Examine the pedigree shown below and answer the following questions.

1. Identify and circle the Beery Twins in the pedigree shown above.

2. What disease(s) is/are found in the Beery twins’ relatives on their maternal side?

3. What disease(s) is/are found in the Beery twins’ relatives on their paternal side?

4. What patterns of inheritance do you observe for each of the following:
   - Fibromyalgia?
   - Depression?
   - Neurological Disorders?
   - DRD dystonia?

These materials were created by MSOE Center for BioMolecular Modeling (http://cbm.msoe.edu).
Examine the bioinformatics strip and answer the following questions.

1. What technology was employed that led to the Beery twins’ final and correct diagnosis?

2. On what chromosome and in what position is the gene for sepiapterin reductase?

3. How many exons are in the sepiapterin reductase gene?

4. What does the sepiapterin reductase enzyme do?

5. What role does the product of the sepiapterin reductase play in the cell?

6. What two neurotransmitters are lacking in the absence of tetrahydrobiopterin?

7. What physiological processes are regulated by these neurotransmitters?

8. Joe Beery’s mutation occurs at mRNA nucleotide 498. Record the specific change that has occurred in the nucleotide bases.

   \[
   \text{UCAACAGAACC} \quad \downarrow \quad \text{GU}
   \]

9. How does this change affect the amino acid sequence of the protein?

10. What, if any, changes occur in the characteristics of the amino acid as a result of this mutation?
11. Circle the amino acid that is mutated in Joe Berry on the picture of sepiapterin reductase shown to the right.

12. How might a change that is so far from the active site have such a profound effect on the protein?

13. Retta Beery’s mutation occurs at mRNA nucleotide 801. Identify the specific change that has occurred in the nucleotide bases.

\[
\text{AGUUCAAGUC} 
\]

14. How does this change affect the amino acid sequence found in the protein?

15. How does this mutation affect the overall structure of the protein?

16. How might this mutation impact the functionality of the protein?

17. Circle the part of the protein affected by this mutation on the model pictured to the right.

18. Label the tetrahydrobiopterin in the model pictured to the right.
19. Why are Joe and Retta Beery normal even though they both have a defective copy of their sepiapterin reductase gene?

20. Why do the twins exhibit dopamine responsive dystonia (DRD) even through their parents are normal?

21. Explain how their first son in the pedigree exhibits a normal phenotype.

22. For convenience, both mutations are shown in the model. Why is this an incorrect representation?

23. Suppose that in the formation of gametes from the Beery twins, there is a crossover such that both mutations are in the same gene. What impact, if any, will this double mutation have on a child receiving the gamete?

24. What sort of treatment do the twins receive to counteract the ravages of their disorder?

25. Look at the Human Sepiapterin Reductase mRNA Gene Map©. What do the red wavy lines and yellow arrows located below the protein sequencing represent?

26. Reflect on what you have learned while studying the Beery Twins story. What are some advantages AND disadvantages of whole genome sequencing.

You may wish to view the YouTube video found at the following link for more background information on the Beery Family:

http://www.youtube.com/watch?v=yUQFHecs8EQ