

Bio 112 Handout for Themes 1

This handout contains:

- Today's iClicker Questions

iClicker Question #7A - before lecture

Which of the following statements is(are) **true**?

- A. Animals can use CO₂ as a carbon source.
- B. Both plants and animals carry out cellular respiration.
- C. All cells obtain energy input directly in the form of light.
- D. More than one.
- E. None of the above.

iClicker Question #7B - after lecture

Which of the following statements are true?

- A. Both plants and animals require externally-supplied vitamins.
- B. Animals can make some monomers from other monomers.
- C. All of the carbon atoms in a plant came from the air.
- D. none are true.
- E. More than one is true.

Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
 - a. Press the button corresponding to the answer you've selected (A thru E).
 - b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

Bio 112 Handout for Themes 2

This handout contains:

- Today's iClicker Questions
- Handouts for today's lecture
- An Interesting Article
- Information for Exam I
- Solutions to Last Year's Exam I

iClicker Question #8A - before lecture

In the classic 1954 science fiction movie "Them", Los Angeles is terrorized by giant ants. These ants are roughly 1000-times larger than regular ants. Which of the following statements is correct?

- A. The giant ants will weigh the same as regular ants.
- B. The giant ants will weigh roughly 1,000-times more than regular ants.
- C. The giant ants will weigh roughly 1,000,000-times more than regular ants.
- D. The giant ants will weigh roughly 1,000,000,000-times more than regular ants.
- E. None of the above.

iClicker Question #8B - after lecture

Consider a solid sphere 2 feet in diameter. If this sphere were tripled in size to 6 foot diameter and made of the same materials, which of the following is correct:

- | | <u>change in surface area</u> | <u>change in weight</u> |
|----|-------------------------------|-------------------------|
| A) | increase 3x | increase 6x |
| B) | increase 9x | increase 27x |
| C) | increase 3x | increase 9x |
| D) | increase 100x | increase 1000x |
| E) | none of the above | |

Beaming in your answers

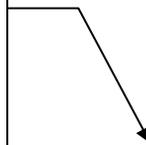
1. Figure out your answer and select the appropriate letter (A-E).
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Bio 112 Size & Scale

(1) Fictional Example

Tibia - the larger of the two bones in the lower leg.



(2) Real-Life examples
a) Primates

Siamang
correct
relative size

Siamang
enlarged to gorilla
& human scale

Gorilla
correct
relative size

Human
correct
relative size

Notice that the gorilla is not just an enlarged (scaled-up proportionally) siamang – the leg bones (among others) must be made larger than you'd expect from just enlarging the siamang to gorilla size.

b) Four-legged mammals:

Rabbit

Rabbit

enlarged to elephant size

Elephant

correct relative sizes

Notice that the elephant is not just a scaled-up rabbit; the leg bones are much thicker. Notice also that the elephant stands with knees locked & legs vertical while the rabbit's legs (which must support much less weight) can be bent at rest.

Virtual Reality “Critter” Animation

This is an animated illustration of the effects of size and scale.

Shown below is the ‘creature’ at normal size.

This creature has a spherical body and a single leg.

- The blue “Strength” indicator shows the strength of the leg – how much weight it can bear without breaking. The strength of the leg depends on the area of the cross-section of the leg. This therefore increases as the square of the size.
- The yellow “Weight” indicator shows the weight of the spherical body of the creature. The weight depends on the volume of the sphere. This therefore increases with the cube of the size.
- At normal size, there is a 5-fold safety margin of strength in the leg. That is, the leg can bear 5-times the actual weight of the creature without breaking. This would allow the creature to walk safely.
- If you click on the checkered background, the animation starts.
 - Gradually, the creature is scaled up 5-fold. That is, it is smoothly and proportionally made 5-times wider, 5-times taller, and 5-times thicker. The relative proportions of the creature remain the same.
 - Click on the body to stop the animation.
 - Click on the checkerboard to re-start it.
 - You will notice that the strength of the leg increases as it gets thicker.
 - By the end of the animation, the strength of the leg has increased 5 x 5 fold, or 25-fold.
 - You will also notice that the weight of the body increases as it gets bigger – the increase is at a faster rate than that of the leg’s strength.
 - By the end of the animation, the weight increases 5 x 5 x 5 fold, or 125-fold.
 - Thus, at the 5-times larger size, the weight is equal to the strength of the leg and the leg would break just standing there.
 - If you click on the leg, a transparent white leg will appear.
 - This leg is the correct diameter to support the larger body with the same 5-fold margin of safety that the original creature had.
 - Notice that the larger creature requires an extra thick leg to support the added weight. This is a much different proportion than the original, smaller, creature.
 - This is like the elephant’s legs being much thicker than those of a scaled-up rabbit.
 - If you click on the thicker leg, it will disappear.

Bio 112:

Why cats have nine lives

Jared M. Diamond

Bio 112: Information for Exam I

Basic Facts

- The exam will be held in Lipke on the date listed on the syllabus from 12:30 to 1:20.
 - The exam will cover reading, lab, and lecture from Evolution 1 through Evolution 9 as described below.
 - The exam will consist of approximately 4 questions. These will not be multiple choice; they will be problem-solving or short answer. The exam is likely to be similar to the exam from last year (see Lab Manual). It will likely consist of questions like:
 - Population Genetics. This will be like practice problem 1, 2, 3 or 4 (see Lab Manual) or Question 4 from last year's exam (see Lab Manual).
 - Evolution Scenario. A problem very much like Survey #1 (the cheetah problem), Questions 1a & 1b from last year's exam, and/or Practice Prob. 5 (Lab Manual).
 - A few short-answer questions about earth history, phylogeny, speciation, etc.
 - You need to know how to solve population genetics problems like those on the practice problems. The exam problems will likely be simpler than the hardest ones on the practice problems.
 - You also need to know:
 - the process of evolution
 - the formation of species
 - the outline of the history of the earth that I presented in lecture
 - the 5 Hardy-Weinberg assumptions and what they mean
 - how to interpret phylogenies
 - how to explain a graph of genotype or allele freqs as it changes over time
 - You will need to be able to describe evolutionary scenarios like in Question 1a & 1b from last year. These ask you to tell a story given certain constraints.
1. You should be familiar with these terms:
- convergent evolution
 - pre/post zygotic
 - kingdom, phylum, etc.
 - anagenesis/cladogenesis
 - analogous/homologous structures
- You **do not** need to know:
 - the specific allele or genotype frequencies of any genetic disease or trait
 - the names of the periods and eras
 - specific classification of any organism
- You may bring in a single sheet of (8 1/2 x 11 inch) paper with any notes you want. You may write on either side. You should be sure that you completely understand the material on your note sheet; it cannot help you if you don't know what it means.
- Tips** • The best way to learn population genetics is to work problems. You should work through all the practice problems. You should work through them and write out answers **before** looking at the answers.
- Tutoring is available (if you think you'll need tutoring you should start ASAP):
go to CC-1-1200 to arrange tutoring.
 - Almost all of the questions will ask you to explain your reasoning or justify your answer. In general, the majority of the points on any question will be for the explanation rather than the answer itself. As a result:
 - Explain yourself carefully and thoroughly; this will increase your chances of part credit.

- Be careful not to write more than necessary; you will be penalized for extra added wrong answers.
- Be careful to make your choice of answer clear. If you write, “yes unless it is not” (for example) you will get no credit.
- Try to use the terms correctly and use standard notation; this will make it easier for the graders to read and therefore more likely to get part credit.

Bio 112 Handout for Themes 3

This handout contains:

- Today's iClicker Questions

iClicker Question #9A - before lecture

In the classic 1954 science fiction movie "Them", Los Angeles is terrorized by giant ants. These ants are roughly 1000-times larger than regular ants. Which of the following statements is correct?

- The giant ants will have the same "skin" surface area as regular ants.
- The giant ants will have roughly 1,000-times more "skin" surface area than regular ants.
- The giant ants will have roughly 1,000,000-times more "skin" surface area than regular ants.
- The giant ants will have roughly 1,000,000,000-times more "skin" surface area than regular ants.
- None of the above.

iClicker Question #9B - after lecture

As they develop, the birds growing in all bird eggs "breathe" through the shell; O₂ diffuses in and CO₂ diffuses out through many tiny holes in the surface of the shell.

An ostrich egg is roughly 10 inches in diameter; a chicken egg is roughly 2 inches in diameter. Based on this, assuming that the holes are the same size in all eggs:

- You would expect more holes per square inch on the surface of an ostrich egg than on the surface of a chicken egg.
- You would expect more holes per square inch on the surface of a chicken egg than on the surface of an ostrich egg.
- You would expect the same number of holes per square inch on the surface of both eggs.
- I don't know.

Beaming in your answers

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