

## Midterm Exam #3 - study guide

### March 21 lecture - algae

- 1) Is there a simple, all-encompassing definition for the group of organisms known as the algae?
- 2) What are algae? (i.e., what do algae have in common with each other?)
- 3) How are algae similar to plants? How are they different?
- 4) Know whether species of the following groups of algae are multicellular or unicellular: green algae, red algae, brown algae, diatoms, dinoflagellates.
- 5) Are all algae protists? Eukaryotes?
- 6) What is wrong with the term "blue-green algae" when used to describe cyanobacteria?
- 7) What is a "seaweed"?
- 8) What is a "kelp"?
- 9) What type of alga is nori made from?
- 10) What is algin (aka alginate)? What specific alga that we discussed do humans harvest to obtain alginate?
- 11) What is the industrial application of algin (i.e., what affect does it have on the products in which it is used)?
- 12) What is an algal bloom? What is an harmful algal bloom?
- 13) How much of Earth's carbon fixation happens in the oceans vs. land?
- 14) What type of organism does the term "plankton" refer to? What about "phytoplankton"?
- 15) What's the "exoskeleton" (i.e., outer casing) of a diatom called? From what material is it constructed?
- 16) What is diatomaceous earth? What are its industrial applications?
- 17) What organisms produce domoic acid?
- 18) What are the consequences to organisms that consume too much domoic acid?
- 19) What is amnesic shellfish poisoning?
- 20) What is bioaccumulation?
- 21) What is biomagnification?
- 22) What's a red tide?
- 23) What causes paralytic shellfish poisoning (name the of organisms and toxin).
- 24) What's Bioluminescence?
- 25) How might bioluminescence in dinoflagellates be an adaptive trait?
- 26) What is luciferase?
- 27) What causes coral bleaching?
- 28) What are zooxanthellae?
- 29) What do corals receive from zooxanthellae, and what do the zooxanthellae provide to the coral in return?

April 2 lecture – mosses and allies (bryophytes); ferns (seedless vascular plants)

- 1) **Know like the back of your hand: the table that details the differences between bryophytes, ferns and allies, gymnosperms, and angiosperms. Be able to apply these differences outside the context of the table in which they are presented (i.e., understand why these differences are important ecologically and evolutionarily).**
- 2) When did the first bryophytes evolve?
- 3) What is sporopollenin?
- 4) What's the difference between roots, rhizomes, and rhizoids?
- 5) What is peat?
- 6) What is a peat bog?
- 7) What is *Sphagnum*?
- 8) What three reasons, that we discussed in lecture, explain why members of the genus *Sphagnum* accumulate as peat (i.e., not decompose?)
- 9) What are the important industrial / human applications of peat moss? Are any of these applications due to the antibacterial properties of peat mosses?
- 10) Why are peat bogs significant in archaeology?
- 11) What's a living fossil/fossil species?
- 12) Approximately how many species of mosses and allies, and how many species of ferns & allies, are there on Earth?
- 13) What is a spore?
- 14) What types of plants dominated during the Carboniferous period?
- 15) Given adequate time and pressure, peat will eventually form what fossil fuel?
- 16) What's a fossil fuel?!
- 17) Are some members of the genus *Equisetum* fossil species?

THE FOLLOWING TERMINOLOGY AND CONCEPTS WERE ALSO PRESENTED IN THIS LECTURE

- 18) What is a phylogenetic tree?
- 19) Be comfortable interpreting phylogenetic trees.
- 20) Be able to define/explain the following terms: ancestor, common ancestor, most recent common ancestor, lineage, descendant.
- 21) What is the most recent common ancestor of all land plants?
- 22) What are the four lineages of land plants? When did each arise? Be able to draw a P-tree of this, as we've done in lecture!

October 4 No lecture this date

April 9 lecture - gymnosperms

- 1) What are the four evolutionary lineages of gymnosperms?
- 2) Which of the four lineages of gymnosperms is most widespread on Earth?
- 3) Which of the four lineages of gymnosperms is most diverse (i.e., contains the largest # of species)?
- 4) Know the four species of exceptional (i.e., tallest, oldest in the world, etc...) conifers as indicated in the posted lecture notes
- 5) What are the "3 parts" of a seed?
- 6) What two features of seeds make them ecologically superior to spores as a dispersal structures? Specifically, what stresses do these two features help overcome?

- 7) What's a pollen tube, and how does it relate to the ability of conifers (and other gymnosperms) to colonize habitats that are too dry for mosses/ferns?
- 8) What species of gymnosperm is the most important for timber products in North America?
- 9) What becomes of an ovule after fertilization?
- 10) What becomes of an egg after fertilization?
- 11) Why is *Ginkgo biloba* such a unique species (4-5 or more reasons jump to mind...!)?
- 12) How many species of gymnosperms are there? In each of the 4 groups?
- 13) Does the cycad lineage contain fossil species?
- 14) Know that conifers are cone-bearing trees (I might not have stated this during lecture, but it is in the lecture notes...)
- 15) Define "pollen"
- 16) What is the difference between pollination and fertilization?
- 17) Once the tiny and newly-formed female cone of a conifer is pollinated, its ovules & eggs will then be fertilized and the small cone will develop into the large woody structure that we so readily recognize as a pine cone. How much time is required for this process?
- 18) *Ephedra* spp. are in the \_\_\_\_\_ lineage of gymnosperms.
- 19) Why are species of *Ephedra* known as "desert tea"?
- 20) What compounds produced by ephedra are used medicinally (and "recreationally") by humans?
- 21) Name two drugs used/made by humans (one of which is pharmaceutical and available in any pharmacy, the other is illegal and highly destructive) that contain the compounds (or derivatives of the compounds) found in *Ephedra* spp.
- 22) Define the terms monoecious vs. dioecious
- 22) Imagine you sit down to dinner with your Aunt or Uncle and they don't know much about botany, describe the physical appearance and something interesting about the biology of *Welwitschia mirabilis*.

Lab material that is an elaboration of concepts introduced in lecture, know this for exams:

- 1) Know the structure of pollen and seed cones in conifers – be able to draw the important anatomy (i.e., a longitudinal section of a pollen and/or seed cone). Essential vocabulary includes: **stem axis, sporangia (on male cone, contain pollen), pollen (pollen grain), air bladders, ovule, egg, micropyle, female cone scale**

Lab material that might appear on lecture quizzes/exams as extra credit, because it is really cool!:

- 1) The Fibonacci series/sequence, the golden ratio, and the golden angle: be able to write out the Fibonacci Series. How is the golden ratio calculated? Why is this mathematical relationship so prevalent in developmental biology.

Here's a good sample question for an upcoming quiz/midterm:

List the four groups of gymnosperms in order of diversity (from greatest number of species to fewest species), and provide the name (scientific OR common name) of an example (representative) of each group (4pts).

Highest diversity (most species): \_\_\_\_\_ Example: \_\_\_\_\_  
 Next highest: \_\_\_\_\_ Example: \_\_\_\_\_  
 Second lowest: \_\_\_\_\_ Example: \_\_\_\_\_  
 Lowest diversity (fewest species): \_\_\_\_\_ Example: \_\_\_\_\_

## April 11 lecture – Angiosperms I

- 1) What's a fruit?
- 2) Are ovaries found in gymnosperms, angiosperms, both, or neither?!
- 3) How many species of angiosperms are there on Earth?
- 4) Have a death grip on the flower anatomy: petal, sepal, anther, filament, stamen, ovary, style, stigma, pistil, carpel, receptacle
- 5) What is a bisexual flower? A unisexual flower?
- 6) Understand bilateral vs radial symmetry of a corolla.
- 7) After fertilization, what does the ovary(-ies) become? What do the ovules become? What about the integument surrounding the ovules – what does it become?
- 8) Understand dioecious vs. monoecious.
- 9) As discussed in lecture, what are the two most expensive spices on Earth (in most countries)?
- 10) With regard to the preceding question, explain the botany of why these spices are so expensive.
- 11) Prior to pollination, where on a flower is the pollen located?
- 12) Upon what female flower structure does pollen "land" or contact prior to growing a pollen tube and conveying sperm to the ovules?
- 13) When looking at a typical monocot vs. dicot flower, how are the two different from each other?
- 14) Why should one never say the following: "That plant has bisexual flowers and is monoecious."
- 15) Abiotic vs. biotic pollination. Provide an example flower for both.
- 16) How are grasses (Poaceae) pollinated? Is this similar to conifers?
- 17) Coevolution. Define and provide an example involving plants.
- 18) Honeyguides – what are they!?
- 19) Explain the risk (disadvantage) and reward (advantage) of being a generalist vs. specialist plant with regard to pollination via animals.
- 20) What, in general, are the color, shape, and size differences in flowers visited by insects, mammals, birds.

### I reiterate:

Know like the back of your hand: the table that details the differences between bryophytes, ferns and allies, gymnosperms, and angiosperms. **Be able to apply these differences conceptually, such that you can explain why they are important ecologically and evolutionarily.**

## April 16 lecture – Angiosperms II

- 1) How many angiosperm species are on Earth?
- 2) What four hypotheses/concepts did we discuss that explain the high diversity of angiosperms on Earth?
- 3) How are orchids pollinated? Like conifers and grasses?
- 4) What are the four largest (most species) families of flowering plants?
- 5) Why is the grass family important ecologically? Economically?
- 6) Why is the legume family important ecologically? Economically?
- 7) Understand and be able to define the difference between: Allopatric speciation and sympatric speciation
- 8) Why does animal pollination help explain angiosperm diversity? There are two important reasons!
- 9) How do vessels help explain angiosperm diversity?
- 10) What are annuals and biennials? How does their existence potentially contribute to high angiosperm diversity? There are two reasons!
- 11) Why do animal pollinators visit the flowers of flowering plants?
- 12) List the five incentives that flowering plants provide to animal pollinators (these five fit into two categories: 1) Food or 2) sex.
- 13) Define mimicry.
- 14) Define sexual deception.
- 15) Why wouldn't you expect sexual deception to be found in a flower that is a generalist in terms of attracting pollinators?!
- 16) Do grasses make pollinia?
- 17) Imagine that you are a plant, and that someday you'd like to reproduce and make seeds of your very own. Imagine further that you are the only plant of your species in a vast forest. Are your odds of sexually reproducing with another plant likely to be better if you are an angiosperm or a gymnosperm? Explain.
- 18) Present in lecture notes, but not discussed in lecture, was information regarding the Paleoherb Hypothesis and Woody Magnoliid Hypothesis. You are not likely to see this information on the exam, unless as extra credit...

## Discussed in lab 12 – Flowers

- 1) Understand bilateral vs radial symmetry of a corolla.
- 2) Why are the flowers of grasses, and the cones of conifers, not colorful like the showy flowers of many angiosperms

## April 18 lecture – seed adaptations and dispersal

- 1) What is the most sensitive/delicate life stage for a plant?
- 2) Quiescence and dormancy both serve a similar ecological function for seeds. What is this function, and how is it an adaptive trait? What is the difference between quiescence and dormancy?
- 3) What is imbibition?
- 4) Imbibition and germination of wheat grains was diagrammed in lecture. Be able to repeat this, using the fundamental biological/chemical principles developed earlier in the semester. Have a command of the vocabulary presented in the posted lecture notes.
- 5) Why is it ecologically/evolutionarily sensible that imbibition provides a cue to seeds that it is time to break dormancy and germinate?
- 6) What is malting? Where does the name come from?
- 7) One cue that can break dormancy is prolonged exposure to cold. Why is ecologically/evolutionarily sensible that cold exposure provides a cue to seeds that it is time to break dormancy and germinate? Why might seeds that require this cue to break dormancy have a higher rate of S&R than those that do not – explain.
- 8) What is scarification? List three factors/forces that can cause scarification, and explain for each of these why scarification is an adaptive trait (how S&R is increased...).
- 9) What was the example we discussed of a chemical cue for breaking dormancy. What ecological cue listed above does this resemble?
- 10) What is unique about orchid seeds and their germination?
- 11) Know the mechanisms of seed dispersal we explored, and the general characteristics of fruits that employ each mechanism.
- 12) What three processes or conversions are involved in the final stages of ripening of fleshy fruits such as blackberries?
- 13) What are the advantages of seed dispersal? Be specific, detailed, and careful...
- 14) What is seed caching? Why do animals do it? Why does it “work” for plants?