Garriga Problem set #2

1. Agrobacterium is a pathogen of dicots, and its plasmid can be used to transfer foreign DNA into these plants.

Describe how the *vir* genes function in this transfer.

Where is the foreign DNA placed?

Define in general term's three types of genes that have been transferred into plants.

2. In golden rice, three transgenes are inserted into the genome of rice to produce what chemical.

What does your body produce from this product?

Where and why might this crop be useful?

3. Below is a pedigree of a rare human skin disease.

Inheritance of the disease by the II-3 male from his father rules out what type of inheritance. Explain your reasoning.

Who in the pedigree has the same Y chromosome as the II-3 male? Give all correct answers.
Who in the pedigree has the same mtDNA as the II-3 male? Give all correct answers.

4. Red-green color blindness is X-linked in humans. If a male is red-green color blind, and both parents have normal color vision, which of the male's grandparents is most likely to be red-green color blind?

5. Describe an argument for the use of growth hormones in cows.

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6. A woman claims that a man is the father of her son. The man claims that he is not and will be able to prove it. How could he prove that he is not the father using only his and the boy’s DNA?

7. A couple comes to a genetic counselor concerned about their chances of having a baby with Tay Sachs disease. The husband had a sibling die of the disease, which is inherited as an autosomal recessive trait. What are the chances that he is a carrier?

PCR analysis showed that both the husband and wife are carriers for Tay Sachs disease. They decide to have IVF and blastomere testing. Describe what will happen.

8. Below is a pedigree for a neurological disease. The son is affected (solid square)
If the disease is caused by a mutation in a gene on the X chromosome, is the mutation recessive or dominant? Assume this for the remaining questions.

From which parent did the son inherit the disease gene?

The identity of the disease gene is known. By PCR you amplify part of the disease gene from the affected son and get a 300 base pair PCR product. From the father’s DNA, you get a 330 base pair product; from the mother you get PCR products of 300 and 330 base pairs; and from the sister, you get PCR products of 300 and 330 base pairs. Is the sister a carrier? Explain your reasoning.

The mother becomes pregnant. Amniocentesis shows that the fetus has a Y chromosome. The parents want to know whether the child will be affected. You conduct a PCR analysis of the disease gene of cells from the fetus? What are the possible results, and what will you tell the parents?

9. A list of propositions appears below. There is something wrong with each one. Briefly describe what is wrong.

Integration of the \textit{Agrobacterium tumefaciens} plasmid into the plant chromosome is controlled the virulence (vir) genes, which are encoded on the bacterial chromosome.

The fact that mitochondrial DNA from African populations is more diverse than mitochondrial DNA from other populations suggests that African populations arose more recently than the less diverse groups.

The defect in Phenylketonuria (PKU) is caused by a lack of the enzyme phenylalanine hydroxylase, which converts the amino acid phenylalanine into the amino acid tyrosine. If untreated, PKU infants will develop severe metal retardation, but if the infants are fed tyrosine they develop normally.

When scientists generated transgenic mice containing the growth hormone gene expressed from the metallothionein promoter, they increased the levels
of growth hormone by raising the temperature at which the transgenic mice were raised.

The nucleus is a organelle that produces energy for the cell.

Women have 22 autosomes and one X chromosome.

Because we can infer from their paternal (male line) descendants that President Thomas Jefferson's maternal uncle and Eston Hemings Jefferson had the same Y chromosome, we can conclude that President Jefferson could have fathered Sally Heming's son Eston.

Expression of the growth hormone gene leads to the production of more fat.