

Final MidTerm Exam 4 (80 points total)

1A. At the end of a mitotic cell division, the two daughter cells have the same number of chromosomes as the original (mother) cell. By the end of meiosis, the number of chromosomes in the cells produced is

- A. the same as in the mother cell
- B. twice that found in the mother cell
- X C. one-half of that found in the mother cell
- A or B B or C A or C no idea

2. (3 points): Consider a cell that is the product of meiosis. What must occur before the progeny of that cell could possibly undergo meiosis again?

- X A. syngamy
- B. DNA replication
- C. cell growth, division and differentiation
- A or B B or C A or C no idea

2B (4 points): What are two possible benefits of sexual reproduction to a species.

Increased genetic variation

3A. In the mutation lab it was concluded that the presence of phage

- X A. selected phage-resistant bacteria that already existed in the population
- B. induced the appearance of mutations that lead to phage resistance in the population
- C. increased the rate of mutation
- A or B B or C A or C no idea

3B. (3 points): What would happen to both a phage and the bacteria it infects if, the bacteria could not possibly develop resistance to, or survive phage infection?

One or the other or Both would become extinct (probably)

4. In most species of bacteria there is a single origin of DNA replication, the site in the DNA where replication begins. You genetically engineer a mutation into a bacterial cell that removes this origin sequence, what is most likely to happen?

- A. the cell would die
- X B. the cell would never divide

unless ...

- C. a second mutation would occur that would allow DNA replication to occur
- A or B B or C A or C no idea

4B (3 points). Briefly explain your choice:

5. You are studying amoeba, cells that normally divide after they reach a certain critical size. In a version of a classic experiment, you inject cytoplasm from one cell into another. Compared to unmanipulated cells, you might expect...

- A. the injected cell will divide earlier than unmanipulated cells.
- B. the injected cell will divide at the same time as unmanipulated cells, but produce larger daughter cells.
- C. the injected cell will divide later than unmanipulated cells, and produce larger daughter cells.
- A or B B or C A or C no idea

5B (3 points). Briefly explain your choice:

5C. (4 points). Consider a population of single celled organisms that divide only after they reach a certain genetically determined size. Describe environmental conditions in which a mutation that causes a cell to divide when it was smaller than the "normal size" might have a reproductive advantage.

If there is lots of food (over a long period), rapid division variants would increase in frequency

6. When a stem cell goes through mitosis, the result is ...

- A. two stem cells
- B. one stem cell and one differentiating cell
- C. two differentiating cells
- A or B B or C A or C no idea

7. In animals, once an egg cell is fertilized, through fusion with a sperm cell, the process of embryonic development begins. Which process is involved in building the body of the organism?

- A. syngamy
- B. mitosis
- C. meiosis
- A or B B or C A or C no idea

8A. During the course of embryonic development many different cell types are produced. These cells differ in ...

- A. DNA
- B. mRNAs and proteins
- C. tRNAs and amino-acyl tRNA synthases
- A or B B or C A or C no idea

8B. (3 points) Briefly (very briefly), describe how the differences between somatic cells arise from what was originally a single cell.

Asymmetries lead to differential gene expression, and so different proteins and cellular behaviors.

9. It is now possible to produce a new organism asexually, via nuclear transplantation. In such an experiment, a somatic cell nuclei is used. This type of experiment demonstrates that...

- A. no genetic information was lost during the formation of somatic cells
- B. genetic information in the egg cytoplasm can be moved into the transplanted nucleus
- C. the genetic information required to form an embryo is located in the egg's cytoplasm
- A or B B or C A or C no idea

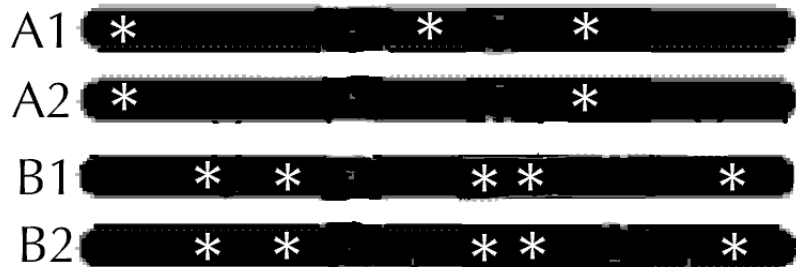
9B (3 points): Why wouldn't we use a sperm nucleus (if the donor were a male) or an egg nucleus (if the donor were a female), rather than a somatic nucleus, to generate a clone?

These are haploid!

10. What process makes it unlikely that any of your children will inherit a chromosome that is identical to the chromosome you inherited from your mother?

- A. mitosis
- B recombination
- C. fertilization
- A or B B or C A or C no idea

11. In the picture, homologous chromosomes A and B are shown aligned early in meiosis. Differences in the sequences of the homologs are marked by "*"s, these sites are not wild type. During the final replication of DNA prior to meiosis, a mutation occurred.



11A (2 points). Circle the asterix that corresponds to this mutation.

11B (3 points). Why do we assume that that the mutation occurred during the final round of DNA replication and not earlier?

Not present in A2!

11C (3 points): With "X"s indicate where cross-overs would have to occur to produce one chromosome that was free of mutations.

11D (3 points): Now assume that this process occurred in a male; which of the four gametes that result would be the most unlikely to produce a reproductively successful organism and why?

the one with the mutations!

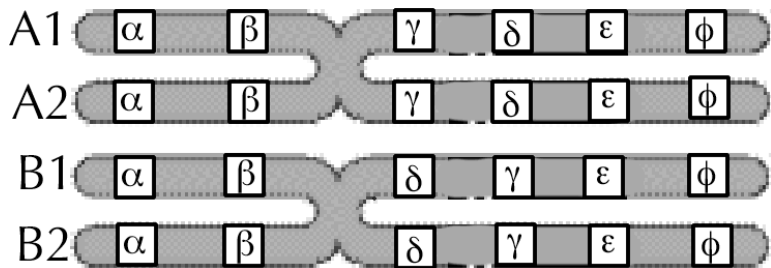
12. Consider an organism, like some species of ladybugs, which can reproduce both sexually and asexually. In one particular asexual population, a chromosomal inversion occurs that has no obvious phenotypic effect. We might be safe in assuming that

- A. there were no genes in the inverted region
- B. the inversion did not disrupt either coding or regulatory sequences
- C. the inversion did not alter genes involved in sexual reproduction
- A or B B or C A or C no idea

12B (3 points) How could a chromosomal rearrangement, like an inversion, produce a mutation?

By changing regulatory or coding regions of genes within or adjacent to the inversion

13: Consider a sexually reproducing organism; it produces gametes with "A" type chromosomes. It mates with an organism that produces gametes that contain a homologous chromosome of the "B" type. Now the offspring of this mating starts to produce gametes.



13A (3 points) Why does the presence of the inversion in B not effect the somatic development of the offspring?

All gene are present

13B (3 points). Using the diagram and an "X" mark where a cross-over event would lead to a gene duplication and gene deletion

14. (4 points). How might you use germ line genetic engineering to produce offspring with enhanced traits, such as improved athleticism or greater intelligence?

Inserting or deleting genes, changing regulation of genes, or gene activity