

# Bio 112 Handout for Ecology 5

This handout contains:

- Today's iClicker Questions
- Information for the Final Exam

## iClicker Question #33A - before lecture

Which of the following are examples of mutualism (in the Bio 112 sense)?

- A. Bacteria growing in the stomach of a cow; the bacteria process cellulose in the cow's food and the cow utilizes nutrients released by the bacteria.
- B. Cows eating grass; the cow's manure is not used to fertilize the field.
- C. Cheetahs eating gazelles.
- D. All of the above
- E. None of the above

## iClicker Question #33B - after lecture

If I wanted to maximize the diversity in a large area of land. How often should I let fire burn away all the vegetation?

- (A) let it all burn completely and often
- (B) let parts of it burn occasionally
- (C) never let it burn

### 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 Final Exam Tips

- The exam will be held in Lipke.
- The exam will cover reading, lab, and lecture of the entire course as described below.
  - roughly 40% of the test will cover Ecology (1 thru 8)
  - roughly 60% of the test will cover the whole course.
- The exam will consist of approximately 6 questions. These will not be multiple choice; they will be problem-solving or short answer. In general, the questions will expect you to apply and make connections between the things I have talked about in lecture. The final exam from Spring 2001 can be found in this handout; solutions are attached.

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## **Exam I Material (Evolution):**

You need to know everything listed on the Exam I Information Sheet (Themes 2 handout)

### **EXCEPT:**

- How to solve Population Genetics Problems
- How to explain a graph of genotype/allele frequencies
- How species are formed (anagenesis/cladogenesis, pre/post zygotic)

⇒ The questions from Exam I that are most like those that could be on the final are 1, 2b, and 3.

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## **Exam II Material (Plants & Themes):**

You need to know everything listed on the Exam II Information Sheet (Animals 3 handout)

### **EXCEPT:**

- basic genetics applied to plants
- How to calculate ratios of size & scale (Exam 2 Question 3a)

⇒ The questions from Exam II that are most like those that could be on the final are 1, 2, 3, and 4.

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## **Exam III Material (Animals & Physiology):**

You need to know everything listed on the Exam III Information Sheet (Ecology 1 handout)

### **EXCEPT:**

- The mechanisms of stimulatory & inhibitory effects on neurons

⇒ The questions from Exam III that are most like those that could be on the final are 1, 2, 3, and 4.

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## **Ecology Material**

– You need to know:

- population growth: exponential & logistic at the level of detail in lecture (& effects on N & K)
- how to recognize & apply predation/parasitism, competition, and mutualism
- niches (fundamental & realized) & how to measure them experimentally
- predator/prey oscillations                      • coevolution                      • mimicry
- succession & disturbance effects on communities
- the overall equations for cellular respiration & photosynthesis
- trophic levels, production efficiency (the “10% rule”) & where the carbon goes
- biogeochemical cycles: balancing flows, effects of changes, closed loops

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– You **do not** need to know:

- climate
  - the specific details of any examples from lecture
  - the specific steps in any successional series
  - details of biogeochemical cycles
- ⇒ This part of the exam will consist of questions like:
- “Describe what is happening in the various parts of this population growth graph”
  - “Given this food chain, how many grams of X production is required to make one gram of Y?”
  - “[description of interaction], is this predation, parasitism, competition, etc?”
  - “[description of situation], what are the realized & fundamental niches of species Y?”
  - etc.

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Other types of questions that could be found on the final (among others not listed):

- “A friend says he’s found a pine flower, is he crazy? Why/why not?” Same for animals.
- You should know the kingdom and phylum of the creatures I described in detail in the Plant Diversity and Animal Diversity sections of the course.

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**“Cheat Sheets”:** You will be allowed to bring in up to 4 sheets of paper (8.5 x 11) with anything you want written on them. You may keep these sheets; we will not collect them.

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# Supplementary Information for Final Exam

## “Pizza Parlor Phylogeny”

This sheet describes some information to add to the Information for the Final Exam found on page 2 and 3 of the handout for Ecology 5. Everything on those sheets still applies to the Final Exam, **except** anywhere that says that you don't have to know the “specific classification of any organism”. You still don't need to know the complete classification (kingdom, phylum, family, etc.) of any organism, but you will need to be able to answer a question like the following:

“Consider a pizza with broccoli and mushrooms. Name 4 organisms, each from a different phylum, that are represented in this pizza. For each organism, give the phylum to which it belongs

- |                    |              |
|--------------------|--------------|
| • Organism 1 _____ | Phylum _____ |
| • Organism 2 _____ | Phylum _____ |
| • Organism 3 _____ | Phylum _____ |
| • Organism 4 _____ | Phylum _____ |

The pizza on the exam will likely be different than the one described above. However, the pizza will only contain items from the following list:

- bread (wheat, yeast, etc.)
- mozzarella cheese (milk)
- mushrooms
- hamburger
- clams
- pine nuts (seeds of the pinion pine tree)
- tomato sauce (tomato, oregano, basil, garlic)
- broccoli
- green pepper
- pepperoni (pork, pepper, other spices)
- squid

To count as “containing” a particular organism, at least part of that organism or something produced by that organism must be present in the pizza. For example, although cockroaches (phylum *arthropoda*) may sometimes *eat* pizza, they are not usually found *on* a pizza, so you would not get credit for listing cockroaches.

You should use Campbell and the links in the On-line Lab Manual for the Phylogenetic Collection Lab as references for phyla and the organisms in them.

Lab 09: Phylogenetic Collection	<ul style="list-style-type: none"><li>• No Pre-lab</li><li>• <a href="#">Lab Manual</a></li><li>• Links to help you find organisms:<ul style="list-style-type: none"><li>◦ <a href="#">A list of Animal Phyla with links.</a></li><li>◦ <a href="#">A list of Bacterial Phyla with links.</a></li><li>◦ <a href="#">A list of Fungal Phyla with links.</a></li><li>◦ <a href="#">A list of Plant Phyla with links.</a></li><li>◦ <a href="#">A list of Protist Phyla with links.</a></li></ul></li></ul>
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**To prepare:** you will find it useful to put a list of the ingredients from the list above and the phyla present in each on your cheat sheet.

# Bio 112 Final Exam

5/23/01

Your Name: \_\_\_\_\_ TA's Name: \_\_\_\_\_

Write your name on every page in the space provided.  
This exam has 10 pages including this coversheet.  
Check that you have pages 1-10.

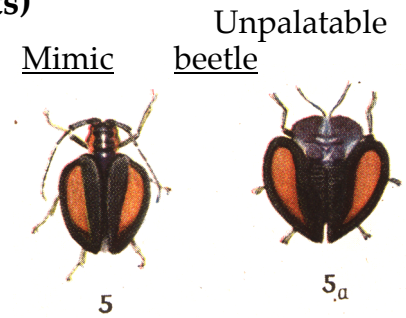
This exam has five questions.

Make your answers as clear and precise as possible.  
Answer all questions in the space provided.

Question	Value	Score
1	16	_____
2	27	_____
3	27	_____
4	14	_____
5	16	_____
TOTAL:	100	_____

## Question 1: Evolution & the History of the Earth (16 points)

a) The picture at the right shows two similar-looking insects. The beetle on the right is unpalatable - it tastes bad and birds rapidly learn not to eat it. The beetle on the left is a mimic, it tastes just fine to birds, but since it resembles the unpalatable beetle, birds do not eat it.



i) To which kingdom and phylum (according to Five Kingdoms) do these two insects belong? (1 pt each)

Kingdom \_\_\_\_\_

Phylum \_\_\_\_\_

ii) Assuming that the ancestors of the mimic did not look like the unpalatable beetle, provide a plausible explanation for how the ancestors of the mimic came to look like the unpalatable beetle by a process of **natural selection**. (8 pts)

b) Put the following 3 events in the proper order. Indicate your answer by writing the corresponding number of the event in the blanks provided. (3 pts)

- | # | <u>Event</u>          |
|---|-----------------------|
| 1 | First whales in water |
| 2 | First fish in water   |
| 3 | First mammals on land |

first event #: \_\_\_\_\_ next event #: \_\_\_\_\_ last event #: \_\_\_\_\_

c) Put the following 3 events in the proper order. Indicate your answer by writing the corresponding number of the event in the blanks provided. (3 pts)

- | # | <u>Event</u>         |
|---|----------------------|
| 1 | First bacteria       |
| 2 | First photosynthesis |
| 3 | First eukaryotes     |

first event #: \_\_\_\_\_ next event #: \_\_\_\_\_ last event #: \_\_\_\_\_

## Question 2: Life Cycles (27 points)

a) In the space below, draw the life cycle of a **flatworm**. Your drawing need not show the parts as they actually appear, but it must show the correct relationships between the parts and be **neat and legible**. You must include asexual reproduction - cutting the worm into two pieces and having each piece grow into a fully-functional worm. Be sure to include the following wherever appropriate; you should use each of these at least once:

### Parts

- zygote
- gamete
- adult worm
- cut pieces

### Processes

- mitosis
- meiosis
- cutting
- fertilization
- re-generation

### Features

- haploid
- diploid
- single cell
- many cells

(12 pts)

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You may use the back of this page for scrap.

## Question 2 , continued:

This is for scrap; we will not grade what you write on this page.



## Question 2, continued:

b) Complete the following table.

– For the moss:

- if the 'thing' is part of the moss life cycle, check "present" and name the corresponding part of the life cycle – if there is more than one part, give only one part.
- if the 'thing' is not part of the moss life cycle, check "not present"

– For the human:

- if the 'thing' is part of the human life cycle, check "present".
- if the 'thing' is not part of the human life cycle, check "not present"

<u>"Thing"</u>	<u>Moss</u> (2 pts each)	<u>Human</u> (1 pt each)
Single <b>haploid</b> cell which is capable of growing into a group of haploid cells.	<input type="checkbox"/> not present <input type="checkbox"/> present Name if <b>present</b> :	<input type="checkbox"/> not present  <input type="checkbox"/> present (No name is necessary)
Single <b>haploid</b> cell that is <b>not</b> capable of growing on its own, but can join with a particular other haploid cell to form a diploid cell.	<input type="checkbox"/> not present <input type="checkbox"/> present Name if <b>present</b> :	<input type="checkbox"/> not present  <input type="checkbox"/> present (No name is necessary)
An organism composed entirely of <b>haploid</b> cells.	<input type="checkbox"/> not present <input type="checkbox"/> present Name if <b>present</b> :	<input type="checkbox"/> not present  <input type="checkbox"/> present (No name is necessary)
A single <b>haploid</b> cell produced by meiosis.	<input type="checkbox"/> not present <input type="checkbox"/> present Name if <b>present</b> :	<input type="checkbox"/> not present  <input type="checkbox"/> present (No name is necessary)
A dormant form of the organism that can be stored without food or light for many months, but can grow into an organism when provided with food.	<input type="checkbox"/> not present <input type="checkbox"/> present Name if <b>present</b> :	<input type="checkbox"/> not present  <input type="checkbox"/> present (No name is necessary)

### Question 3: Animals & Plants (27 points)

a) Give 3 **differences** between a **single grain of pine pollen** and a **single human sperm**. Note that one of your differences **may not** be "pine pollen comes from a plant and human sperm comes from an animal".

(1) (1 pt)

(2) (2 pts)

(3) (3 pts)

b) Give one **similarity** between a **single grain of pine pollen** and a **single human egg**. (3 pts)

c) Give **three** major **differences** between a grain of **pine pollen** and a **moss spore**.

(1) (1 pt)

(2) (2 pts)

(3) (3 pts)

### Question 3, continued:

d) A friend tells you that he has found the following animal parts or features. For each animal part or feature: (1 pt each)

- circle **possible** if this animal part or feature could exist; no explanation is necessary
- circle **impossible** if this animal part or feature could not exist; no explanation is necessary

i) Asexual reproduction of an entire sponge (not just regeneration of a part).

Possible

Impossible

ii) A gill from an earthworm.

Possible

Impossible

iii) A chloroplast from a flatworm (planarian).

Possible

Impossible

iv) More than one heart from a squid.

Possible

Impossible

v) A nematode mating.

Possible

Impossible

vi) The brain of a trout.

Possible

Impossible

vii) The kidney of a planarian.

Possible

Impossible

e) Consider the following statement:

“Considering the animals described in lecture and excluding jellyfish, vertebrates are the only animals that breathe through their mouths.” True or false? Circle the right answer and explain your reasoning. (5 pts)

True

False

Reasoning:

## Question 4: Ecology (14 points)

All parts of this question refer to the following situation. These data come from studies done recently in upstate New York. They involve 5 species:

- Oak Trees:
  - produce fruits called **acorns**.
- Gypsy moths:
  - eat leaves of **oak** trees
- Mice:
  - prefer to eat **acorns**; will also eat **gypsy moth caterpillars**
- Ticks:
  - live on **mice**; drink their blood
- Lyme Disease bacteria:
  - live in **ticks**
  - if **ticks** bite humans, humans get Lyme disease

a) To which phylum (using the Five Kingdoms system) does each of the following organisms belong? (1 pt for each blank)

i) Gypsy moths \_\_\_\_\_

ii) Mice \_\_\_\_\_

b) Give the trophic level (primary producer, secondary consumer, etc.) of each of the following organisms: (1 pt each)

i) Oak trees \_\_\_\_\_

ii) Gypsy moths \_\_\_\_\_

iii) Ticks (note that there are two possible answers here; give **both**)

\_\_\_\_\_

c) What is the relationship between the **ticks** and the **mice**. Circle one. (1 pt)

mutualism

competition

predation/parasitism

d) Assuming that the mice eat all the acorns they gather, what is the relationship between the **mice** and **oak trees**. Circle one. (1 pt)

mutualism

competition

predation/parasitism

### Question 4, continued:

These questions refer to the community described on the previous page.

- Every 2 to 5 years, there is an abundant crop of acorns. A year where there is a large crop of acorns is called a 'mast year'.

e) During a mast year, a larger number of humans contract Lyme disease than during other years. Explain this observation. (3 pts)

f) Following a mast year, there is often a great increase in the gypsy moth population. Explain this observation. (3 pts)

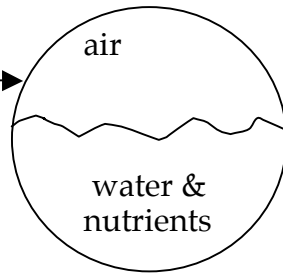
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You should not need to write below this line.

### Question 5: Ecosystems (16 points)

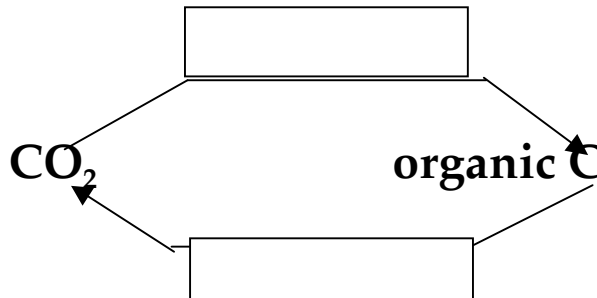
Consider the following theoretical ecosystem, the BioBall™.

- completely enclosed in a glass sphere
- only light can get in
- only heat can get out



- Contains 2 organisms only:
- **plant** that lives in water
  - **snail** that eats plant

a) Shown below is the carbon cycle for the BioBall™. Indicate where each organism participates in this cycle by writing "plant" or "snail" in the boxes as appropriate. (6 pts)



b) You observe that the CO<sub>2</sub> level in the BioBall™ drops during the daytime and rises during the nighttime. Explain this observation. (5 pts)

c) Consider the nitrogen cycle in the BioBall™ and what you know about biogeochemical cycles.

- the plants take in NO<sub>3</sub><sup>-</sup> and convert it to organic N
- the snail eats organic N and excretes NH<sub>4</sub><sup>+</sup>

This is not stable for the long term, since the NO<sub>3</sub><sup>-</sup> will run out and toxic NH<sub>4</sub><sup>+</sup> will build up. You have several choices to remedy this situation:

- (1) add NO<sub>3</sub><sup>-</sup> fertilizer whenever NO<sub>3</sub><sup>-</sup> gets low
- (2) add a bacterium that can live in the BioBall™ and can convert NH<sub>4</sub><sup>+</sup> to N<sub>2</sub>.
- (3) add a bacterium that can live in the BioBall™ and can convert N<sub>2</sub> to NO<sub>3</sub><sup>-</sup>.
- (4) add a bacterium that can live in the BioBall™ and can convert NH<sub>4</sub><sup>+</sup> to NO<sub>3</sub><sup>-</sup>.

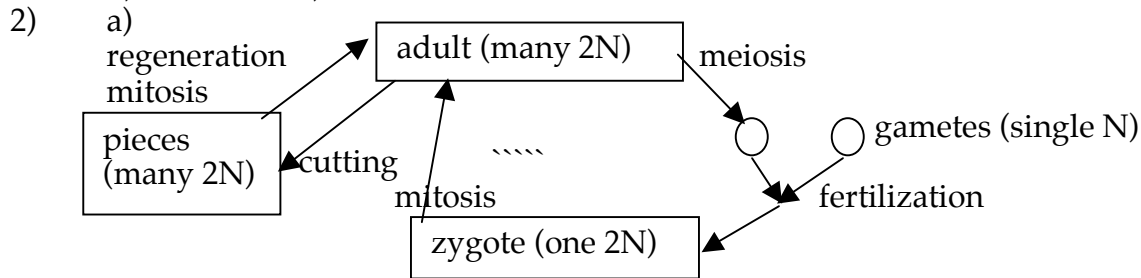
Which of these is the best choice to ensure the long-term stability of the organisms in the BioBall™? Write the number of your answer in the box and explain your reasoning below. (5 pts)

Explanation:

# Solutions to Final Exam from Spring 2001

- 1) a) i) kingdom: animalia      phylum: arthropoda  
 ii) there were 4 parts to a complete answer.
- Pre-existing variation: some ancestors of the mimic (5) looked one way while others looked like the unpalatable beetle (5a).
  - Variation is genetic: the color pattern is inherited.
  - One genotype at an advantage: beetles that look like the unpalatable one are not eaten as much and therefore have more offspring.
  - Increase in population: because the ones that look like the unpalatable beetle have more offspring, their genotype takes over the population. The result is a species of mimic beetle.

b) 231      c) 123



b)

<u>moss</u>	<u>human</u>
present: spore	not present
present: sperm	present
present: g'phyte	not present
present: spore	present
present: spore	not present

- 3) a) pine pollen                      human sperm  
 4 cells                                      one cell  
 can't swim                                  swim  
 doesn't fertilize egg                      fertilizes egg  
 made by mitosis                              made by meiosis  
 is a g'phyte                                      isn't
- b) both are haploid
- c) pine pollen                              moss spore  
 4 cells    1 cell  
 g'phyte    spore  
 grows to pollen tube                          grows to g'phyte plant  
 not for dispersal                              for dispersal  
 made in male cone                              made in sporangium  
 made by mitosis                                  made by meiosis
- d) Possible: (i), (iv), (v), (vi)              Impossible: (ii), (iii), (vii)
- e) True. All others breathe through skin or gills that are external to the mouth.
- 4) a) i) mandibulata                      ii) craniata  
 b) i) 1° producer                      ii) 1° consumer                      iii) 2° or 3° consumer  
 c) predation/parasitism                      d) predation/parasitism  
 e) increasing acorns ⇒ increase in mice ⇒ increase in ticks ⇒ increase in lyme disease  
 f) more acorns feed mice so they don't need to eat the gypsy moths ⇒ more gypsy

moths

- 5) a) top: plant                      bottom: snail  
 b) in daytime, lots of photosynthesis ⇒ lower CO<sub>2</sub>; at night, less photosynthesis so respiration

