

Answers for Final Exam – part II (questions 4-11)

(material in parentheses was not required for a correct answer; I provide it here just to satisfy your own curiosity)

4. (b-f are worth 5pts, g and h are worth 3 pts, rest are worth 4 pts)

- a. The B and O alleles encode a glycine at position #176, while the A allele encodes an arginine.
- b. The codons that encode glycine all start with GG and then have any base at the third position; the codons that encode arginine start with CG and then have any base at the third position OR AGA or AGG. So, the simplest situation would be that the second and third base are identical in all three alleles, but that the first base of codon #176 is a C for allele A and a G for alleles B and O (other scenarios are possible too).
- c. At position #266 the A and O alleles encode a Leucine (CU_ or UUA or UUG) while the B allele encodes a methionine (AUG). The simplest scenario is again that the second and third bases of codon #266 are identical in all three alleles, but the first base is different (A for B allele and C or U for A and O alleles).
- d. The I gene encodes an enzyme (a “transferase” to be exact) that catalyzes the addition of a 4th sugar group to the trisaccharide that is found on the surface of RBCs.
- e. The difference between the two forms of the enzyme (A and B) affects what type of sugar molecule is used as a substrate (the B form prefers a galactose molecule while the A form prefers an N-acetylgalactosamine) to add to the trisaccharide substrate.
- f. The I^O allele does not encode a functional enzyme (it encodes a truncated enzyme that is missing the catalytic site).
- g. 2; h. total of 4; i. 3; j. total of 6
- k. neither parent can be O blood type; either both parents are AB, OR one parent is A and the other parent is B or AB.
- l. either both I^AI^B or one parent I^A_ and the other parent I^B_

5. (10 pts) $\frac{3}{4} A_ \times \frac{1}{2} bb \times 1 C_ = 3/8$

6. (10 pts) a. 7 b. 10

7. (10 pts) a. all are enzymes

b. This could be answered several ways; the RNA polymerase is the only one that interacts with nucleic acids; the serine protease is the only one that catalyzes the cleavage of its substrate, rather than the bonding of two substrates; All but the RNA polymerase could be used to modify a protein (hence activate or inactivate).

8. (12 pts) a. Bb R_ x Bb RR b. Bb Rr x bb Rr c. Bb Rr x bb rr

9. (15 pts) a. endocrine; b. all; c. all except contact-dependent; d. endocrine
e. only cells that express the appropriate receptor gene can respond

10. (10 pts) They both carried a foreign gene, the GFP (from jellyfish), but in one strain the GFP coding sequence was under the control of a promoter that is only active in intestinal cells (it has binding sites for transcription factors only found in intestinal cells), while in the other strain, the GFP was under the control of a different promoter, one that is only active in neurons.

11. (12 pts) a. All cells except Red blood cells (they don't have a nucleus)

b. Liver cells (the cells that make clotting factor, ie. that express the gene)

c. Liver cells and Plasma (the clotting factor is made in the liver cells, and then secreted into the plasma portion of the blood so that it can circulate throughout the body).