

Problem Set 12 Due Saturday Nov 19 by midnight

1. (1) Explain, in general, how an “X:A” ratio can work to initiate the process of sex determination in either *C. elegans* or *Drosophila*.
2. (1) The gene *sex lethal (sxl)* in *Drosophila* works to determine sexual phenotype by
 - a. only being transcribed in females
 - b. only being spliced into an active protein in females
 - c. activating dosage compensation genes in males
 - d. preventing activation of dosage compensation in females.
3. (.5) Although the general mechanism of sex determination in *Drosophila* and *C. elegans* is similar, the way the gene products involved work together is different. In *Drosophila*,
 - a. different sex determining genes are transcribed depending on X:A ratio
 - b. different sex determining genes are translated depending on X:A ratio
 - c. the Y chromosome determines which sex determining genes will be transcribed
 - d. sex determining protein products activate dosage compensation in females
4. (.5) The inability of an XY individual to respond to (bind) testosterone will (in humans):
 - a. Prevent the gonad from differentiating into testes
 - b. Prevent the gonad’s secretion of testosterone
 - c. Prevent the differentiation of the male ductal system
 - d. Allow the differentiation of the female ductal system
 - e. Prevent the gonad’s secretion of anti-Mullerian hormone.
5. (.5) Anti Mullerian Hormone is involved in
 - a. Maintaining the male ductal system
 - b. Degrading the male ductal system
 - c. Maintaining the female ductal system
 - d. Degrading the female ductal system
6. (.5) Regarding *C. elegans*, *Drosophila* and mammalian dosage compensation: in terms of the level of transcription from the X chromosomes in females/hermaphrodites, which is more similar to mammals?
 - a. *C. elegans*
 - b. *Drosophila*
 - c. both
7. (1) An individual is born with XXY chromosomes. This can result in a variety of phenotypes. Select from the following choices to describe their possible phenotypes.
 - a. Gonad differentiates into testes
 - b. Gonad differentiates into ovaries
 - c. Internal ductal systems are male
 - d. Internal ductal systems are female
 - e. Secrete testosterone
 - f. Secrete anti-Mullerian hormone
 - g. Have male secondary sex characteristics (e.g., facial hair)
 - h. Have female secondary sex characteristics (e.g., breasts)

8. (2) A University of Colorado scientist who studied snakes came into work one day to find that his female rattlesnake had a male baby rattlesnake in her cage. The female rattlesnake had never been mated, and her cage was completely secure. Although rare, this kind of “virgin” birth (parthenogenesis) has been seen before in snakes. Postulate how this happened, including an explanation of how the baby is male. (Hint: there are two different sex chromosomes in rattlesnakes, just as in humans. Think about how this could happen, then figure out what the sex chromosomes are for a male rattlesnake vs. female)

9. (1) If an XX human embryo had a homozygous mutation that specifically **prevented methylation** of the Xist promoter what would happen to expression of products from the X chromosomes in this individual and why?

10. (1) In the scenario above, what will the sex of the embryo be?

11. (1) In the same scenario above, will the embryo be able to survive? Why or why not?