Genetics and Medicine Exam 3 Biology 1010 Spring 2015

1. Down syndrome is due to trisomy of chromosome 21. However, individuals with Down syndrome range in their severity of the expressed phenotypes associated with this birth defect. What causes this variability?
    a. Only two of the three chromosomes will be expressed and which two will determine the range of impacts.
    b. Since this is sex-linked two of the three X chromosomes will be "silenced" and this remaining X chromosome will determine the phenotype.
    c. While chromosome 21 contains all of the same genes, they are not identical in all individuals, thus the phenotype can vary extensively.
    d. The expression of the genes on the three chromosomes will provide more of the typical functions except where one chromosome carries a recessive mutant gene.
2. Mitosis _____ the information from the parent cell in the daughter cells and meiosis _____ the information from the parent cell in the daughter cells.
    a. Retains; retains
    b. Retains; alters
    c. Alters; retains
    d. Alters; alters
3. Which of the following statements about a DNA molecule is **incorrect**?
    a. The DNA helix is a regular, spiral-shaped molecule.
    b. The nitrogenous bases stack in a planar arrangement with little space between adjacent nucleotides.
    c. The sugar phosphate linkages define the backbone of the DNA molecule.
    d. The nitrogenous bases face outward from the backbone.
4. Human height shows a continuous variation from the very short to the very tall. Height is most likely controlled by
    a. Lethal genes
    b. Environmental factors
    c. Sex-linked genes
    d. Multiple genes
5. Recombination or crossing over is important because
    a. Only prokaryotic cells can utilize this mechanism of gene rearrangement.
    b. It provides for complete transfer of parental genetic information between generations.
    c. It increases the variety of genetic information contained in the gametes.
    d. It allows chromosomes to segregate sooner during meiosis.
6. Suppose we have a heterozygous individual AaBb and we cross it with an individual that is AAbb. What will be the proportion of aabb homozygotes in the progeny?
    a. 0%
    b. 25%
    c. 50%
    d. More than 50%
7. All animal cells in either mitosis or meiosis change shape to a roughly spherical shape. Why?
    a. Microtubules help determine the cells normal shape but when the spindle is made all newly made microtubule subunits are shifted to build the spindle which destabilizes the remaining microtubules causing the cell to round up.
    b. The microtubules determining cellular shape are disassembled and remade or recycled into the spindle apparatus causing the rounding up of the cell.

c. Having round cells makes it easier to determine the mid-plane for arrangement of the chromosomes and to establish a location for cytokinesis. The cytoskeletal changes impact all components to change the shape to spherical.
d. When the chromosomes condense and the nuclear membrane disappears the overall shape of the cell is impacted by collapse of the cytoskeleton causing the cell to become spherical.

8. Mendel obtained hybrids for two traits, for example seed texture (round vs wrinkled) and seed color (green vs yellow) in pea plants. When the hybrids were bred with each other he observed the progeny showed
   a. One phenotype
   b. Two phenotypes
   c. Three phenotypes
   d. Four phenotypes
9. Cancer is not usually inherited because
   a. The chromosomal changes in cancer are usually confined to somatic cells.
   b. Cancer typically causes disruptions of meiosis.
   c. The causes of cancer do not include gene mutation.
   d. The cancerous cells usually interfere with the ability to produce gametes.
10. The human genome has ~3.2 billion base pairs and approximately 23,000 genes. What is the likely explanation for the large genome size and the small number of genes?
    a. Human genes are so interrupted by introns that the genes are large enough when introns are accounted for to take up the whole genome.
    b. There are large regions of the human genome that do not contain active genes.
    c. All of the genes are clustered toward the middle of the chromosomes to keep them from end-inactivation.
    d. The genes are shaded or protected from mutation by the extra DNA.
11. DNA differs from RNA because DNA
    a. Contains phosphate groups not found in RNA.
    b. Contains thymine in place of uracil.
    c. Consists of a single rather than a double polynucleotide strand.
    d. Contains the sugar ribose rather than the sugar deoxyribose.
12. The deoxyribonucleotide sequence that encodes a gene in most eukaryotic cells often contains sequences called _____ not found in the mRNA used to make the protein encoded by the gene.
    a. Exons
    b. Spacers
    c. Introns
    d. Codons
13. In our detailed look at a small portion of human chromosome #11 we found
    a. A continuous line of different genes.
    b. Regions within genes or in between genes that contained mobile genetic elements or jumping genes.
    c. Only about 4 genes.
    d. Genes important for our visual senses.
14. Consider the process of meiosis of a pea plant, whose diploid chromosome number is 14. When does this chromosome number become haploid and what is the state of the haploid chromosome?
    a. Anaphase II, 7 chromosomes with single chromatid/chromosome.
    b. Anaphase I, 7 chromosomes each with 2 chromatids
    c. Anaphase I, 14 chromosomes each with 2 chromatids

d. Anaphase II, 14 chromosomes with a single chromatid/chromosome

15. Although Mendel studied 7 pairs of traits that assorted independently and pea has 7 chromosomes, two of his pairs of traits turned out to be in the same linkage group but nonetheless were inherited independently because
    a. During prophase I recombination occurs between genes that are widely separated on a linkage group.
    b. Linkage groups assort independently during meiosis because during prophase I homologous chromosomes pair.
    c. There are many more linkage groups than there are chromosomes in pea.
    d. It didn't matter how many pairs of traits Mendel studied because chromosome number and independent assortment are not related.

Essay questions

1. Assume that you are dealing with a recessive sex-linked gene called Q/q (Q-dominant; q-recessive). How would inheritance differ if the gene were found on the Y chromosome from what one would expect if the recessive gene were on the X chromosome? Enumerate the possibilities. (6 points)
2. What is the relationship between an interphase chromosome and a metaphase chromosome or chromatid? (4 points)