

Supplemental Material

CBE—Life Sciences Education

McNeal *et al.*

Biology 1020 In class engagement form

Your name: _____

1) Did you wear a skin sensor today (Circle one)? Yes or No

2) How engaged did you feel in class today (Circle the number below)?

Not Engaged		Somewhat		Very Engaged
1	2	3	4	5

3) What was the most engaging or memorable aspect of class today? _____

4) What was not engaging or seemed uninteresting to you in class today? _____

5) In comparison to other courses I have had in college, today's class engaged me (Circle the number below):

At a lower level		At the same level		At a higher level
1	2	3	4	5

6) Anything else you would like to tell us about the class (e.g, what was attention getting/what was not)?

Survey Item Number	Published Instrument Author, Year, and Item Used
1	Klymkowsky et al., 2010, Q1
2	Klymkowsky et al., 2010, Q5
3	Klymkowsky et al., 2010, Q30
4	Klymkowsky et al., 2010, Q2
5	Klymkowsky et al., 2010, Q3
6	Klymkowsky et al., 2010, Q10
7	Klymkowsky et al., 2010, Q11
8	Klymkowsky et al., 2010, Q13
9	Klymkowsky et al., 2010, Q20
10	Klymkowsky et al., 2010, Q19
11	Klymkowsky et al., 2010, Q16
12	Klymkowsky et al., 2010, Q22
13	Klymkowsky et al., 2010, Q28
14	Klymkowsky et al., 2010, Q6
15	Klymkowsky et al., 2010, Q12
16	Klymkowsky et al., 2010, Q26
17	Klymkowsky et al., 2010, Q8
18	Wick et al., 2013, Q5
19	Wick et al., 2013, Q7
20	Wick et al., 2013, Q9
21	Wick et al., 2013, Q14
22	Wick et al., 2013, Q15
23	Wick et al., 2013, Q16
24	Wick et al., 2013, Q18
25	Shi et al., 2010, Q1
26	Shi et al., 2010, Q9
27	Shi et al., 2010, Q10
28	Shi et al., 2010, Q11
29	Shi et al., 2010, Q12
30	Shi et al., 2010, Q15
31	Shi et al., 2010, Q17
32	Shi et al., 2010, Q18
33	Shi et al., 2010, Q19
34	Shi et al., 2010, Q20
35	Shi et al., 2010, Q21
36	Shi et al., 2010, Q22
37	Shi et al., 2010, Q23

1.

Many types of house plants droop when they have not been watered and quickly "straighten up" after watering. The reason that they change shape after watering is because ...

- A. Water reacts with, and stiffens, their cell walls.
- B. Water is used to generate energy that moves the plant.
- C. Water changes the concentration of salts within the plant.
- D. Water enters and expands their cells.

2.

There exists a population in which there are three distinct versions of the gene A (a1, a2, and a3). Originally, each version was present in equal numbers of individuals. Which version of the gene an individual carries has no measurable effect on its reproductive success. As you follow the population over a number of generations, you find that the frequency of a1 and a3 drop to 0%. What is the most likely explanation?

- A. There was an increased rate of mutation in organisms that carry either a1 or a3.
- B. Mutations have occurred that changed a1 and a3 into a2.
- C. Individuals carrying a1 or a3 were removed by natural selection.
- D. Random variations led to a failure to produce individuals carrying a1 or a3.

3.

How is genetic drift like molecular diffusion?

- A. Both are the result of directed movements.
- B. Both involve passing through a barrier.
- C. Both involve random events without regard to ultimate outcome.
- D. They are not alike. Genetic drift is random; diffusion typically has a direction.

4.

In which way are plants and animals different in how they obtain energy?

- A. Animals use ATP; plants do not.
- B. Plants capture energy from sunlight; animals capture chemical energy.
- C. Plants store energy in sugar molecules; animals do not.
- D. Animals can synthesize sugars from simpler molecules; plants cannot.

5.

In which way are plants and animals different in how they use energy?

- A. Plants use energy to build molecules; animals cannot.
- B. Animals use energy to break down molecules; plants cannot.
- C. Animals use energy to move; plants cannot.
- D. Plants use energy directly, animals must transform it.

6.

What makes DNA a good place to store information?

- A. The hydrogen bonds that hold it together are very stable and difficult to break
- B. The bases always bind to their correct partner.
- C. The sequence of bases does not greatly influence the structure of the molecule.
- D. The overall shape of the molecule reflects the information stored in it.

7.

What is it about nucleic acids that makes copying genetic information straightforward?

- A. Hydrogen bonds are easily broken.
- B. The binding of bases to one another is specific.
- C. The sequence of bases encodes information.
- D. The shape of the molecule is determined by the information it contains.

8.

When we want to know whether a specific molecule will pass through a biological membrane, we need to consider ...

- A. the specific types of lipids present in the membrane.
- B. the degree to which the molecule is water soluble.
- C. whether the molecule is actively repelled by the lipid layer.
- D. whether the molecule is harmful to the cell.

9.

Lipids can form structures like micelles and bilayers because of ...

- A. their inability to bond with water molecules.
- B. their inability to interact with other molecules.
- C. their ability to bind specifically to other lipid molecules.
- D. the ability of parts of lipid molecules to interact strongly with water.

10.

Why is double-stranded DNA not a good catalyst?

- A. It is stable and does not bind to other molecules.
- B. It isn't very flexible and can't fold into different shapes.
- C. It easily binds to other molecules.
- D. It is located in the nucleus.

11 .

In a diploid organism, what do we mean when we say that a trait is dominant?

- A. It is stronger than a recessive form of the trait.
- B. It is due to more, or a more active gene product than is the recessive trait.
- C. The trait associated with the allele is present whenever the allele is present.
- D. The allele associated with the trait inactivates the products of recessive alleles.

12.

How similar is your genetic information to that of your parents?

- A. For each gene, one of your alleles is from one parent and the other is from the other parent.
- B. You have a set of genes similar to those your parents inherited from their parents.
- C. You contain the same genetic information as each of your parents, just half as much.
- D. Depending on how much crossing over happens, you could have a lot of one parent's genetic.

13.

Gene A and gene B are located on the same chromosome. Consider the following cross: AB/ab X ab/ab. Under what conditions would you expect to find 25% of the individuals with an Ab genotype.

- A. It cannot happen because the A and B genes are linked.
- B. It will always occur, because of independent assortment.
- C. It will occur only when the genes are far away from one another.
- D. It will occur only when the genes are close enough for recombination to occur between them.

14.

Natural selection produces evolutionary change by...

- A. changing the frequency of various versions of genes.
- B. reducing the number of new mutations.
- C. producing genes needed for new environments.
- D. reducing the effects of detrimental versions of genes.

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15.

It is often the case that a structure (such as a functional eye) is lost during the course of evolution. This is because ...

- A. It is no longer actively used.
- B. Mutations accumulate that disrupt its function.
- C. It interferes with other traits and functions.
- D. The cost to maintain it is not justified by the benefits it brings.

16.

You follow the frequency of a particular version of a gene in a population of asexual organisms. Over time, you find that this version of the gene disappears from the population. Its disappearance is presumably due to ...

- A. genetic drift.
- B. its effects on reproductive success.
- C. its mutation.
- D. the randomness of survival.

17.

You are doing experiments to test whether a specific type of acupuncture works. This type of acupuncture holds that specific needle insertion points influence specific parts of the body. As part of your experimental design, you randomize your treatments so that some people get acupuncture needles inserted into the "correct" sites and others into "incorrect" sites. What is the point of inserting needles into incorrect places?

- A. It serves as a negative control.
- B. It serves as a positive control.
- C. It controls for whether the person can feel the needle.
- D. It controls for whether needles are necessary.

18.

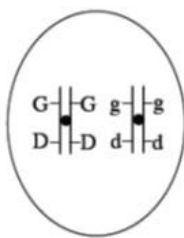
How does a gene produce a phenotype? CHOOSE THE ONE BEST ANSWER.

- A. The gene codes for a carbohydrate which produces the phenotype.
- B. The gene codes for a protein which produces the phenotype.
- C. The gene codes for DNA which produces the phenotype.
- D. The gene produces the phenotype directly.
- E. I do not know.

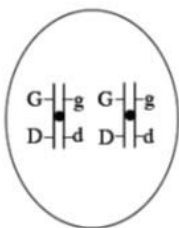
19.

Suppose there are two genes on two different chromosomes, one gene called G and the other called D. An individual has the genotype GgDd. Which of the following drawings correctly shows cells in this individual after DNA replication but before cell division of the first stage of meiosis? Assume no crossing-over occurs between the chromosomes. CHOOSE THE ONE BEST ANSWER.

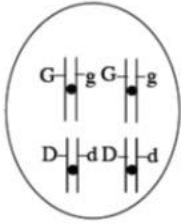
A. A



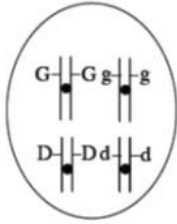
B. B



C. C



D. D



E. E – I do not know

20.

Cystic fibrosis in humans is caused by mutations in a single gene and is inherited as an autosomal (non-sex chromosome) recessive trait. A normal couple has two children. The first child has cystic fibrosis, and the second child is unaffected. What is the probability that the second child is a carrier (heterozygous) for the mutation that causes the disease? CHOOSE THE ONE BEST ANSWER.

- A. 1/4
- B. 1/2
- C. 2/3
- D. 3/4
- E. 1
- F. I don't know

21.

A child has a recessive disease, but his parents do not. Which of the following statements about that child's parents is true? CHOOSE THE ONE BEST ANSWER.

- A. One parent has one copy of the disease-causing version of the gene.
- B. One parent has two copies of the disease-causing version of the gene.
- C. Each parent has one copy of the disease-causing version of the gene.
- D. Each parent has two copies of the disease-causing version of the gene.
- E. I do not know.

22.

What MOST IMPORTANT characteristic of DNA allows it to store information?
CHOOSE THE ONE BEST ANSWER.

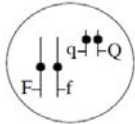
- A. The weak hydrogen bonding of bases in DNA.
- B. The specific pairing of bases in DNA.
- C. The specific order of bases in DNA.
- D. The unique shapes of bases in DNA.
- E. I do not know.

23.

As pictured on the right, “F” and “f” represent two different versions of one gene. “Q” and “q” represent two different versions of another gene.

What are the possible sperm cell genotypes produced from this cell? CHOOSE THE ONE BEST ANSWER.

- A. F, f, Q, q
- B. Ff, Ff, Qq, Qq
- C. FQ, fq, Fq, fQ
- D. Ff, Qq, FQ, fq, Fq, fQ
- E. I do not know.



24.

Why are geneticists able to apply what they learn from mice, fruit flies, and yeast to humans? CHOOSE ALL THAT APPLY.

- A. Mice, fruit flies, yeast and humans all have DNA as their genetic material.
- B. Mice, fruit flies, yeast and humans all have RNA as their genetic material.
- C. Mice, fruit flies, yeast and humans all have protein as their genetic material.
- D. Mice, fruit flies, yeast and humans all have amino acids as their genetic material.
- E. I do not know.

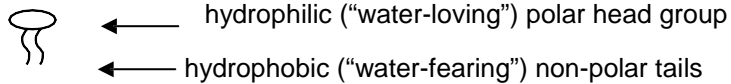
25.

Many infectious diseases are becoming difficult to treat because of bacterial resistance to antibiotics. Populations of bacteria can become resistant when they are exposed to an antibiotic. What is the best general explanation for how this occurs?

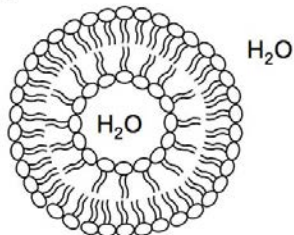
- A. The antibiotic induces specific mutations in some of the bacteria that make them antibiotic-resistant.
- B. The antibiotic activates bacterial genes encoding enzymes that can destroy the antibiotic.
- C. The antibiotic increases the bacterial mutation rate, so that resistant mutant bacteria are more likely to arise.
- D. Antibiotic-resistant mutant bacteria already present in the population survive and reproduce in the presence of the antibiotic.
- E. I do not know

26.

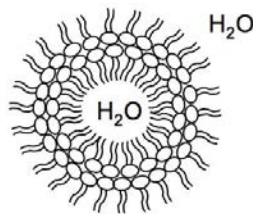
A phospholipid molecule is diagrammed at the right, and the four diagrams A-D below represent cross sections of spherical structures composed of phospholipids. Which of these structures is most likely to form when a phospholipid is vigorously dispersed in water?



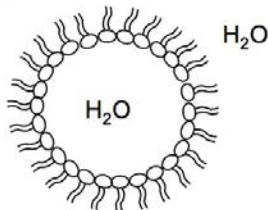
A.



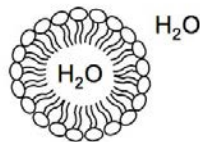
B.



C.



D.



27.

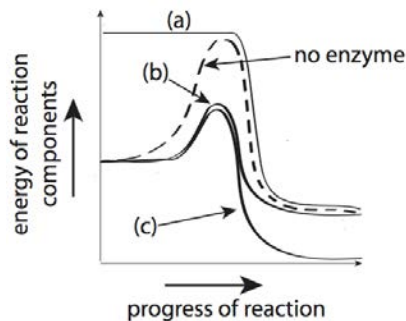
Consider a short polar charged region and a short non-polar region in a long polypeptide chain. When dissolved in water, the polypeptide will most likely fold to form a protein in which:

- A. The non-polar region is exposed on its surface and the polar region is interior.
- B. The polar region is exposed on its surface and the non-polar region is interior.
- C. both the non-polar and the polar region are exposed on its surface.
- D. both the non-polar region and the polar region are interior.

28.

Consider the following chemical reaction: $A + B = C$.

In the diagram below, the dashed line represents the energetics of this reaction WITHOUT an enzyme. Which of the solid lines (a, b, c) in the diagram best represents the way the curve would look in the presence of an enzyme catalyst that increases the reaction rate?



- A. (a)
- B. (b)
- C. (c)

29.

If the intracellular reaction $A + B \rightarrow C$ proceeds in the presence of a specific enzyme and no other components, you can conclude that:

- A. the reaction would not proceed in the absence of the enzyme.
- B. the reaction would proceed in the absence of the enzyme but at a slower rate.
- C. the reverse reaction $A + B \leftarrow C$ would not proceed in the presence of the enzyme.
- D. the reaction in the presence of the enzyme will not proceed any faster if the temperature is raised a few degrees.

30.

Which of the following substances will be least likely to diffuse through a pure phospholipid bilayer membrane that contains no proteins?

- A. a)
- B. b)
- C. c)
- D. d)

31.

The oxygen atoms in the H₂O broken down during photosynthesis end up in:

- A. ATP molecules generated by photosynthesis.
- B. carbohydrates generated by photosynthesis.
- C. molecular O₂ released during photosynthesis.
- D. new H₂O molecules that are produced by respiration.

32.

In the presence of oxygen, cells oxidize glucose completely to carbon dioxide and water according to the chemical equation: In the process, about 35 molecules of ATP are generated per molecule of glucose oxidized, so that some of the energy released by oxidation is recovered as usable chemical energy. The principal role of O₂ in this process is to:

- A. accept electrons released by glucose oxidation, forming H₂O.
- B. supply the oxygen for CO₂ production.
- C. react with glucose to cleave it into smaller fragments for further oxidation.
- D. participate as a reactant in generation of ATP from ADP and Pi.

33.

The photograph below shows a single replicated chromosome (consisting of two sister chromatids) just before mitosis. This chromosome contains:

- A. two single-stranded DNA molecules.
- B. one double-stranded DNA molecule.
- C. two double-stranded DNA molecules.
- D. many double-stranded DNA molecules.



34.

The replicated chromosome shown in Question 33 contains:

- A. DNA from one of your parents in the sister chromatid on the left and DNA from the
- B. other parent in the sister chromatid on the right.
- C. DNA contributions from both parents, resulting from recombination (crossing over).
- D. DNA from only one of your parents.

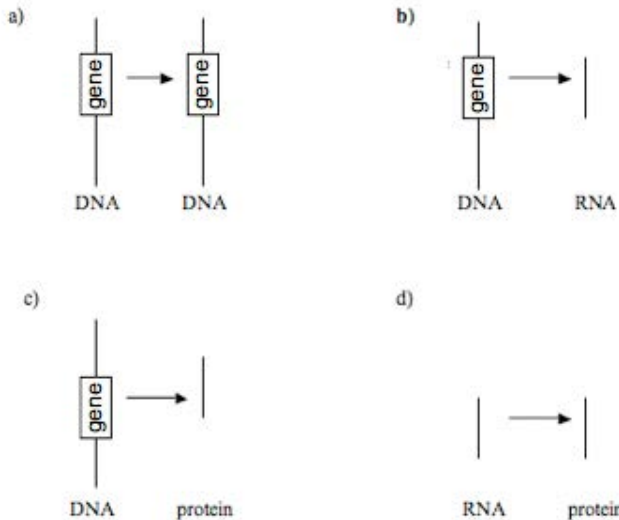
35.

Which of the following statements about DNA synthesis at the replication fork of a replicating DNA molecule is FALSE?

- A. Nucleotides are added at the 3' ends of all the new strands in a replicating DNA molecule.
- B. Double-stranded DNA synthesis requires both deoxyribonucleotides and ribonucleotides.
- C. The sequence of each newly synthesized single strand is identical to that of the parental single strand that served as its template.
- D. One of the two new strands must be synthesized in fragments because the two strands have opposite directionality.

36.

Transcription is best represented by which of the following diagrams?



37.

The human hexokinase enzyme has the same function as the bacterial hexokinase enzyme but is somewhat different in its amino acid sequence. You have obtained a mutant bacterial strain in which the gene for hexokinase and its promoter are missing. If you introduce into your mutant strain a DNA plasmid engineered to contain the coding sequence of the human hexokinase gene, driven by the normal bacterial promoter, the resulting bacteria will now produce:

- A. the bacterial form of hexokinase.
- B. the human form of hexokinase.
- C. a hybrid enzyme that is partly human, partly bacterial.
- D. both forms of the enzyme.

Principles of Biology (BIOL 1020-004) – Fall 2017

Lecture: 11 am – 12:15 pm TR in SCA101
Instructor: Dr. Min Zhong
e-mail: zhongmi@auburn.edu
Phone: 334-844-3925
Office hours: 9:00-11:00 am, W, in SCL210 (by appointment through email, **please clarify your class section (BIOL1020-003) in ANY emails you send !**)

SI leader Tajnea Foster (tkf0004@auburn.edu)
SI section: TR 7-8:30pm in Mell 3510a.

LA weekly coaching 7-8pm on Monday, in CHEM 134.

Text:

1. Campbell Biology (11th edition) by Reese etc
2. Mastering Biology access – MB take-home assignment and in-class Learning Catalytics (LC), and other activities.
3. Canvas website –chapter objectives, preview notes, lecture ppts, quizzes etc.
4. Cheap calculator.

Grading:

Lecture test #1 -----	150 pts
Lecture test #2 -----	150 pts
Lecture test #3 -----	150 pts
Lecture final (comprehensive)-----	200 pts
TBL activities and quizzes -----	250 pts
Research Project -----	100 pts

Grand Total: 1000 pts

Bonus credits: • Bonus quizzes will not be announced and are in form of in-class quiz/activities/survey, attendance as well as writing assignments.

Grades:

A=90-100%	900-1000 pts
B=80-90%	800-899 pts
C=70-79%	700-799 pts
D=60-69%	600-699 pts
F=below 60%	< 600 pts

Scantrons will be provided for each test, but you must bring a #2 pencil.

Attendance: Attendance in lecture is optional. However, past experience shows that a correlation exists between class-cutting and poor grades.

All notes given in this class are protected by copyright laws and may NOT be distributed, posted on the internet, or commercialized.

Make-up policy: Students who miss the normal exams will need to contact me and turn in the valid excuse within **48 hours** from the time that the exams were given. The makeup exam schedule is determined by the instructor and will need to be done within ONE week (5 work days) from the time that the exams were given. **Normally it will be at 5pm-6pm or 7-8 am on Friday of that test week in a room (TBA) of SCL.** Students will need to check the class email for the makeup details. Students who miss the makeup without valid excuses will get zero on the exam.

The format, questions and difficulty-level of make-up exams are not guaranteed to be same as the normal exam, which are at the discretion of the instructors. Students are not allowed to choose the make-up dates, formats on their own.

Valid excuses include: 1). illness documented by a physician. 2) evidence of personal or family emergency. 3) official university excuses.

Excuses are only accepted for the exams. No excuses need for general lectures or any bonus credits.

Cheating: All forms of academic dishonesty will be reported to the Academic Honesty Committee. Students may be required to sign an honor pledge on exams. The academic honesty code found in Chapter 1200 of the SGA code of laws (http://www.auburn.edu/tigercub/rules/code_of_laws.doc) should be considered an extension of this syllabus and should be read and upheld by all students.

Contingency plans: If normal class activities are disrupted due to unavoidable situations such as instructor illness, any crisis situation, weather related situations or epidemic outbreak, the syllabus and course plans may be modified to allow completion of the course. If this occurs, a revised syllabus will be posted on Blackboard and will replace the original materials. You will be notified by class email should such revision of the syllabus occur.

Special Accommodations: Students who need special accommodations please bring me your memo from the Program for Students with Disabilities (1322 Haley Center, 844-2096) as soon as possible. You are also encouraged to see me after class or during my office hours to discuss your situation and special needs confidentially.

Tentative test dates: Sep 19 – 1st Lecture test,
Oct 19 – 2nd Lecture test,
Nov 16 – 3rd Lecture test.

Final – **Dec 13**

Tentative Course Calendar

Date	Lecture	Content	Class visit
8/22	Chapter1:	Syllabus and Introduction	
8/24	Chapter2:	The Chemical context of Life	
8/29	Chapter2:	The Chemical context of Life	
8/31	Chapter3:	Water and Life	
9/5	Chapter4:	Carbon and the Molecular Diversity of Life	
9/7	Chapter5	Biological molecules	
9/12	Chapter5	Biological molecules	
9/14	Chapter6:	Cells	
9/19	1st Lecture test	(Chapter1-5)	
9/21	Chapter6:	Cells	
9/26	Chapter7:	Membrane Structure and Function	
9/28	Chapter8:	An Introduction to Metabolism	
10/3	Chapter9:	Cellular Respiration and Fermentation	
10/5	Chapter9:	Cellular Respiration and Fermentation	
10/10	Chapter10:	Photosynthesis	Class observation #1
10/12	Fall Break		
10/17	Chapter10:	Photosynthesis	Class observation #2
10/19	2nd Lecture test	(Chapter6-10)	
10/24	Chapter12:	The Cell Cycle	
10/26	Chapter13:	Meiosis and Sexual Life Cycles	
10/31	Chapter14:	Mendel and the Gene Idea	
11/2	Chapter15:	The Chromosomal Basis of Inheritance	
11/7	Chapter16:	The Molecular Basis of Inheritance	
11/9	Chapter17:	From Gene to Protein	

11/14	Chapter17:	From Gene to Protein	Class observation #3
11/16	3rd Lecture test	(Chapter12-16)	
11/20-24	Thanksgiving Holiday		
11/28	Chapter22:	Evolution	Class observation #4
11/30	Chapter23+24:	Microevolution and macroevolution	
12/5	Chapter23+24:	Microevolution and macroevolution	Class observation #5
12/7(Class end)	Chapter 52+54	Ecology + Community Ecology	
12/13	7:00-9:30pm	Final Exam (Comprehensive)	

What is your First Name? _____

What is your Last Name? _____

What section of BIOL 1020 were you enrolled?

- 003
- 004

What is your GENDER?

- Male
- Female
- Choose not to answer

What is your ETHNICITY? CHOOSE ALL THAT APPLY.

- American Indian/Native American
- Asian/Asian American
- Black/African/African American
- Latino(a)/Hispanic
- Native Hawaiian/Pacific Islander
- White/Caucasian
- Other - please explain _____

What is your MAJOR? _____

What is your current Auburn Student Status?

- Freshman
- Sophomore
- Junior
- Senior
- Super-Senior
- Other

How confident are you that you will succeed in this course?

- Very confident
- Somewhat confident
- Not at all confident

What is are your future career plans/goals? _____