

Name: _____

Dr. Reichler's Bio 325-uex Summer 2008 Quiz 7/28

- 1) Genes that cause PWS and AS are closely linked on Chromosome 15. People with these diseases rarely reproduce, but let's suppose that a couple produces two children with AS. One child, Pat, has two children with PWS. The other child, Robin, has one child with AS. Does one of Pat and Robin's parents have AS or PWS? If so, is it their mom or dad? What are the sexes of Pat and Robin?
- 2) Two people mate. They are heterozygous for three different traits coded for by three different genes (P, D, and Q). The P and D genes have simple dominance, and the Q gene has incomplete dominance. What is the chance of having an offspring that has the recessive phenotype for P and D with the intermediate trait for Q?
- 3) Which genes are closer to each other? A and B that have 34% recombination or C and D that have 22% recombination?
- 4) When looking at the inheritance of two traits coded for by two different genes, what can you infer from a cross that results in 50% recombinant offspring?
- 5) Can genes located on different chromosomes have less than 50% recombination?
- 6) If crossing over occurs twice between two genes, would you get any recombinant offspring?
- 7) Would you be able to use linkage mapping to determine the distance between two genes on the Y chromosome?
- 8) Two individuals have mutations in two of their smell receptors on chromosome 11. One for the ability to smell apples, and the other to smell oranges. The mutations act as recessive alleles. You want to know how far apart the genes are. Two heterozygous individuals mate and have 100 offspring with the following traits. 80 can smell both oranges and apples, 12 cannot smell apples or oranges, while 4 can smell apples but not oranges, and 4 can smell oranges but not apples. How far apart are these two genes?
- 9) When looking at three linked genes, how do you identify the double cross-over, and why do you need to?
- 10) You are studying three genes located on the same chromosome that occur in this order: A, B, and C. Out of 100 offspring there are 30 recombinants of A-B and 40 recombinants of B-C. How many recombinant offspring would you expect between A and C?
- 11) What leads to discrepancies between a linkage map and the actual DNA sequence?
- 12) If a woman has poor ATP production due to a mutation in her mtDNA, and her mate has normal mtDNA, what will be the phenotypes and genotypes of their offspring?

Answers:

1) Pat and Robin's mother is abnormal. We know this because Pat and Robin both have Angelman syndrome. The AS gene is inactivated in the sperm, so both children must have inherited the deletion from their mother. Therefore, they did not get the gene from their mother, and the gene from their father is normally inactivated. This causes them to have Angelman syndrome. We do not actually know if Pat and Robin's mother has AS or PWS. We only know she has the deletion. Their mother could have either AS or PWS, depending on whether their mother inherited the deletion from Pat and Robin's grandmother or grandfather.

Pat is a male because he has children with PWS. He transmitted the chromosome carrying the deletion to his two children, and the mother of Pat's children normally inactivates the PWS gene in the egg. Therefore, both children have PWS. As in the answer about the parents, we know Robin is a female because she has a child with AS.

2) $0.25 \times 0.25 \times 0.5 = 3.125\%$

3) C and D are closer.

4) The genes are either far apart on the same chromosome (unlinked) or on two different chromosomes.

5) No, independent assortment means that the different alleles will have an equal chance of ending up in either gamete.

6) No, the double cross-over would return the genes to their original chromosome giving only parentals.

7) A gene on the Y chromosome in mammals would only be transmitted from father to son. It would be difficult to genetically map Y-linked genes because a normal male has only one copy of the Y

8) 8 m.u.

9) The pair of traits with the fewest offspring are derived from the double cross-over. By seeing which genes are separated by the double cross-over, you can determine the order of the genes.

10) A and C are not linked, there are 70 m.u. between them and so you would get about 50 recombinants.

11) Areas of the DNA that have greater or less than average crossing-over.

12) They all have mom's mtDNA.