The summer work for AP Biology includes questions that pertain to the book, "The Violinist's Thumb" and two chapters from the AP Textbook. Dr. Vinton will be sending these handouts directly to each student. Please contact her at (585) 489-4699 if you have not received your work packet by July 1st.

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Introduction

1. How many pairs of chromosomes are there in the human genome and how are they numbered?
2. Approximately how many genes are in the human genome?
3. What four letters carry the genetic code?
4. What are chromosomes made up of?
5. Why is the DNA molecule easy to replicate?
6. What is the RNA copy of DNA called?
7. What is the product of most genes?
8. What are changes in the DNA called?
9. Mitochondria are now an integral part of our cells. What were they probably at one time?
10. What is junk DNA?

Chromosome 1

1. What are two principal properties of life?
2. What is an emergent property?
3. For what does the repeating 120-unit sequence near the centromere of Chromosome 1 code?
4. Why is it hypothesized that RNA was the first genetic material?
5. What is hypothesized about the first organisms on earth that contradicts what is contained in most textbooks?

Chromosome 2

1. Why is it surprising that humans have 23 pairs of chromosomes instead of 24?
2. How is the above fact explained?
3. What type of evidence is used to cite the chimpanzee as our nearest living relative?
4. Why is it hypothesized that our relatives were a small isolated band?

Chromosome 3

1. Francis Crick in 1953 jumped up in Eagle Pub and shouted "We have discovered the secret of __?__"
2. What was Gregor Mendel's contribution to science?
3. What contribution did Watson and Crick make to the science of genetics?

Chromosome 4

1. According to Ridley, genes are there to cause disease. True or false?
2. Huntington disease (HD) is caused by a gene in chromosome 4 that codes for what protein?
3. What is meant by saying that a disease is caused by "unstable CAG repeats?"
4. Nancy Wexler helped find the gene involved in HD, a disease her mother had. Does Nancy herself have the HD form of that gene?

Chromosome 5

1. Are genetic characteristics usually determined by a single gene?
2. What is pleiotropy?
3. Can any one gene be called "the asthma gene?"
4. Why are asthma and allergies probably getting worse?
5. What is the most common asthma trigger?

Chromosome 6

1. Briefly describe a few of the problems associated with the study of intelligence.

Chromosome 7

1. According to Ridley, is human language inherited?
2. Cite some evidence that human language is due at least partially to instinct.
3. What is evolutionary psychology and what does it have to do with genes?

Chromosomes X and Y

1. Do all vertebrates determine the sex of offspring by the inheritance of the Y chromosome?
2. Do X and Y chromosomes usually swap genes during cell division, as do other chromosome pairs in the nucleus?
3. Why do recessive "X-linked" genetic characteristics (e.g. color-blindness and hemophilia) show up more often in men than women?
4. Why does Ridley say that there is a genetic war between X and Y?
5. What are DAX and SRY genes? Why does Ridley call them "antagonists?"
6. The gene Xq28 is famous for its possible association with what human characteristic?
7. Why does Ridley discuss the X and Y chromosomes between the discussions of Chromosomes 7 and 8 –why not just wait until the end?

Chromosome 8

1. In "The Selfish Gene", Richard Dawkins explains what he means by genes being "selfish." Explain this idea in your own words.
2. Within a gene, what is the role of an exon? An intron?
3. What percentage of the human genome is made up of true genes?
4. Of what importance is the human gene that encodes for reverse transcriptase?
5. What are pseudogenes?
6. How did the discovery of minisatellites lead to the development of DNA fingerprinting?

Chromosome 9

1. How can genes that cause diseases such as sickle-cell anemia or cystic fibrosis actually impart disease resistance to some individuals?
2. What does Ridley mean by stating that there is "no human genome" and that the Human Genome Project is founded upon a fallacy?
3. What is meant by the statement that genes for human blood groups illustrate human polymorphism?
4. Give an example of a blood group and its resistant qualities.

Chromosome 10

1. What does Ridley mean by the phrase, "no gene is an island?"
2. Why does Ridley state that "cortisol and stress are virtually synonymous?"
3. How do "monkeys hold the clue" to understanding how behavior affects genes?

Chromosome 11

1. In the study of genetics, what is meant by "a chopstick gene?"
2. How do genes that affect neurotransmitters also affect personality?
3. Does Ridley believe that our essential personality is embedded in our genetic code?
4. How can cholesterol-reducing drugs and diets also increase violent behavior?

5. Should cholesterol-free diets be prescribed for everyone? Why or why not?

Chromosome 12

1. What is a homeotic gene?
2. What is a homeobox?
3. Why does Ridley state the knowledge of the fruit fly genome, specifically the set of Hox homeotic genes on our Chromosome 12, shines a bright light on the human genome?
4. What does the phrase “ontogeny recapitulates phylogeny” mean?

Chromosome 13

1. What is "genetic geography?"
2. How does Ridley use "genetic history" to explain why native Americans tend to be less tolerant of alcohol than Europeans?
3. What is your opinion of the Committee for the Prevention of Jewish Genetic Disease?

Chromosome 14

1. What enzyme, encoded by the TEP1 gene on chromosome 14, is needed to prevent senescence (aging) in cells?
2. How does the DNA prevent loss of important code at its beginning and end each time the DNA molecule is copied?
3. What is a telomere?
4. What is the job of telomerase in normal human function?
5. Would long telomeres or short telomeres be most likely to be associated with long-lived individuals?
6. What are HeLa cells?

Chromosome 15

1. What is meant by saying that a gene has a paternal imprint or maternal imprint?
2. Is it the maternal or paternal gene that stimulates development of the placenta?
3. Is it the maternal or paternal gene that stimulates development of the cerebral cortex?
4. Which parent is most likely responsible for an offspring’s genes for mood?
5. Which parent is most likely responsible for an offspring’s genes for advanced thinking?
6. Do gender roles have an innate, genetic basis?

Chromosome 16

1. How is learning different from instinct?
2. Are most human behaviors instinctual (inherited) or learned?
3. What is the role of the synapse in learning and memory?
4. Animals without the CREB protein cannot do what?

Chromosome 17

1. How does the idea of "mutiny" provide a good model of a cell becoming cancerous?
2. What effect do oncogenes have in cells?
3. Under what circumstances would oncogenes be beneficial?
4. What is the role of tumor suppressor genes?
5. Why is the p53 protein called "Guardian Angel of the Genome?"
6. What happens when cancer cells have a damaged TP53 gene (the gene that makes p53 protein)?

7. What is apoptosis?

Chromosome 18

1. In "cutting and pasting" genes in genetic engineering, [what enzymes?] are the "scissors" and [what enzymes?] are the "glue."
2. In the thirty year history of genetic engineering, about how many environmental or public health accidents/incidents have occurred worldwide?
3. What is gene therapy?
4. What was the first disease treated with gene therapy?
5. What is a transgenic animal? Why might a transgenic animal be useful to humans?
6. According to Ridley, "Genetic diagnosis followed by __?__ cure is probably the genome's greatest boon to medicine."
7. Why has genetic engineering in plants superseded that in animals, at least thus far?

Chromosome 19

1. The APOE gene is important in what group of diseases?
2. There are three variants of the APOE gene in the human population. Are they distributed equally worldwide?
3. Does Ridley advocate testing for genetic disorders, even when there is no cure?
4. According to Ridley, who own's your genetic information, you or the government?

Chromosome 20

1. The PRP gene codes for what substance in the body?
2. How does this protein cause disease?
3. What human diseases are caused by these proteins?

Chromosome 21

1. What is the cause of Down syndrome?
2. What is eugenics?
3. Why is "eugenics" often now considered to be a "dirty word?"
4. Does Ridley see the problems of eugenics as "letting science get out of control?"

Chromosome 22

1. What is the HFW gene?
2. Why does Ridley scorn environmental explanations of behavior as much as genetic explanations?
3. How is human behavior an example of the chaotic nature of biology?