

BI 203 - Study Guide for Midterm #2

Gymnosperms

General

Chapter 20

What are the reproductive and vegetative problems that the seedless vascular plants had not yet solved evolutionarily? What are the solutions to those problems that the gymnosperms found? What are the differences among algae, seedless plants and seed plants in the relationships between old sporophyte, gametophyte, and new sporophyte?

What are the main phyla of the gymnosperms? Which of these are diverse? Which are abundant? Which are both? What are the hypothesized evolutionary relationships among these phyla and both the seedless vascular plants (SVP's) and the angiosperms? What traits separate them?

Are gymnosperms homosporous or heterosporous? What is the difference between homospory/heterospory and monoecious/dioecious? What are the male and female "strobili" in gymnosperms? What are the male and female gametophytes in gymnosperms? How big are they? Are they dependent on or independent of the old sporophyte? How do the gametes meet in gymnosperms and how does this differ from what happened in the SVP's?

What is a seed? How can we say that it is three plants in one? What are the main parts of a gymnosperm seed and how do they compare with the main parts of an Angiosperm seed in terms of their source tissues?

Have a good understanding of the main steps of the conifer life cycle that we discussed in class. See also Fig. 20-22.

Secondary growth

Chapter 27

What are the differences between apical and lateral meristems? Who has each and where are they found? How does secondary growth solve the two main vegetative growth problems of the SVP's?

What is the difference between primary phloem/primary xylem and secondary phloem/secondary xylem? What is the difference between secondary cell walls and secondary growth? Can you have secondary cell walls without secondary growth? Vice versa? What are examples of tissue of each?

Where does the vascular cambium arise? Where does it lay down new xylem and new phloem? What is the fate of the old xylem and old phloem? What problem does this cause for the epidermis? How is this solved by the cork cambia? What are the differences among inner bark, outer bark, epidermis, periderm, and cork? How are they related and what are the different components of each?

Other Gymnosperm phyla

What major animal group shared their heyday with the Cycadophyta? When? Where are most cycads currently found? What is unusual about Ginkgos compared to the other gymnosperms? Have they changed substantially through evolutionary time? How do the life cycles/reproductive traits of the cycads and ginkgos differ from the conifers?

Why is it thought that the Gnetophyta of all gymnosperms are most closely related to angiosperms? What is the "wierdest plant on Earth"? Where would you go to find it?

Angiosperms

Chapters 21 and 22

Are the angiosperms more or less diverse than the gymnosperms? More or less common than the gymnosperms? What are the two major classes of angiosperms and how do they differ in terms of diversity, structure, and other characteristics? How are they related to the Magnoliids?

What are the main parts of a flower and how do they relate to the megasporangium, microsporangium, megagametophyte, and microgametophyte? How are they thought to have arisen evolutionarily? What is an ovule? Is its structure the same in angiosperms and gymnosperms? How does the location of the ovule differ between angiosperms and gymnosperms? What are perfect flowers and complete/incomplete flowers? How do these relate to monoecy/dioecy?

What are the four main ways in which angiosperm life cycles differ from the conifer life cycle? Are angiosperms homosporous or heterosporous? How do the angiosperm sporophyte, megagametophyte, and microgametophyte compare to those in the conifers? In the SVP's? In the Bryophytes? Where does the fruit come from? What role do the cotyledons play in the seed?

Have a good grasp of the main steps we talked about for the angiosperm life cycle in class. See also Figure 21-23.

What are the various ways in which angiosperms promote outcrossing? Do they have more or less control over this than the gymnosperms? Why? What is self-incompatibility and how does it relate to outcrossing? What regulates self-incompatibility? Are all plants self-incompatible? What are some ecological situations in which it might be advantageous to be self-compatible instead?

What are 4 general evolutionary trends in flower morphology? Where do the Magnoliids fall within these trends? What are the two types of Magnoliids?

How do flower characteristics vary according to who pollinates them? How do insect perceptions of flower color differ from our own? What is coevolution? What are the main modes of dispersal for fruits? How have fruits adapted for their different modes of dispersal?

What are the main differences between gymnosperms and angiosperms with respect to their modes of reproduction? Why are angiosperms generally more efficient at pollination and seed dispersal than gymnosperms? How do angiosperms and gymnosperms differ in terms of tissue structure - e.g., xylem and phloem construction, arrangement of vascular bundles, predominance of secondary growth?

Plant growth, development, and structure

The four main points:

1. What are the major cell and tissue types?
2. Where do they come from?
3. What are their functions?
4. How are they arranged in the plant body? How is this similar or different in different parts of the plant?

Embryo development/structure

Reading: Chap. 23 - pp. 555-559, 562-563, including fig. 23-8, 23-12 (p. 568)

What are the two main axes of differentiation in the embryo and what tissues are associated with each? What are the different kinds of meristems? Which are found in the embryo? Which in the roots? In the shoots? What are the relationships among the apical meristems, primary meristems, and primary tissues?

Tissue types/cell types

Reading: Chap. 24

What are the three main cell types and how do they differ in terms of shape, functions, and other characteristics? What are the different types of vascular tissue and their characteristics? How do the components of vascular tissue differ between gymnosperms and angiosperms? What tradeoffs are inherent in the design of the xylem of gymnosperms and angiosperms?

What cell types compose the different tissue types? What functions do these different cell types have in the different tissue types?

Root anatomy

Reading: pp. 589-602

What are the main functions of roots? Which roots do most of the absorption for plants? What are the main longitudinal growth zones and their characteristics? What are the characteristics and functions of the root cap and root hairs? Where do branch roots come from and how is their pattern of development different from initiation of branches in the shoot?

What type of stele is typically found in roots? What are the different pathways of water and ion flow in the root cortex? How does the endodermis constrain these pathways before water/ions reach the xylem? Why might this be important for the plant?

What is the arrangement of xylem and phloem in the root vascular bundle? What is the pericycle and why is it important? What happens during secondary growth of roots? How does this constrain some of their functions?

Shoot anatomy

Reading: pp. 610-615, 618-621, 624 (Morphology of a leaf) - 633 (including fig.26-28), p. 636

How does the pattern of stem development and elongation differ in the shoot and root? How are they similar? How do the patterns of vascular tissue arrangement differ among the conifers, magnoliids, monocots, and eudicots?

What are the basic parts of a leaf? How can you tell simple from compound leaves? What types of structures/cells would you find in a leaf epidermis? What functions do they have? What types of structures/cells are found in the leaf mesophyll? What functions do they have? What functions do the veins have in leaves?

Photosynthesis

Reading: Chapter 7

Overview

Why is photosynthesis important in the universal battle against entropy? (Don't laugh, this is serious business!) Is photosynthesis exergonic or endergonic? What about respiration? How are photosynthesis and respiration linked (in the big picture)?

What is the basic reaction in photosynthesis? What is the first main product of photosynthesis that the cell can use? What are the two main steps in photosynthesis and what is the role played by each? What is the structure of a chloroplast and where do the different steps of photosynthesis take place in the chloroplast?

Carbon fixation reactions

What is the Calvin cycle? What are the three main steps in the cycle? At each step: 1) what are the reactants and what are the products? 2) what and how much chemical energy is necessary to make the step happen? For the fixation step, what enzyme is critical for this process to occur? Why might this be the most important and most abundant enzyme in the world? How many times do you need to go through the Calvin cycle to get one molecule of glucose? Of PGAL? Why is this?

What are the net inputs and outputs of the Calvin cycle in terms of energy and sugars?

Energy transduction (Light dependent) reactions

What pigments are involved with light absorption in photosynthesis? How do the roles of these pigments differ? In which organisms do we find which pigments? How are the pigments arranged in order to optimize light interception and electron excitation? What constitutes the reaction center? What constitutes the antennae complex? What are the two different photosystems and how do they differ? How are they arranged in the process of photophosphorylation?

What are the main sequence of steps in photophosphorylation? Where does this take place in the chloroplast and how is the structure of the chloroplast important? When does water get split and where do its electrons go? How does the electron transport chain end up generating ATP's? How does it generate NADPH? What are the two sources of protons that lead to the build up of an electrochemical gradient across the thylakoid membrane?

What are the differences between cyclic photophosphorylation and noncyclic photophosphorylation? Why is cyclic photophosphorylation important in the energetic "bookkeeping" of photosynthesis?

C3, C4, and CAM photosynthesis

What is the problem with the Rubisco enzyme? Why is it called Ribulose biphosphate carboxylase-oxygenase? What is photorespiration? How does it differ from dark respiration? What is the cost of photorespiration to the plant? Why does it happen? What conditions lead to higher rates of photorespiration?

How does the C4 pathway solve problems of photorespiration? What is the role of the Calvin cycle in C4 photosynthesis? What is the primary enzyme, the precursors, the products and the cost of the C4 pathway? Is this a cycle? What is Kranz anatomy? Why don't all plants have C4 photosynthesis? In what regions is C4 particularly important? Why?

How is CAM photosynthesis similar to and different from both C3 and C4? What are the advantages and disadvantages of each?