PLNT3140 INTRODUCTORY CYTOGENETICS

MID-TERM EXAMINATION

1 p.m. to 2:15 p.m. Thursday, October 17, 2013

Answer any combination of questions totalling to exactly 100 points. If you answer questions totalling more than 100 points, answers will be discarded at random until the total points equal 100. This exam is worth 15% of the course grade.

Hand in these question sheets along with your exam book.

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1. (10 points) Draw two chromosomes (four chromatids total) along with their kinetochores and spindle fibers for mitotic metaphase I and for meiotic metaphase I. What are the differences that you would see under the microscope, between the two?

2. (5 points) If you look under the microscope at a typical differentiated tissue (eg. plant roots), only a small percentage of the cells you look at will be undergoing mitosis. Why is that?

3. (10 points) The image at right shows what you might see under the microscope if doing FISH with a probe that detects a single locus in diploid cells at Interphase. Draw similar images showing what you would expect to see under the microscope with the same FISH probe during the different phases of mitosis.

4. (10 points) Define convex and concave lenses. What is different about these to types of lenses, with respect to how they focus light?

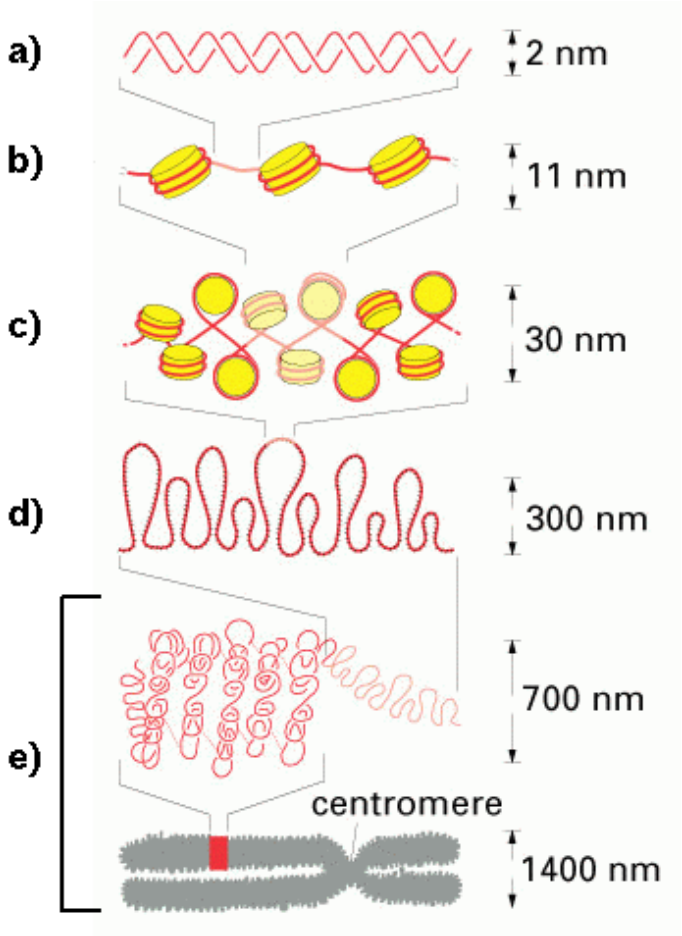
5. (20 points) Fill in the blanks in your exam book. You don't have to rewrite the paragraph.

Like all organelles, the nucleus is designed for carrying out specific functions.The purpose of the nucleus is to support the critical processes of _____a_____ and ____b_____. These two processes conflict with the processes ocurring at ____c_____ during the cell cycle. At this stage, chromosomes must be _____d_____, whereas during G1, chromosomes are _____e_____.

The nuclear envelope has two surfaces, the outer and inner membranes. Spanning this membrane are protein complexes known as _____f_____. These regulate _____g_____. At prophase of mitosis, the nuclear membrane _____h_____. At this time, chromosomes begin to become visible because they are coiling. At telophase, the nuclear envelope _____i_____ and the chromosomes _____j_____.

6. (10 points) Give two reasons why root tip cells are an excellent choice of material for observing mitosis in plants.

7. (20 points) Using the accompanying figure as a guide, briefly (1 or 2 sentences each for letters a - e), summarize the levels of chromosome structure



8. (15 points) Draw one or more diagrams illustrating semi-conservative replication within an origin of replication in a linear chromosome. Make sure to show

- 5' and 3' ends
- RNA primers
- leading and lagging strands
- the final product, illustrating how some DNA fails to be replicated in a given round of DNA synthesis.

9. (10 points) What would be the effects on reproductive fitness in a eukaryotic organism in which a mutation occurred that eliminated pairing in meiosis? Explain your reasoning?

10. (10 points) The figure at right shows part of chromosome 3 in the salivary glands of *Drosophila melanogaster* over a 22 hour time period during larval development. At five loci shown in the figure, these polytene chromosomes exhibit "puffs", which are evidence of changes in chromatin structure. You may assume that the genes encoded at these five loci have a function in larval development. Based on these observations, describe what you think is happening at the level of transcription and chromatin structure for each of these five loci.