answer some Integrating Questions and Review Questions. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 3.15, 3.16, and 3.17 in class (Purpose, Methods, Findings)

4. _______ Advanced: Take a peek at some of the published research papers in the Bibliography at the bottom of the page with the goal to find one original figure you studied in the reading and where it is in the paper?

(Preparing for) Thursday's lecture:

Budgeting homework time (40 min): Chapter 3, section 3.4 (mitosis) is 2514 words in length with four photographic figures that do not require much thinking and notetaking for Trifectas. Reading at 200 words per minute would mean the section might take 13 minutes to read. Of course, when done properly, when you pause to review figures, try Integrating Questions, and take notes, this assignment will take you more like 40 minutes.

5. _______ For Thursday's lecture, read Chapter 3, section 3.4: and as you read it be sure to take handwritten notes.

6. _______ Try to answer some Integrating Questions and Review Questions. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

7. _______ (Tip): Prepare to explain (aloud) what's generally happening/being explained in Figures 3.19, 3.20, 3.21 and Table 3.5 in class.

8. _______ Advanced: Take a peek at some of the published research papers in the Bibliography at the bottom of the page.
Week 9

(Preparing for) Tuesday's lecture:

Budgeting homework time (40 min): Section 3.5 of How can two parents produce non-identical offspring? is 1931 words in length with three visual figures (yet no data figures for trifectas). Reading at 200 words per minute would mean the section might take 10 minutes to read. But when you pause to review figures and take careful notes, this assignment should take you more like 40 minutes.

1. _______ For Tuesday's lecture, carefully and slowly read Section 3.5 of "How can two parents produce non-identical offspring?" and please take handwritten notes in your lecture notebook.

2. _______ Try to answer some Integrating Questions and Review Questions. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ (Tip): Prepare to explain (aloud) what's generally happening/being explained in Figures 3.22, 3.23, and 3.24 in class.

4. _______ Advanced: Take a sneak peek at the next section ELSI 3.2 on engineering better babies.

(Preparing for) Thursday's lecture:

Budgeting homework time (30 min): Read section ELSI 3.2 (Ethical, Legal, Social Implications): "Should we engineer better babies?" It is short, only 832 words in length, with 1 art figures (no data figures for trifectas). Reading at 200 words per minute would mean the section might take 4 minutes to read. If done properly, when you pause to take careful notes and prepare your arguments for the debate, this assignment should take you approximately 30 minutes.

1. _______ For Thursday's lecture, read ELSI 3.2 (Ethical, Legal, Social Implications): "Should we engineer better babies?" and take handwritten notes in your notebook.

2. _______ Try to answer the Integrating Questions

3. _______ DEBATE Homework due at start of class: Prepare two arguments, with Claim Evidence Reasoning for each, to support your side during a debate. Use Carbonless paper (bring two copies) so you can turn one in at the start of lecture and keep the other with you.

   Debate topic: Resolution -> "It is abundantly clear that we should definitely use genetic testing to eliminate genetic diseases (post-haste)"

   1. Affirmative: All students that attend Tuesday labs will be on the PRO side.
   2. Negative: All students in Thursday labs will be on the NO side.
Week 10

Tuesday lecture:
EXAM II

(Preparing for) Thursday's lecture:

Budgeting homework time (70 min): Chapter 2, section 2.1 is 3322 words in length with three data figures that require thinking and notetaking for the Trifecta. Reading at 200 words per minute would mean the section might take 20 minutes to read. Yet figures 2.5 and 2.6 are challenging and require time to think and read about them for the Trifecta. Of course, when done properly, when you pause to review figures, try Integrating Questions, and take notes, this assignment will take you more like 70 minutes.

1. _______ For Thursday's lecture, review the introductory page of Chapter 2: Central Dogma. Then carefully read section 2.1: "How does DNA communicate information to the cell?" and take handwritten notes in your lecture notebook.

2. _______ Try to answer some Integrating Questions and Review Questions.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 2.3, 2.5 and 2.6 in class (Purpose, Methods, Findings).
Week 11

(Preparing for) **Tuesday's lecture:**

**Budgeting homework time (50 min):** Chapter 2, section 2.3 is that is 1725 words in length with three data figures that require thinking and notetaking for the Trifecta. Reading at 200 words per minute would mean the section might take 10 minutes to read. Yet figures 2.20 and 2.21 are challenging and require time to think and read about them for the Trifecta. Of course, when done properly, when you pause to review figures, try Integrating Questions, and take notes, this assignment will take you more like 50 minutes.

1. _______ **For Tuesday's lecture,** carefully read section 2.3: "How do cells make proteins?" and take handwritten notes in your lecture notebook.

2. _______ Try to answer some [Integrating Questions](#) and [Review Questions](#).

3. _______ (Trifecta): Prepare to explain (aloud) Figures 2.20, 2.21 and 2.22 in class (Purpose, Methods, Findings).

(Preparing for) **Thursday's lecture:**

**Budgeting homework time (60 min):** Chapter 2, section 2.4 is 2673 words in length with several exercises that require you to use NCBI to look for the insulin gene, find introns, and then the ORF finder to understand the gene further. Reading at 200 words per minute would mean the section might take 12 minutes to read. Yet integrating questions 35-38 are challenging and require time to think and perform what they request of you. Of course, when done properly, when you really try to do the Integrating Questions, and take notes, this assignment will take you more like 60 minutes.

1. _______ **For Thursday's lecture,** read another section of Chapter 2: Central Dogma. Carefully read section 2.4: "Can cells pick and choose information?" and take handwritten notes in your lecture notebook.

2. _______ Perform the exercises outlined in [Integrating Questions 35-38](#) and then answer the remaining IQs and [Review Questions](#).

3. _______ (Tip): Prepare to demonstrate how to perform/explain (aloud) in class how to do IQs 35-38: thus how to use online tools at NCBI and OMIM to find the DNA, RNA and amino acid sequence of any gene, with insulin as an example.
Week 12

(Preparing for) Tuesday's lecture:

Budgeting homework time (60 min): Chapter 1, has a cover page, section 1.1 is 660 words, and section 1.2 on Drs. Griffith and Avery is 1725 words in length. While this is about 2300 words in total, thus the reading would be estimated to take 12 minutes. Yet careful reading and notetaking takes time and it has four data figures. While the Trifectas are easy to prepare for, Table 1.1 may be more difficult.

1. _______ For Tuesday's lecture, start Chapter 1: Heritable Material by reviewing the cover page and reading the short section 1.1: "What is biological information?" No notes needed.

2. _______ Now slowly carefully read section 1.2: "What is the heritable material?" and take careful handwritten notes in your lecture notebook.

3. _______ Try to answer some Integrating Questions and Review Questions.

4. _______ (Trifecta): Prepare to explain (aloud) Figures 1.2, 1.3, 1.4 and Table 1.1 in class (Purpose, Methods, Findings).

(Preparing for) Thursday's lecture:

Budgeting homework time (60 min): Read ELSI 1.1 and the first 2/3 of section 1.4 in "Chapter 1: Heritable Material." While this is about 3700 words in both the readings combined, only the 2700 words in section 1.4 need careful reading and notetaking. Also, there are no traditional Trifectas to prepare for, just three simple questions posed below to be ready to answer aloud in class.

1. _______ For Thursday's lecture, revisit Chapter 1: Heritable Material and read section ELSI 1.1: "Who Owns Your DNA?" (975 words), and then read the first 2/3’s of section 1.4 "How does DNA's shape affect its function?" Take notes on section 1.4 all the way up until it switches to the new light blue box topic of "DNA Replication" (2700 words). Read on, but don't need notes.

2. _______ Try to answer some Integrating Questions and Review Questions.

3. _______ (Tip): Prepare to explain (aloud) in class: 1. What's difference between the chemical structure of DNA vs RNA, 2. What's incorrect in Figure 1.10?, 3. What's incorrect in Figure 1.13?
Week 13

(Preparing for) Tuesday's lecture:

Budgeting homework time (45 min): Chapter 1, section 1.5 on Epigenetics is 1840 words in length. At 200 words per minute, reading section 1.5 should just take 10 minutes. But when done properly, when you pause to review figures, read and think about a few of the Integrating & Review Questions, and take careful notes, this homework assignment should take you more like 45 minutes (if you focus).

1. _______ For Tuesday's lecture, continue Chapter 1: Heritable Material by reading section 1.5: "Is all genetic information encoded linearly in the DNA sequence?" and take careful handwritten notes.

2. _______ Try to answer some Integrating Questions and Review Questions.

3. _______ Prepare to explain (aloud) Figures 1.19 (the method), and do a Trifecta for Figures 1.20, and 1.21 in class (Purpose, Methods, Findings).

(Preparing for) Thursday's lecture:

Budgeting homework time (45 min): Ch. 4, section 4.1 is about 1250 words in length and ELSI 4.1 is 1100 words thus the total is 2350 words. At 200 words per minute, reading section 4.1 & ELSI should take 12 minutes. But when done properly, when you pause to review three figures, read and think about a few of the Integrating & Review Questions, and take careful notes, this homework assignment should take you more like 45 minutes (but longer if you are distracted by texts, friends, email etc.).

1. _______ For the second lecture, read the cover page of Chapter 4: Evolution and Origin of Cells in the ICB textbook, but you do not need to take notes on that page. Then slowly read section 4.1 "What is evolution?" and as you read it on your computer be sure to take handwritten notes*. Last, read the section Ethical, Legal, Social Implications (ELSI) 4.1: "Are evolution and religion compatible?" You do not need to take notes on the ELSI reading, just think about it.

2. _______ Try to answer Integrating Question and Review Questions. As you read the ICB textbook always attempt to answer at least one of the yellow Integrating Questions each time you get to a set of them. Also answer the green Review questions.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 4.1, 4.2 and ELSI Figure 4.1 in class. As you read a section from the ICB textbook always attempt to pause and study each figure/drawing/table that is discussed. In class, during lecture, you may be randomly chosen to explain these aloud (remember the LA will hand you a microphone so everyone can hear you in lecture) so prepare well.

4. _______ Advanced TIP: scroll down to the bottom of the page and click on the link to an original version of Darwin’s Origin of Species, peek at it, and look at some of the other research papers in the Bibliography.
Week 14

(Preparing for) Tuesday's lecture:

Budgeting homework time (70 min): In Ch. 4, the first 2/3's of section 4.2 is 3000 words in length which should take 15 minutes if you just read it. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, this homework assignment should take you more like 70 minutes (and that's if you are not distracted).

1. _______ Read Chapter 4’s section 4.2 "Could abiotic molecules form biologically important molecules before life evolved?" and as you read it on your computer be sure to take handwritten notes*. You should focus mostly, and only take detailed notes for, the first 2/3s of the section. You can stop taking notes once you complete the yellow Integrating Questions 5 & 6. Read the remaining section regarding RNA and directed evolution, but no notes are needed on this, just be amazed at what is said.

2. _______ Try to answer some Integrating Question and Review Questions. As you read the ICB textbook always attempt to answer at least one of the yellow Integrating Questions each time you get to a set of them. Also try to answer the green Review questions.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 4.5, 4.6, and 4.8 in class (Purpose, Methods, Findings)

4. _______ Advanced: Click on "Explore More on Abiotic Production of Organic Molecules" to learn a little about research published in 2016. Just take a peek, read the abstract.

Thursday lecture:

Thanksgiving Break
**Week 15**

(Preparing for) **Tuesday's lecture:**

**Budgeting homework time (60 min):** In Ch. 4, the first half of section 4.3 is 2000 words in length. This should take 10 minutes if you just read it. But when done properly, when you pause to review quite a few figures, read and think about a few of the Integrating Questions, and take careful notes, this homework assignment should take you more like 60 minutes (if you are focused). **Special Allowance:** Your group can divide up the Trifectas for this lecture.

1. _______ For Tuesday's lecture, read Chapter 4's section 4.3(1st half) in the ICB textbook. For section 4.3 "Can non-living objects compete and grow?" you only need to carefully read and take notes on items up to and including information related to Figure 4.13. Be sure to take handwritten notes. Then stop taking notes and just read the rest to learn about research on vesicles competing with each other. Explore Bio-Math Exploration 4.2 if you find it interesting.

2. _______ Try to answer some Integrating Question and Review Questions. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 4.11, 4.12, 4.13 and 4.17 in class.
   
   *Special Allowance today*: If you wish your group can designate who will be responsible for each figure and thus split up the responsibility and reduce the load (Purpose, Methods, Findings).

(Preparing for) **Thursday's lecture:**

**Budgeting homework time (45 min):** In Ch. 4, section 4.4 is 1500 words. This should take 8 minutes if you just read it. But when done properly, when you pause to review the two figures, read and think about the Integrating Questions, and take careful notes, this homework assignment should take you more like 45 minutes (if you are focused).

1. _______ For Thursday's lecture, read the short reading in section 4.4 "Can non-living objects harvest and store energy?". Be sure to take handwritten notes.

2. _______ Try to answer the two Integrating Question and Review Questions. As you read the ICB textbook always attempt to test yourself a little, answer at least one of each set.

3. _______ (Trifecta): Prepare to explain (aloud) Figures 4.16 and 4.17 in class.