HYBRID EDITION

LB-144: CELL & ORGANISMAL BIOLOGY

TOP HAT *course: app.tophat.com/e/104419,* ZOOM *classroom is: 934-1774-2369*

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 (he/him/his), Associate Professor, Lyman Briggs College & Dept. of Physiology
ZOOM Office: 5173534606, **luckie@msu.edu,** Holmes Office: W-26D, Phone: 517-353-4606

LEARNING ASSISTANTS

Olivia Haas (haassoli@msu.edu), Bonita Yoder (yoderbon@msu.edu), Saarah Alam (alamsaar@msu.edu), Kaitlyn Eberhardt (eberha53@msu.edu), Emma Bush (bushemma@msu.edu)

COURSE WEBSITE **http://ctools.msu.edu/144** (mirror => cf.psl.msu.edu/144)

TEXTBOOK (online-only, for Luckie's LB144 custom textbook, http://store.trunity.com/)
"Integrating Concepts in Biology" by Campbell, Heyer & Paradise, 2020 Edition, Trunity Holdings Inc

COURSE PACK "LB-144 Course Pack," (Luckie) from MSU Library Services via local bookstore

INTERNET 20+Mbps (download): 10+Mbps (upload) best. Use D2L, Zoom, TopHat, CATME, Turnitin.

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 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. Specifically, we will study genes (molecular biology), living cells inside organisms (cell biology), organisms and their environments (ecology), genetic variation and inheritance (genetics), and the interactions of the environment and genetics over time (evolution) that led to the diversity of life observed on the planet today.

Our lecture will meet twice a week as two 80-minute class meetings. Once a week in-person (live, synchronous) and once on TopHat (recorded, asynchronous). In this class, you will have daily homework and in lecture we will review and discuss, in depth, parts of the readings. We will examine how scientists perform their work to help 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 will need to do before each lab and readings that you will need to complete (with notes taken) before each lecture. Come to lecture and lab well-prepared or mastering the new material may take much longer than 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 & JCLUB
Held each week on Mondays 12:40-2:00pm in-person in our classroom, also you can make appointments.

ACADEMIC HONESTY
Turnitin.com will allow you to review writing 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 available online -> https://lbc.msu.edu/advising/academic-policies.html

GRADING
Your grade in this course (LB144) is based on the total percentage earned in the both the lecture portion and the laboratory portion of the course, each worth half. 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 hour 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 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 thus ask you to not list your name but your "B-PID" (found on D2L). This helps eliminate bias and make grading more fair.

***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 do not make logical arguments or provide thoughtful evidence to support them, your appeal will not likely gain traction to 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. Practice at doing and communicating science. Speak your thoughts smartly.

a) Communicate Scientific Thoughts: Manifest your smart thinking in the best words possible.
   1. Speaking: a high priority of this course is for you to practice public speaking & listening.
   2. Reading: practice careful reading of papers, identification of points, interpretation of figures.
   3. Writing: practice composition of text, writing manuscripts, building data figures and graphs.

b) Design and Analyze Experiments: Make a hypothesis, design experiments, make predictions. Interpret data collected, look for patterns, ways to best share and represent findings.

2. Study the Biology Idea of "Information". Learn examples and mechanisms to store/transmit information at molecular, cell, organismal, population levels.

These "**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., some beach mice have light colored fur because a mutation in a gene makes it difficult for their hair cells to make dark hair pigment)

c) Interactions among organisms and the environment determine *individual* survival and reproduction. (e.g., animals who are in cooperative groups and communicate live longer)

d) Selection (and other mechanisms) acts on individuals and leads to the evolution of *populations*. (e.g., beach mice with fur that matches the color of sand live longer than others because?)

e) Information in DNA => becomes (transcribed) information as RNA => becomes (translated) information as proteins (e.g. How viruses enter our cells, take control, & make viral proteins)

f) Small simple chemicals can associate to form nucleotides, amino acids, lipids, carbohydrates; which can polymerize, form structures and functions we define as "alive" (life on earth).

3. Practice Transfer of Learning: Work with your group to intentionally transfer knowledge learned in one context (e.g. squirrels) to another new context (e.g. humans).

a) Reflect: Develop personal learning goals and regularly reflect on your progress during the semester. (e.g. regularly consider "What I am supposed to be learning here? Have I mastered that? What about transfer? Can I link this to life on Mars, or humans, or something different?")

b) Collaborate: Confidently cooperate in teamwork, and practice team building, communication and leadership. (e.g. "that's a good idea, should we also test if it works in another animal?" "Jon, you haven't spoken much, what do you think?")

HYBRID EDITION

LB-144: CELL & ORGANISMAL BIOLOGY (LECTURE)

SCHEDULE: Each week= TOP HAT online video lecture & *LIVE in-person lecture*

	Date	*Scale/Level*	*Readings (emphasis)*	*Instructors LIVE or TopHat*
W1	W, 31 **Aug.**	Ecological	Lect.1, Ch18 (18.1 crickets call)	*LIVE in-person (Luckie & LAs)*
W2	online	Ecological	Lect. 2, Ch18 (18.1 frogs sing)	Online videos (Luckie & LAs)
	W, 7 **Sep.**	Ecological	Lect. 3, Ch18 (18.3 corals settle)	*LIVE in-person (Luckie & LAs)*
W3	online	Population	Lect. 4, Ch17 (17.1&.2 fireflies)	Online videos (Chris Paradise)
	W, 14	Population	Lect. 5, Ch17 (17.2 storm petrel)	*LIVE in-person (Luckie & LAs)*
W4	online	Population	Lect. 6, Ch17 (17.3 meerkats)	Online videos (Chris Paradise)
	W, 21	Population	Lect. 7, Ch17 (17.3 continued)	*LIVE in-person (Luckie & LAs)*
W5	M, 26	***EXAM I***	*LIVE in-person (in classroom)*	
	W, 28	Organismal	Lect. 8, Ch16 (16.1 blood BP)	*LIVE in-person (Luckie & LAs)*
W6	online	Organismal	Lect. 9, Ch16 (16.1 sandworts)	Online videos (Chris Paradise)
	W, 5 **Oct**.	Organismal	Lect. 10, Ch16 (16.3 vaccines)	*LIVE in-person (Luckie & LAs))*
W7	online	Organismal	Lect. 11, Ch3 (3.1 Mendel)	Online videos (Luckie & LAs)
	W, 12	Organismal	Lect. 12, Ch3 (3.1 Mendel/SBE)	*LIVE in-person (Luckie & LAs)*
W8	online	Organismal	Lect. 13, Ch3 (3.3 division)	Online videos (Malcolm Campbell)
	W, 19	Organismal	Lect. 14, Ch3 (3.4 mitosis)	*LIVE in-person (Luckie & LAs)*
W9	online	Organismal	Lect. 15, Ch3 (3.5 mitosis)	Online videos (Malcolm Campbell)
	W, 26	Organismal	Lect. 16, Ch3 (3.5 meiosis)	*LIVE in-person (Luckie & LAs)*
W10	M, 31	***EXAM II***	*LIVE in-person (in classroom)*	
	W, 2 **Nov**.	Cellular	Lect. 17, Ch2 (2.1 RNA types)	*LIVE in-person (Luckie & LAs)*
W11	online	Cellular	Lect. 18, Ch2 (2.3 Translation)	Online videos (Malcolm Campbell)
	W, 9	Cellular	Lect. 19, Ch2 (2.4 NCBI)	*LIVE in-person (Luckie & LAs)*
W12	online	Molecular	Lect. 20, Ch1 (1.1, 1.2 Griffith)	Online videos (Luckie & LAs)
	W, 16	Molecular	Lect. 21, Ch1 (1.4 DNA struct)	*LIVE in-person (Luckie & LAs)*
W13	online	Molecular	Lect. 22, Ch1 (1.5 epigenetics)	Online videos (Malcolm Campbell)
	W, 23	Molecular	Journal Club	*LIVE in-person (Luckie & LAs)*
Thanksgiving Break, Nov. 24-27				
W14	online	Molecular	Lect. 23, Ch4 (4.1 Evolution)	Online videos (Malcolm Campbell)
	W, 30	Molecular	Lect. 24, Ch4 (4.2 Miller)	*LIVE in-person (Luckie & LAs)*
W15	online	Molecular	Lect. 25, Ch4 (4.3 competition)	Online videos (Malcolm Campbell)
	W, 7 **Dec**.	Molecular	Lect. 26, Ch4 (4.4 store energy)	*LIVE in-person (Luckie & LAs)*

TBA see official schedule (tentative time/date) **FINAL EXAM** finals week 2022

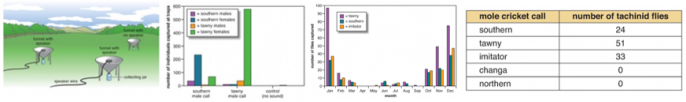
Readings

Ecological System—Information & Environment: Communication within a species, between species, and to exploit other species.

Have organisms evolved to exploit communication between individuals of other species? (Prey Detection)

- (18.1 crickets call)

Cricket songs are exploited by natural enemies

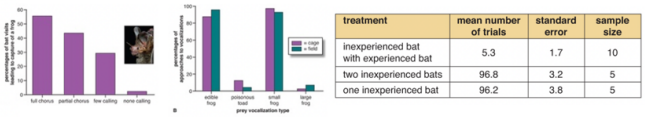


mole cricket call	number of tachinid flies
southern	24
tawny	51
imitator	33
changa	0
northern	0

Raj Ulagaraj, T. Walker: Phonotaxis of crickets in flight: attraction of male and female crickets to male songs, *Science* 182(4118):1278, 1973.

- (18.1 frogs sing)

Frog choruses attract some predators



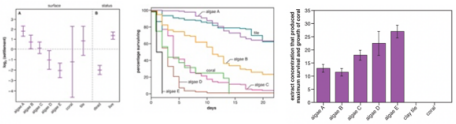
treatment	mean number of trials	standard error	sample size
inexperienced bat with experienced bat	5.3	1.7	10
two inexperienced bats	96.8	3.2	5
one inexperienced bat	96.2	3.8	5

Rachel Page, M. Ryan: Social transmission of novel foraging behavior in bats: frog calls and their referents, *Curr Biol* 16(12):1201-1205, 2006.

Is chemical communication used to block competition or defend self? (Competition)

- (18.3 corals settle)

Information is used by corals during settlement



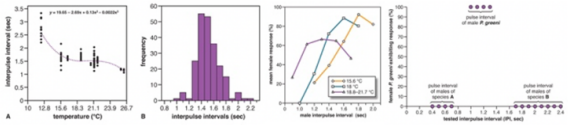
Lindsay Harrington, Katharina Fabricius, et al: Recognition and selection of settlement substrata in corals, *Ecology* 85(12):3428-3437, 2004.

Populations—Behavior & Exchange: Non-heritable information transfer in individuals, imperfect transfer produces variation.

How is information transmitted between members of animal species? (Populations, Communication, Animal Behavior)

- (17.1-2 fireflies blink)

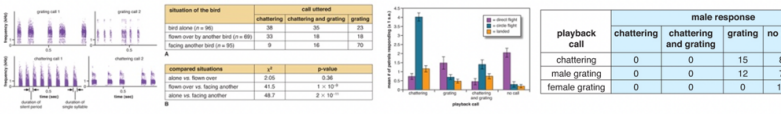
Simple communication in a firefly



Sara Lewis, Michaelidis C, Demary K: Male courtship signals & female signal assessment in fireflies, *Behavioural Ecology* 17:329-35, 2006.

- (17.2 storm petrels call)

More complex communication in a bird



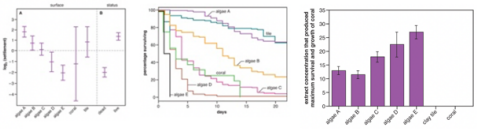
playback call	male response			
	chattering	chattering and grating	grating	no
chattering	0	0	15	
male grating	0	0	12	
female grating	0	0	0	

Vincent Bretagnolle: Calls of Wilson's storm petrel: functions, sexual recognitions and geographic variation, *Behaviour* 111:98-112, 1989

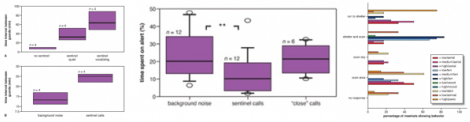
Does group living require more derived mechanisms of information transfer? (Social behavior, Eusociality)

- (17.3 meerkats bark)

Signals and information transfer are used in social animals



Marta Manser: Response of foraging group members to sentinel calls in suricates, *Suricata suricatta*, *Proc Biol Sci* 266(1423):1013-1019, 1999.



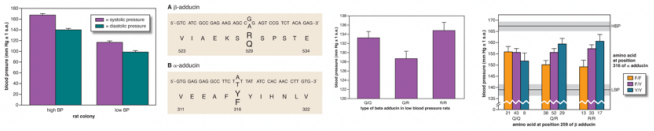
Manser M, Bell M, Fletcher L: The information that receivers extract from alarm calls in suricates, *Proc Biol Sci* :268:2485, 2001.

Organisms—Individual Variation to Group Evolution: Life evolves in altered environment, variation by several mechanisms.

What causes individual variation? (Variation and Population Genetics)

- (16.1 rat blood pressure)

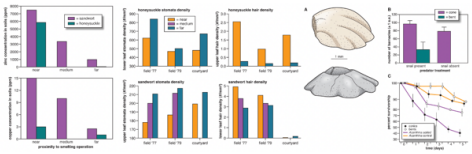
Variation, mutations and independent assortment



Giuseppe Bianchi G, et al (1994) Point mutations in adducin genes in blood pressure variation. Proc. Nat. Acad. Sci. USA 91: 3999-4003.

- (16.1 sandworts & barnacles)

Variation caused by the environment



Nicholas Caiazza, Quinn JA (1980) Leaf morphology in A.patula & L.japonica along pollution gradient. Bulletin Torrey Bot. Club 107(1): 9-18.

Why do we need annual vaccines? (Non-Mendelian genetics)

- (16.3 flu vaccines)

Random mix of chromosomes leads to rapid (non-mendelian) evolution

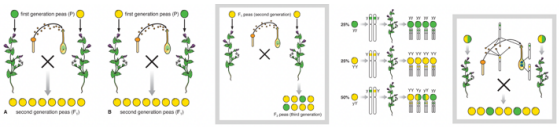
Lu J, Gu J, Li K, et al. (2020) COVID-19 Outbreak with Air Conditioning in Restaurant. Emerging Infectious Diseases. 26:1628-1631.

Organisms—Reproduction and Cell Division: How cells divide and pass DNA information to the newly produced cells.

How can traits disappear and reappear in a later generation? (Mendelian genetics)

- (3.1 Mendel's peas)

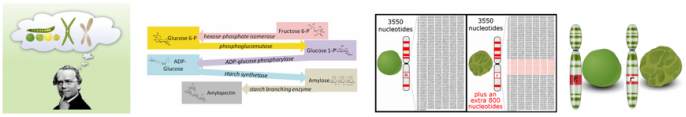
Traits discovered by Gregor Mendel in pea plants



Gregor Mendel. 1866. Versuche über Plflanzenhybriden. Verhand- lungen des naturforschenden, Bd. IV für Jahr 1865, Abhandlungen, 3–47.

- (Evo-Ed.com SBE1 gene)

Gene for traits discovered by Mendel in pea plants

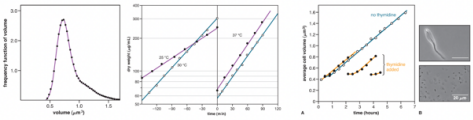


Madan K. Bhattacharyya, Alison M. Smith, et al (1990) The wrinkled-seed of Mendel is caused by a transposon-like insertion. Cell, 60, 115-122

How do prokaryotes communicate their identity to the next generation? (Cell Division)

- (3.3 *E.coli* cell division)

Prokaryotes use cellular fission to produce daughter cells

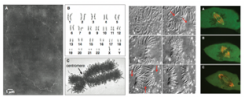


Kubitschek HE. (1971) Control of cell growth in bacteria: experiments with thymine starvation. J Bacteriol 105(2):472-476.

Do eukaryotes produce new cells the same way as bacteria? (Mitosis & Meiosis)

- (3.4 kangaroo mitosis)

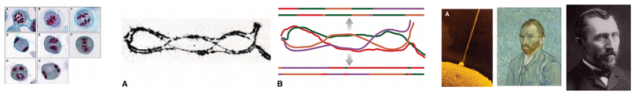
Eukaryotic DNA must be partitioned in daughter cells



name	description	duration (hours)
G_1	growth and normal cellular functions	10
S	synthesis of DNA	8
G_2	growth and normal cellular functions	4
mitosis	separation of chromosomes	2

- (3.5 meiosis & ELSI)

Meiosis produces unique chromosomes

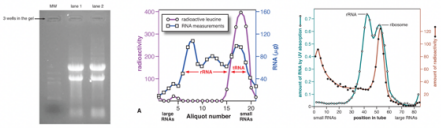


Cells—Central Dogma: How cells process molecular information from DNA to RNA to protein.

How does DNA communicate information to the cell? (Transcription & Translation)

- (2.1 RNA types)

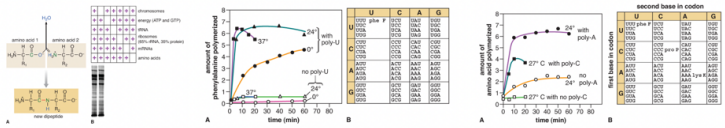
Gene activity controls timing &level of RNA transcription



Margaret Chipchase, Birnstiel ML. Synthesis of transfer RNA by isolated nuclei. Proc Natl Acad Sci USA. 49(5):692-699, 1963.

- (2.3 RNA translation)

How do cells make proteins from RNA?



Nirenberg MW, Leder P. RNA codewords and protein synthesis: effect of binding of SRNA to ribosomes. Science 145(3639):1399-1407, 1964.

- (2.4 RNA insulin & NCBI)

What is a gene, can cells choose information?? *NCBI Tutorial*

Gerstein MB, Bruce C, Rozowsky JS, et al. What is a gene, post-ENCODE? History and updated definition. Genome Res 17(6):669-681, 2007.

Molecules—Heritable Information: Identifying the heritable substance.

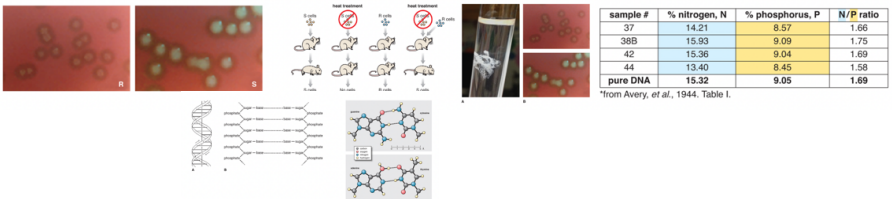
What is biological Information? (Heritable Material)

- (1.1, 1.2 Griffith & Avery)

What is the heritable material?

- (1.4 DNA structure)

How does DNA's shape affect its function?



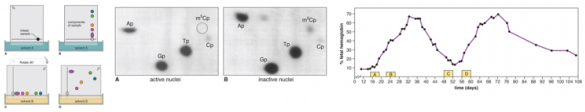
sample #	% nitrogen, N	% phosphorus, P	N/P ratio
37	14.21	8.57	1.66
38B	15.93	9.09	1.75
42	15.36	9.04	1.69
44	13.40	8.45	1.58
pure DNA	15.32	9.05	1.69

*from Avery, *et al.*, 1944. Table I.

Watson JD, Crick FH. nucleic acids. Wilkins MH, et al. Molecular ... Franklin RE, Gosling RG. Molecular configuration. Nature 171:737, 1953.

- (1.5 HELLO epigenetics)

Is all genetic information encoded in the DNA?



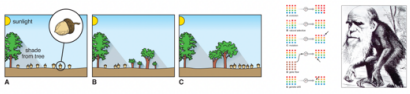
DeSimone J, Heller P, Hall L, et al. 5-Azacytidine stimulates fetal hemoglobin synthesis in anemic baboons. PNAS 79(14):4428-4431, 1982.

Evolution of Life, Earth and Humans: How chemicals, cells and humans developed over time.

What is evolution? (evolution & origin of life)

- (4.1, ELSI 4.1 evolution)

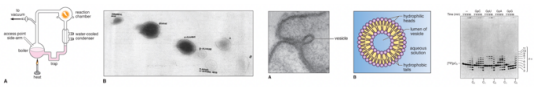
The origin of life by natural processes continues to evolve.



Charles Darwin. On the Origin of Species, 1859, Darwin Online : https://darwin-online.org.uk/converted/pdf/1860_Origin_F376.pdf

- (4.2 Stanley Miller, origin of life)

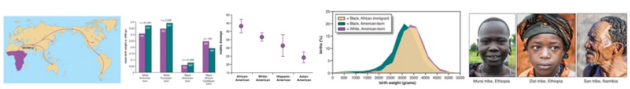
Could abiotic chemicals form biological molecules?



Miller SL. A production of amino acids under possible primitive earth conditions. Science 117(3046):528-529, 1953.

- (6.5 Human Evolution)

What do our genomes tell us about human evolution?



Collins JW Jr, Wu SY, David RJ Differing intergenerational birth weights in Illinois. Am J Epidemiol. Feb 1;155(3):210-6. 2002

THE TEXTBOOK

What is so insanely great about this textbook?

Drs. Malcolm Campbell, Chris Paradise and Laurie Heyer wrote an extraordinary textbook for learning biology. Over the past 50 years, research in biology has become more quantitative and interdisciplinary, relying more heavily on other sciences. To understand large ecosystems, or to make sense of massive data from human and other genomes, today's biologists must be able to use modern math, statistics, computation, and tech tools.

Yet biology instruction and traditional textbooks have also not kept pace with modern biology nor current 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.

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 learning[1].

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. 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 experts[2] have always said "should be done" in biology textbooks:

1. **Biology data**: You are presented both historical and modern published research data used to answer biological questions. You practice interpreting that data, making sense of it, just as scientists do.

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

3. **Big Ideas**: The text focuses on big ideas, you will focus on these big ideas of biology.
- 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. **Math**: Mathematics is used as an important tool. Self-contained Bio-Math Explorations (BMEs) help you understand how math is applied to answer biological questions.

5. **HPS ethics**: Finally, the text raises your awareness about ELSI (ethical, legal, and social implications) and you engage with case studies of real-world implications of what you are learning.

---

[1] Barsoum M, Sellers PJ, Campbell AM, Heyer LJ, Paradise CJ. Implementing recommendations for introductory biology by writing a new textbook. CBE Life Sci Educ. 2013;12:106–116.

[2] Vision and Change By the American Association for the Advancement of Science, A New Biology for the 21st Century By the National Research Council, Trivializing Science Education By Bruce Alberts, "Computing Has Changed Biology: Biology Education Must Catch Up" By Pavel Pevzner and Ron Shamir, "Revising the AP Biology Curriculum" By William B. Wood, "Mathematical Biology Education: Beyond Calculus" By Raina Robeva and Reinhard Laubenbacher, "Student Use of Out of Class Study Groups in an Introductory Undergraduate Biology Course" By Stephen M. Rybczynski and Elisabeth E. Schussler, "A Study Assessing the Potential of Negative Effects in Interdisciplinary Math Biology Instruction" By Andreas Madlung, Martina Bremer, Edward Himelblau, and Alexa Tullis, "Effects of Collaborative Group Composition and Inquiry Instruction on Reasoning Gains and Achievement in Undergraduate Biology" By Jamie Lee Jensen and Anton Lawson, Connecting Learning to Teaching By John Girash

Integrating Concepts in Biology

By A. Malcolm Campbell, Laurie J. Heyer, and Christopher J. Paradise

Table of Contents

In the entire textbook, each of the five units focuses on one of the Big Ideas of biology. Each chapter in a unit focuses on a particular level of the biological hierarchy. We will focus on two Big Ideas (two units).

Big Idea 1: Information

Living systems have multiple mechanisms to store, retrieve, and transmit information. Main ideas include:

1. Heritable information provides for continuity of life.
2. Imperfect information transfer produces variation.

Big Idea 2: Evolution

The diversity and unity of life can be explained by the process of evolution. Main ideas include:

1. The origin of living systems occurred by natural processes, and life continues to evolve.
2. Natural selection is a mechanism of evolution that accounts for adaptation.

you are here		Big Ideas of biology				
		Information	Evolution	Cells	Homeostasis	Emergent Properties
levels of the biological hierarchy	molecules	1	4	7	10	13
	cells	2	5	8	11	14
	organisms I	3	6	9	12	15
	organisms II	16	19	22	28	25
	populations	17	20	23	29	26
	ecological systems	18	21	24	30	27

Chapter 18: Discusses commonalities in communication within and between species, how information is used by organisms to find and exploit other species. Case studies include: (i) mole crickets versus parasites, (ii) frog choruses and predators (opossums and bats), and (iii) where corals decide to grow.

Chapter 17: Discusses language and information transfer between organisms. How animals communicate and find each other through signals, using light or sound. Case study stories include: (i) fireflies, with light signals, (ii) a story about bird vocalizations, (iii) meerkats vs. mongooses (iv) how do plants communicate?

Chapter 16 & 3: In these chapters, you will learn how to predict patterns of inheritance and how organisms passed their genetic information to future generations. How prokaryotes (E. coli) reproduce, how eukaryotes use mitosis and meiosis. The laws discovered by Gregor Mendel and viral mechanisms.

Chapter 2: In this chapter, you will follow the path of researchers who made many ground-breaking discoveries about how cells produce proteins, processes that were nicknamed "central dogma" (transcription and translation) that answer "how does DNA communicate information to the cell?"

Chapter 1: You will explore and interpret the original data from experiments that led to our current understanding of DNA as heritable information. Case studies presented are: (i) Griffith and Pseudomonas bacteria story, then (ii) Oswald Avery's data and story, (iii) the Watson, Crick story with Franklin and Wilkins; and a discussion of how methylation of DNA sequences reduces expression.

Chapter 4-6: You will analyze data that illuminate the origin of eukaryotic cells from prokaryotic ancestors, the mechanisms of evolution (natural selection, mutation, gene flow, genetic drift), as well as evidence on how life on earth evolved (NASA, Stanley Miller experiment, RNA World hypothesis). And you will evaluate data regarding complexity of human biology in areas of medicine and evolution.

THE LECTURE
ASSIGNMENT SCHEDULE

Researchers have found increased structure and active learning increase everyone's ability to learn in introductory biology courses[3]. 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. Given we believe the textbook we are using is outstanding, we are structuring short readings, with integrating questions 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.

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, and via clicker questions. Active participation includes, the following behaviors:

1. *Bringing forth new ideas, information, or perspectives to academic conversations*
2. *Discussing your readings and reflections with instructors and peers*
3. *Meeting with the instructors to discuss your interests, assignments, or project*
4. *Participating in small group discussions and activities*
5. *Assuming responsibility for personal behavior and learning*

While working on group projects, students should be mindful, all participants should exercise:

- *Respect for themselves, each other*
- *Openness and a positive attitude toward new ideas and other's ideas*
- *Flexibility and tolerance of ambiguity*
- *Good communications amongst themselves.*

EXAMS*:* There will be two midterm exams and a final exam, each may be comprehensive of all prior material. Midterm exams may be traditional multiple-choice format, or may be essay-style Answers to open-book & take-home exams must also be submitted online to http://turnitin.com/.

Assignments (pts)**:**

Week	**Assignment(s)**	**@Lecture**	**%**
(*all*)	Attendance, Participation, Homework, Quizzes	X	**20**
5	**Exam I**	**X**	**25**
10	**Exam II**	**X**	**25**
15	**Final Exam**	**X**	**30**

Total = 100% of lecture grade

Tardis Pass -▯- One-Time Time Travel RE-DO permit, improve work via revision opportunity.

[3] Haak, D., J. HilleRisLambers, E. Pitre, and S. Freeman. 2011. Increased structure and active learning reduce the achievement gap in introductory biology. *Science* 332:1213-1216. Freeman, S., D. Haak, and M.P. Wenderoth. 2011. Increased Course Structure Reduces Fail Rates in Biology. *CBE Life Science Education* 10 (2):175-186

HYBRID EDITION

LB-144: CELL & ORGANISMAL BIOLOGY (LABORATORY)

LAB COORDINATOR

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

LAB MANUAL

found inside "LB-144 Course Pack," (Luckie) from MSU Library Services via local bookstore

COURSE WEBSITE http://ctools.msu.edu/144

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*** (although you have to strive to be a "cooperative" group). By pooling your knowledge, members of your group will get "stuck" less often be able to progress far beyond what any individual in the group could do alone.

Week	Before Lab Meeting	During Laboratory Meeting Activities & Assignments DUE
1	*ONLINE LAB*	*Talking to Strangers* Film, Quiz, Honey Guide paper
2	View "IDEO" Film	Film Quiz & Debrief, Writing INTROS, Form Groups
3	View "Islands" Film	Film Quiz, 4-slide Proposal Talk & movie, Grading TITLES
4	Group Contract	***2¶-Draft due***, Preparing for LA and Prof Thesis Interviews: Q&A
5	*GEA1* on Catme.org	**LA Interviews begin** (during & outside lab time, groups of 4, 60m)
6		**LA Interviews (cont.)** Writing RESULTS & FIGURES
7		***Half-Draft due*** (2¶+ Results/Figs paper), Grading FIGURES
8	*GEA2* on Catme.org	**PCR** & **Prof Interviews begin** (during lab, in groups of 2, 60min)
9-12		Gene research (PCR, gels, Primers, BLAST =Molecular Teams)
13		***Final film*** and/or ***Final paper (DRAFT1) due***
14-15	*GEA3* on Catme.org	**Prof Interviews completed** (during lab, in groups of 2, 60min)

THE LABORATORY

You will need the Laboratory Manual resources provided in the Course Pack. Review the lab guide materials required for each week during the semester. 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 locally (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 5minute documentary film showing the results of your research and write a formal research manuscript. Each week, 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.

While working on group projects, you should be mindful of other students in your group; therefore, it is important for all participants to exercise:

- Respect for themselves, each other
- Openness and a positive attitude toward new ideas and other's ideas
- Flexibility and tolerance of ambiguity
- Good communications amongst themselves

ASSIGNMENT SCHEDULE & VALUES

Speaking (value)	*Writing (value)*	*Discussing/Demonstrating*
Proposal talk & movie= 10%	Proposal 2¶-Paper= 10%	LA Thesis interview= 10%
	Half-Draft Paper= 20%	Prof Thesis interview= 20%
	Final Paper/Film=30%	

Week	**Assignment(s) Due**	**Value (%)**
3	**Proposal Talk & movie**	**10**
4	**Proposal *2¶-Paper***	**10**
5	*LA Thesis Interview* (individual score, group format)	**10**
7	***Half-Draft Paper***	**20**
7-15	*Prof Thesis Interview* (individual score, pair format)	**20**
12	Final **Paper** -or- (Film option)	**30**

Total = 100% of lab grade

Tardis Pass -- One-Time Time Travel RE-DO permit, improve work via revision opportunity.

The "Honors Option" (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 done as a group) and a talk (not a poster) if you seek individual credit for an Honors Option. Be aware the UURAF application deadline is often in January.

MSU & LBC INFORMATION AND POLICIES

Face Coverings:
Face coverings must be worn by anyone who is not vaccinated versus the SARS-CoV-2 coronavirus (all faculty, staff, students, vendors, and visitors) while participating in MSU-related or MSU-sponsored activities. If you have a medical condition that may prevent you from safely wearing a face covering, you should contact MSU's Resource Center for Persons with Disabilities to begin the accommodation process.

Face coverings should (a) be non-medical grade to maintain supplies for health care use, (b) fit snugly against the side of your face, (c) cover your nose and mouth, (d) be secured with ties or ear loops, and (e) allow for breathing without restriction. Cloth face coverings should only be worn for one day at a time, and they must be properly hand washed or laundered before subsequent use. Face coverings may vary (for example, disposable non-medical face coverings or neck gaiters are acceptable).

Absence due to illness: Students who need to quarantine themselves, have been sick with COVID-19 symptoms, tested positive for COVID-19, or have been potentially exposed to someone with COVID-19 must follow CDC guidance to self-isolate or stay home. Illness or self-isolation will not harm performance or put one at a disadvantage in the class.

Technical Assistance
If you need technical assistance at any time during the course or to report a problem you can:

- Visit the Distance Learning Services Support Site
- Visit the Desire2Learn Help Site (http://help.d2l.msu.edu/)
- Or call Distance Learning Services: (800) 500-1554 or (517) 355-2345

Mental Health Resources
College students often experience issues that may interfere with academic success such as academic stress, If you or a friend is struggling, we strongly encourage you to seek support. Helpful, effective resources are available on campus, and most are free of charge.

- Drop by Counseling & Psychiatric Services (CAPS) main location (3rd floor of Olin Health Center) for a same-day mental health screening.
- Visit https://caps.msu.edu for online health assessments, hours, and additional CAPS services.
- Call CAPS at **(517) 355-8270** any time, day or night.
- 24-Hour MSU Sexual Assault Crisis Line **(517) 372-6666** or visit https://centerforsurvivors.msu.edu/

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

Inform Your Instructor of Any Accommodations Needed

- From the Resource Center for Persons with Disabilities (RCPD): Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. Please present this form to me at the start of the term and/or two weeks prior to the accommodation date (test, project, etc.).

LBC Student Success and Advising Team

LBC advisors work to educate, coach, and support students in our College. For more information about the Student Success and Advising team visit: https://lbc.msu.edu/advising/index1.html

To make a zoom or phone appointment with an advisor visit: https://lbc.msu.edu/advising/advising-appointments.html

To review LBC Academic Policies, including LBC's Academic Grievance Policy, visit: https://lbc.msu.edu/advising/academic-policies.html

Related Policies:
Institutional Data Policy:
https://tech.msu.edu/about/guidelines-policies/msu-institutional-data-policy/
Student Privacy Guidelines and Notification of Rights under FERPA
https://reg.msu.edu/ROInfo/Notices/PrivacyGuidelines.aspx

Commitment to Integrity: Academic Honesty

Article 2.3.3 of the Academic Freedom Report states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the (insert name of unit offering course) adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Web site: www.msu.edu.)

Therefore, unless authorized by your instructor, you are expected to complete all course assignments, including homework, lab work, quizzes, tests and exams, without assistance from any source. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use answers provided by Chegg.com or CourseHero.com or similar "cheat" web sites to complete any course work in this course. Students who violate MSU academic integrity rules may receive a penalty grade, including a failing grade on the assignment or in the course. Contact your instructor if you are unsure about the appropriateness of your course work. (See also the Academic Integrity webpage.)

LINKS TO UNIVERSITY POLICIES

- **Spartan Code of Honor**
- **Academic Integrity**
- **RCPD Disability Accommodations Statement**
- **Mental Health**
- **Tolerance and civility**
- **Religious Observance Policy**
- **Student Athletes**
- **MSU Final Exam Policy**

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 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 and 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. Grades are pretty simple, like getting an "A" or "B+" or "C" written at the top of each assignment– and you can always check your grade on the D2L gradebook – but be sure to keep your own spreadsheet and alert me if my gradesheet 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.

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

Letter Grade	***Percentage***	***Performance***
A (4.0)	90 to 100%	*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 & well it was done. The student taught Prof something original.
B+ (3.5)	85 to 89.9%	*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.
B (3.0)	80 to 84.9%	*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.
C+ (2.5)	75 to 79.9%	*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.
C (2.0)	70 to 74.9%	*Average Work* - A "2.0" is average, the student did the minimum work required.
D+ (1.5)	65 to 69.9%	*Below Average Work* - the student did less than minimum work required.
D (1.0)	60 to 64.9%	*Poor Work*- the student did less than minimum work required and of poor quality.
F (0.0)	0 to 59.9%	*Failing Work*- the student did far less than minimum work required and very poor quality.

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*).

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 (LIVE or virtually).

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.

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 below that level, you still get a 50% score if you tried. If you prepare for class, you'll get good grades, and if you don't, you get at least get some credit for trying. 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 can become 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.

---"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!)

- **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:

Barry S, Murphy K, Drew S. 2015. From deconstructive misalignment to constructive alignment: Exploring student uses of mobile technologies in university classrooms. Comput. Educ. 81:202–210.

Dahlstrom E, Bichsel J. 2014. Educause Center for Applied Research (ECAR) Study of Undergraduate Students and Information Technology, 2014. Res. Pap. [accessed 2015 June 21] **http://net.educause.edu/ir/library/pdf/ers1407/ers1407.pdf**

Kuznekoff JH, Munz S, Titsworth S. 2015. Mobile Phones in the Classroom: Examining the Effects of Texting, Twitter, and Message Content on Student Learning. Commun. Educ.:1–22.

Mueller PA, Oppenheimer DM. 2014. The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking. Psychol. Sci. 25:1159–1168.

Murphy Paul A. May 3 2013. You'll Never Learn!: Students can't resist multitasking, and it's impairing their memory. Slate. [accessed 2015 June 30] **http://www.slate.com/articles/health_and_science/science/2013/05/multitasking_while_studying_pided_attention_and_technological_gadgets.html**

Ravizza SM, Hambrick DZ, Fenn KM. 2014. Non-academic internet use in the classroom is negatively related to classroom learning regardless of intellectual ability. Comput. Educ. 78:109–114.

Sana F, Weston T, Cepeda NJ. 2013. Laptop multitasking hinders classroom learning for both users and nearby peers. Comput. Educ. 62:24–31.

Shirky, C. Sept. 8 2014. Why I Just Asked My Students To Put Their Laptops Away. Medium. [accessed 2015 June 30] **https://medium.com/@cshirky/why-i-just-asked-my-students-to-put-their-laptops-away-7f5f7c50f368**

Weaver BE, Nilson LB. 2005. Laptops in class: What are they good for? What can you do with them? New Dir. Teach. Learn.:3–13.

Weinschenk, S. Sept. 11 2012. Why We're All Addicted to Texts, Twitter and Google. Psychology Today [accessed 2015 June 30] **https://www.psychologytoday.com/blog/brain-wise/201209/why-were-all-addicted-texts-twitter-and-google**