

(16 pts) Multiple True/False - CIRCLE ALL ANSWERS THAT ARE TRUE!!!!

1. Which of the following is (are) true about **human endogenous retroviruses (HERV's)**?
 - a. **They have been implicated as the cause of some cancers.**
 - d. **They have been implicated as the cause of some autoimmune disorders.**
2. Which of the following is true about industrial farming of beef cattle?
 - a. **Time from birth to slaughter size is less than half of what it was 100 years ago.**
 - c. **More than 20% of cows will harbor the O157:H7 strain of E. coli.**
 - d. **Runoff waste from the feedlots contains hormones used in the cows.**
3. Influenza...
 - d. **has two different outer coat proteins.**
4. Which of the following diseases could be treated using gene therapy?
 - c. **Severe Combined Immunodeficiency Disease**
 - d. **a genetic disease where the protein is missing**

5. a. (2 pts) What is a prion? (Describe in 1 sentence or *less*)

An infectious protein

b. (2 pts) Name one disease caused by a prion: **CJD, vCJD, BSE, Mad Cow Disease, Chronic Wasting Disease, Scrapies, Kuru**

c. (4 pts) In class we debated whether or not viruses were alive.

i. Do you think prions are alive? **(You can give either answer here)**

ii. List two pieces of evidence for your response to the question above:

If yes:

- They can evolve (since coded for by genes)
- They can interact with other entities (cause change in conformation in other molecules)

If no:

- They cannot reproduce independently
- They do not metabolize on their own
- They cannot obtain their own nutrients

6. a. (3pts) What is an **antibody**?

An antibody is a protein synthesized by B-cells that binds to antigens (non-self molecules).

b. (3pts) What is an **antibiotic**?

An antibiotic is a drug that kills bacteria, usually by preventing cell wall synthesis.

7. In the movie GATTACA, Vincent takes on Jerome's identity and DNA.

a. (2 pts) What is the best explanation for why Jerome provides Vincent with blood, hair, and urine samples. (Circle ONE)

- all of Jerome's cells have the same DNA

b. (6 pts) Name two of the technologies shown or used in the movie that our society is capable of, and then for each describe how the GATTACA society is more advanced.

Current Technology

"Improvement" in GATTACA society

i. PGD can select for more than just disease genes - also for hair color, eye color, etc.

ii. DNA sequencing Can sequence much, much faster

iii. Genetic engineering We don't do it in humans - they do

c. (2 pts) List two examples of imagery in the film that relate to the film's theme:

Helical staircase, clean/uniform clothing of valids and messy clothing of invalids, water theme as origin of life, highlighting the As,Cs,Gs, and Ts in the credits

8. a. (4 pts) Which of the following genes would most likely be found in a highly infectious, highly lethal form of influenza virus that could cause the next pandemic? (Circle all that apply)

avian influenza NS1 gene

human influenza coat protein gene

b. (4 pts) Describe *briefly* the mechanism by which these genes could end up in a single virion.

If the same person is infected with both the human and avian strains of the flu simultaneously, and both strains infect the same cell, a strand of RNA containing the avian NS1 gene could wind up in the same virion as a strand of RNA containing the human influenza coat protein gene during the assembly of new virions.

9. The following DNA sequences correspond to the first few codons of two alleles of HIV's reverse transcriptase gene.

a. (4 pts) Write the protein sequences corresponding to each in the spaces below:

allele 1: Met - Gly - Arg - Ser - Lys allele 2: Met - Gly - Ala - Gln - Asn (swapped in Version B)

b. (2 pts) Assuming one of these alleles mutated to give rise to the other, describe this mutation:

There must have been either an insertion or a deletion at the seventh nucleotide position.

This caused a frameshift, altering the sequence of the protein after the insertion/deletion.

c. (6 pts) Allele 2 codes for a reverse transcriptase enzyme that is less accurate at base pairing than the protein made by allele 1. Which strain of HIV is more likely to develop resistance to HIV drugs and why? (1-3 sentences)

HIV strain 2 is more likely to develop resistance to HIV drugs because more mistakes will be made by reverse transcriptase, causing mutations. The more mutations a virus acquires, the more likely it is that one of these mutations will change the protein targeted by a drug so that the drug no longer inhibits the protein.

10. (10 pts) Matching: For each of the definitions on the left, match with a cell from the list on the right. There is at least one answer for each definition, and there may be more than one. The choices may be used once, more than once, or not at all.

- a. I cell that produces antibody
- b. D, H, I, J a somatic cell found in an adult
- c. E cell *required* for human reproductive cloning
- d. A, B, C, D (G) cell that is undifferentiated
- e. D hematopoietic stem cells are an example of this type of cell

Choices:

- A. embryonic stem cell
 B. umbilical cord stem cell
 C. amniotic fluid-derived stem cell
 D. adult stem cell
 E. enucleated egg
 F. sperm
 G. trophoblast cell
 H. T - cell
 I. B - cell
 J. Macrophage

11. a. (2 pts) What type of toxin is this bacterium likely making? enterotoxin

b. (2 pts) What is the mechanism by which the antibiotics kill cells? (Circle ONE)
 - they prevent cell wall synthesis

c. (2 pts) What is the most likely mechanism by which an antibiotic-resistant strain of *M. schivelli* evolved? (Describe in 1-2 sentences)

A bacterium's plasmid had a resistance gene on it and it passed from one bacterium to another through a sex pilus.

d. (2 pts) If you wanted to use *M. schivelli* as a bioweapon, what two biological features would it need to have?

Lethal toxins (causing cell-suicide), spore-forming, replicate very quickly

12. a. (3 pts) "The way [viruses integrate] is by inserting a segment of their genetic code into the DNA of their host."

The genetic code is not the same as a genome (the genetic code is the codon-amino acid table!) Also, the entire viral genome is inserted into the host DNA.

b. (3 pts) "Unfortunately for Popeye but happily for healthy students, all 30 UCSB campus dining facilities have stopped serving the spinach until the E. coli virus outbreak has been resolved."

E. coli is a bacterium

c. Definition of therapeutic cloning: "A procedure in which cells, typically skin cells, are taken from a patient and inserted into a fertilized egg whose nucleus has been removed."

The nucleus of the skin cell is taken and put into an enucleated egg (which has not been fertilized).

13. On the next page, read the article describing the ethical concerns over therapeutic cloning. Then answer the following questions.

a. (3 pts) Is the science describing reproductive and therapeutic cloning in this article accurate? Describe *briefly*.

Yes, the author is completely accurate in describing the science behind both technologies.

b. (4 pts) Give two examples of language (particular phrases) that are used in the article to sway the reader to their side of the issue:

“clone and kill” technique, creation of a human life for the sole purpose of her exploitation and destruction, the exploitation of the weak by the powerful, creation of a subclass of human beings

c. (3 pts) What assumption made by the author is pivotal to his argument that therapeutic cloning is wrong?

That human embryos have the same status and rights as human beings who have been born.

d. (3 pts) How would you best describe the author’s motivation or influences that might affect his opinion on reproductive and therapeutic cloning? (no more than 2 sentences!)

The author is a Reverend, so most likely his religion has influenced his position on the status of human embryos, leading him to these conclusions.

Have a Great Summer!