1. MULTIPLE CHOICE (50%). Choose the one alternative that best completes the statement or answers the question (2.5 points for each question).

1) Innate immunity _____.

A) depends on an infected animal's previous exposure to a pathogen

B) is found only in vertebrates

C) is based on recognition of antigens that are specific to a pathogen

D) is the first, and most general, mechanism of protection against pathogens

2) Inflammatory responses typically include _____.

A) release of substances to decrease the blood supply to an inflamed area

B) increased activity of phagocytes in an inflamed area

C) reduced permeability of blood vessels to conserve plasma

D) inhibiting the release of white blood cells from bone marrow

3) You and a friend were in line for a movie when you noticed the woman in front of you sneezing and coughing. Both of you were equally exposed to the woman's virus, but over the next few days, only your friend acquired flu-like symptoms and was ill for almost a week before recovering. Which one of the following is a logical explanation for this?

A) Your friend had allergies.

B) Your friend had an autoimmune disorder.

C) Your friend had antibodies to that virus.

D) You had an immunological memory of that virus.

4) In a diploid cell with 5 chromosome pairs (2n = 10), how many centromeres will be found in a nucleus at G2 of the cell division cycle?

A) 10 B) 20 C) 5 D) 40

5) Density-dependent inhibition is explained by which of the following processes?

A) As cells become more numerous, the protein kinases they produce begin to compete with each other, such that the proteins produced by one cell essentially cancel those produced by its neighbor.

B) As cells become more numerous, the cell surface proteins of one cell contact the adjoining cells, and they signal each other to stop dividing.

C) As cells become more numerous, they begin to squeeze against each other, restricting their size.

D) As cells become more numerous, the level of waste products increases, which slows metabolism and inhibits growth.

6) Which of the following statements is correct in comparing sexual and asexual reproduction?

A) In sexual reproduction, individuals transmit half of their nuclear genes to each of their offspring.

B) Asexual reproduction produces only haploid offspring.

C) Asexual reproduction, but not sexual reproduction, is characteristic of only plants and fungi.

D) In asexual reproduction, offspring are produced by fertilization without meiosis.

7) Which of the following statements is true of a species that has a chromosome number of $2n = 16$?

A) The species is diploid with 32 chromosomes per cell.

B) Each diploid cell has eight homologous pairs of chromosomes.

C) The species has 16 sets of chromosomes per cell.

D) A gamete from this species has four chromosomes.

8) How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*?

A) 4 B) 8 C) 64 D) 16

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9) A black guinea pig crossed with a guinea pig with albinism produced 12 black offspring. When the albino was crossed with a second black animal, six blacks and six albinos were obtained. What is the best explanation for this genetic situation?

A) Albinism is a recessive trait; black is a dominant trait.

B) Albinism is a recessive trait; black is codominant.

C) Albinism and black are codominant.

D) Albinism is a dominant trait; black is incompletely dominant.

10) Abnormal chromosomes are frequently found in malignant tumors. Errors such as translocations may place a gene in close proximity to different control regions. Which of the following events might then occur to make the cancer worse?

A) expression of inappropriate gene products

B) an increase in nondisjunction

C) failure of the cancer cells to multiply

D) a decrease in mitotic frequency

11) During meiosis, a defect occurs in a cell that results in the failure of spindle microtubules binding at the kinetochores. Which of the following statements describes the most likely result of such a defect?

A) Excessive cell divisions will occur resulting in cancerous tumors and an increase in the chromosome numbers known as polyploidy.

B) New microtubules with more effective binding capabilities to kinetochores will be synthesized to compensate for the defect.

C) The defect will be bypassed in order to ensure normal chromosome distribution in the new cells.

D) The resulting cells will not receive the correct number of chromosomes in the gametes, a condition known as aneuploidy.

12) A heat-killed, phosphorescent (light-emitting) strain of bacteria is mixed with a living, non-phosphorescent strain. Further observations of the mixture show that some of the living cells are now phosphorescent. Which of the following observations would provide the best evidence that the ability to phosphoresce is a heritable trait?

A) evidence that DNA was passed from the heat-killed strain to the living strain

B) especially bright phosphorescence in the living strain

C) evidence that protein passed from the heat-killed strain to the living strain

D) phosphorescence in descendants of the living cells

13) If a cell were unable to produce histone proteins, which of the following results would be a likely effect on the cell?

A) Amplification of other genes would compensate for the lack of histones.

B) There would be an increase in the amount of DNA produced during replication.

C) The cell's DNA could not be packed into its nucleus.

D) Spindle fibers would not form during prophase.

14) If the bacterium *Staphylococcus aureus* experiences a cost for maintaining one or more antibiotic-resistance genes, what would happen in environments that lack antibiotics?

A) These bacteria would be outcompeted and replaced by bacteria that have lost these genes.

B) These bacteria would try to make the cost worthwhile by locating and migrating to microenvironments where traces of antibiotics are present.

C) The number of genes conveying antibiotic resistance would increase in these bacteria.

D) These genes would be maintained in case the antibiotics appear.

15) Which of the following statements are correct?

I) Hormones often regulate homeostasis through antagonistic functions.

II) Hormones of the same chemical class usually have the same function.

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III) Hormones are secreted by specialized cells usually located in exocrine glands.
IV) Hormones are often regulated through feedback loops.

A) only II and III B) only I and IV
C) only I and III D) only III and IV

16) The genetic code is essentially the same for all organisms. From this, one can logically assume which of the following statements to be true?

A) A gene from an organism can theoretically be expressed by any other organism.
B) The same codons in different organisms translate into different amino acids.
C) DNA was the first genetic material.
D) Different organisms have different types of amino acids.

17) The reason for differences in the sets of proteins expressed in a nerve and a pancreatic cell of the same individual is that nerve and pancreatic cells contain different _____.

A) genes B) regulatory sequences
C) promoters D) sets of regulatory proteins

18) Which of the following develops the greatest pressure on the blood in the mammalian aorta?

A) systole of the left ventricle B) systole of the left atrium
C) diastole of the right ventricle D) diastole of the right atrium

19) What makes sexually reproduced offspring genetically different from their parents?

A) genetic recombination during meiosis
B) crossing over during mitosis
C) genetic recombination during mitosis
D) Sexual reproduction does not produce genetically different offspring.

20) In an animal that switches between sexual and asexual reproduction, when is sexual reproduction more likely to occur?

A) when males and females find each other
B) when conditions for survival are unfavorable
C) when conditions for survival are favorable
D) What conditions favor sexual over asexual remains a complete mystery.

2. Short Answers (50 %):

1. Give two examples of how genetic engineering has improved or might potentially improve food quality (10%).
2. How could phylogenies be used to help researchers search more efficiently for novel medicines derived from seed plants? (10%).
3. In 2005, Icelandic scientists reported finding a large chromosomal inversion present in 20% of northern Europeans, and they noted that Icelandic women with this inversion had significantly more children than women without it. What would you expect to happen to the frequency of this inversion in the Icelandic population in future generations? (10%).
4. As a physician, you have a patient with symptoms that suggest a hepatitis A infection, but you have not been able to detect viral proteins in the blood. Knowing that hepatitis A is an RNA virus, what lab tests could you perform to support your diagnosis? Explain the results that would support your hypothesis. (10%).
5. Cancer-promoting mutations are likely to have different effects on the activity of proteins encoded by proto-oncogenes than they do on proteins encoded by tumorsuppressor genes. Explain. (10%).

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