**DNA, RNA and Protein Biosynthesis**

What were the groundbreaking experiments that proved DNA was the genetic material? Explain how each experiment led us to our understanding of the role of DNA in an organism.

Why is DNA considered a chemical language? What are the basic units involved in the structure of DNA? How are they arranged? How is RNA different?

Describe the process that leads to the synthesis of complementary DNA strands. What is the purpose of DNA Replication? When/where does it occur?

What is a gene? How do new copies of genes emerge?

Describe the biosynthesis of RNA and the process of translation that leads to protein production. What is the enzymatic pathway that leads from genes to proteins? What role do proteins play in the body? What roles do different types of RNA play? How is DNA “read/interpreted?”

How do genes actually give rise to specific physical traits? Give examples.

Explain how Mendel’s Principles of Dominance and Probability elucidate differences in genes and phenotypes.

What do the Laws of Segregation and Independent Assortment state? You should show how these laws apply to actual phenomena. Show/explain how these laws apply at different stages of meiosis (gamete formation).

You may use diagrams, pictures, etc. to illustrate your explanations.

**Biotechnology**

Provide a full explanation for how the biotechnologies of Transformation, DNA Extraction, Gel electrophoresis and PCR work (unless you’ve already done so in your lab write-ups). How do they relate to the natural processes of DNA replication and protein biosynthesis?

What are the applications for these technologies and new the gene-editing tool CRISPR?

Characterize the ethical debate on the use of these technologies. Where do you stand on the issue? Please back up your position with thoughtful analysis.

**Epigenetics**

Characterize the main ideas of Epigenetics and cite/explain some of the current research that has helped us understand the complexities of the epigenome. Explain the implications of epigenetics research.

***Tie it all together***. How are the epigenome and the genome related/intertwined? What is the relationship between these two components of a living being? How has the emergence of epigenetics reshaped our understanding of how e