BIOL 1010 - Biotechnology and Society

December 2007
Professor: Dr. James J. Cheetham
14 Pages – 80 Questions

STUDENT NAME: _____

STUDENT NUMBER: _____

INSTRUCTIONS:

1. Fill in your **NAME** and **STUDENT NUMBER** on the front of the Scantron form **AND** on the Question Sheet.

2. All answers must be entered by filling in the appropriate circles on the Scantron form with a pencil. ***Choose only one answer for each question***.

3. The exam consists of 80 questions. Each question is worth 1 point.

4. There is no correction factor, so answer all 80 questions.

5. **HAND IN THE QUESTION SHEETS WITH YOUR SCANTRON FORM**. If your question sheets are not handed in, your exam will not be graded.

No Calculators Allowed

Fill in the correct answers for each of the following questions on the Scantron sheet.
Note: ONLY ONE of the choices is correct. (1 mark each, 80 marks total)

1. To the closest approximation, the number of genes in the human genome is:
   a. 100,000
   b. 60,000
   c. 22,000
   d. 10,000
   e. 5,000

2. SCNT stands for.
   a. Stem cell nuclear transfer
   b. Somatic cell nuclear transfer
   c. Stem cell non transfer
   d. Somatic cell novel transfer
   e. Stem cell nuclear transmission

3. Use of transgenic animals to produce pharmaceuticals is often referred to as:
   a. Horse sperm
   b. Pharming
   c. Cloning
   d. SCNT
   e. PMPs

4. To the closest approximation, what percentage of the DNA in the human genome actually contains genes that code for proteins?
   a. 0 %
   b. 0.1 %
   c. 2 %
   d. 5 %
   e. 10 %

5. Kary Mullis is credited for inventing:
   a. Surfing
   b. The polymerase chain reaction
   c. Monopoly
   d. Cosmid cloning
   e. DNA

6. A restriction endonuclease that recognizes 4 nucleotides cuts DNA____
   a. Less than a restriction endonuclease that recognizes 8 nucleotides.
   b. More than a restriction endonuclease that recognizes 8 nucleotides.
   c. The same number of times as a restriction endonuclease that recognizes 8 nucleotides.
   d. Only where there are four guanines in a row.
   e. Does not cut DNA.

7. Sir Alexander Fleming:
   a. Was born in England.
   b. Developed biological warfare agents.
   c. Used mixtures of fresh cow dung and urine to prevent apple canker disease.
   d. Discovered the antibiotic penicillin.
   e. Was an only child.

8. Promoters are useful because they can ensure that:
   a. A gene product is free of mutations.
   b. A gene product is not transgenic.
   c. A gene product is not antigenic.
   d. A gene product is expressed in a specific tissue or organ.
   e. None of the above.

9. Transcription of a part of a DNA molecule with a nucleotide sequence of A-A-A-C-A-A-C-T-T results in a mRNA molecule with the complementary sequence of:
   a. G-G-G-A-G-A-A-C-C
   b. U-U-U-G-U-U-G-A-A
   c. T-T-T-G-A-A-G-C-C
   d. C-C-C-A-C-C-T-C-C
   e. None of the above

10. In environmental biotechnology, the triple bottom line refers to which three factors:
   a. Environmental, Economic, and Social
   b. Environmental, Fiscal, and marine
   c. Economic, agricultural, and industrial
   d. Agricultural, industrial, and medical
   e. None of the above

11. What are alleles?
   a. genes for different traits, such as hair color or eye color.
   b. alternative forms of a gene for a single trait, such as blue eyes or brown eyes.
   c. the location of genes on a chromosome
   d. recessive forms of a kind of characteristic carried by genes.
   e. dominant forms of a kind of characteristic carried by genes.

12. If the sequence of nucleotides in one chain of a DNA molecule is T-C-A-A-G-C, a new nucleotide chain will be produced during replication with the complementary sequence:
   a. T-C-A-A-G-C
   b. A-G-T-T-C-G
   c. C-T-G-G-A-T
   d. G-A-C-C-T-A
   e. none of the above

13. If a heritable change is made when DNA is copied, a _____ may result.
   a. clone
   b. death
   c. mutation
   d. base pair
   e. fertilized egg

14. PCR means:
    a. Polymerase Chain Reaction
    b. Plasmid Coil Removal
    c. Point Cross Restriction
    d. Primer Circle Reaction
    e. none of the above

15. When an organism has two copies of the same allele it is said to be:
    a. homozygous
    b. heterozygous
    c. hemizygous
    d. zygotic
    e. replicative

16. When an organism has two different alleles of the same gene it is said to be:
    a. homozygous
    b. heterozygous
    c. hemizygous
    d. zygotic
    e. replicative

17. Watson and Crick determined:
    a. the function of DNA
    b. the structure of individual bases
    c. the structure of DNA
    d. RNA structure
    e. the three letter amino acid code

18. If a mammalian sperm cell contains 8 chromosomes, it comes from an animal that has ____ chromosomes.
    a. 4
    b. 8
    c. 12
    d. 16
    e. 24

19. Using bacteria to clean up pollutants is specifically called
    a. Biotic stress
    b. Phytoremediation
    c. Phytochemical production
    d. Bioremediation
    e. Plant chemical reduction

20. What is the function of a vector in genetic engineering?
    a. cut DNA into many fragments
    b. carry DNA into a new cell
    c. link together newly joined fragments of DNA
    d. make millions of copies of a specific segment of DNA
    e. separate fragments of DNA by their length and electrical charges

21. What is the function of a restriction enzyme in biotechnology?
    a. cut DNA into many fragments
    b. carry DNA into a new cell
    c. link together newly joined fragments of DNA
    d. make millions of copies of a specific segment of DNA
    e. separate fragments of DNA by their length and electrical charges

22. Which of the following techniques is **NOT** used in forensic DNA analysis?
    a. gene therapy
    b. STR analysis
    c. gel electrophoresis
    d. polymerase chain reaction
    e. they are all used

23. A circular piece of DNA found in bacterium in addition to the bacterium's main chromosome is called a:
    a. sticky end
    b. plasmid
    c. donor gene
    d. gene clone
    e. gene

24. What is the function of DNA ligase in recombinant technology?
    a. make millions of copies of a specific segment of DNA
    b. carry DNA into a new cell
    c. separate fragments of DNA by their length and electrical charges
    d. cut DNA into many fragments
    e. link together newly joined fragments of DNA

25. The two strands of a DNA double helix are held together by _____.
    a. covalent bonds between the sugars of one nucleotide and the phosphates of the adjacent nucleotide
    b. ionic bonds between DNA and water
    c. hydrogen bonds between bases on opposite DNA strands
    d. ionic bonds between DNA and water
    e. covalent bonds between the sugars of one nucleotide and the phosphates of the adjacent nucleotide

26. Select the proper pairings of nucleotides.
    a. adenine-guanine / cytosine-thymine
    b. thymine-adenine / guanine-cytosine
    c. deoxyribose-phosphate / adenine-cytosine
    d. thymine-adenine / guanine-cytosine
    e. deoxyribose-phosphate / adenine-cytosine

27. Transformation is the process by which foreign _____ is taken up from a cell's environment, permanently changing the characteristics of a cell and its offspring.
    a. DNA
    b. RNA
    c. protein
    d. lipids
    e. mRNA

28. A pair of prospective parents is concerned about the risk of having a child with cystic fibrosis, because both the man and woman have a sibling who died from the disease. They undergo genetic testing and find that each carries one cystic fibrosis allele and one normal allele. What is the likelihood that their unborn child will have cystic fibrosis? (Recall that cystic fibrosis results from a recessive mutation.)
    a. 25% (The chance that this baby will have cystic fibrosis is 1 in 4.)
    b. 100% (All of their children will have cystic fibrosis.)
    c. 50% (The chance that this baby will have cystic fibrosis is 1 in 2.)
    d. 0% (None of their children will have cystic fibrosis.)
    e. None of the above

29. What is complementary DNA (cDNA)?
    a. the strand of DNA opposite the strand used to make mRNA
    b. a sequence of DNA as it is found in the genome
    c. any sequence of cloned DNA
    d. DNA made from a mature mRNA template
    e. DNA made through the polymerase chain reaction

30. The appearance of an organism is its
    a. Genotype
    b. Phenotype
    c. Genotype ration
    d. Phenotype ratio
    e. None of the above

31. Which is **NOT** a major function of DNA?
    a. Store information
    c. Catalyze chemical reactions
    b. Replicate itself
    d. Undergo mutations
    e. All of the above are functions of the genetic material

32. The direction of replication of DNA is:
    a. 5' to 3'
    b. 3' to 5'
    c. 5' to 5'
    d. 3' to 3'
    e. Variable

33. The actual genetic makeup of an organism is called its
    a) Phenotype
    b) Homozygous type
    c) Heterozygous type
    d) Genotype
    e) None of the above.

34. At the start of his essay, George Grant said that we are _____ society?
    a. revolutionary
    b. biological
    c. technological
    d. computerized
    e. ontological

35. Which disease results in deformed red blood cells, poor circulation, and anemia?
    a. Male pattern baldness
    b. Sickle-cell disease
    c. Colour blindness
    d. Hemophilia
    e. Duchenne muscular dystrophy

36. Which provides protection against malaria in the heterozygote?
    a) Duchenne muscular dystrophy
    b) Hemophilia
    c) Sickle-cell disease
    d) Male pattern baldness
    e) Colour blindness

37. If a characteristic is sex-linked it usually:
    a) occurs most commonly in males
    c) occurs only in females
    b) can never occur in males
    d) is always fatal
    e. None of the above

38. Because one original strand of the double stranded helix is found in each daughter cell, the replication process is called:
    a) Proofreading
    b) Semiconservative
    c) Redundant
    d) Freeing DNA
    e) Mutation positive

39. Damage to DNA is usually repaired by:
    a. Purines
    b. Nucleotides
    c. Enzymes
    d. Replication forks
    e. Gnomes

40. Which best describes a transgenic organism?
    a. One that acts as the donor for DNA to be moved into another organism
    b. One produced by cloning a mutant cell
    c. One that contains a foreign gene and is free living in the environment
    d. One produced by the polymerase chain reaction
    e. Any genetically modified organism resulting from laboratory research

41. Telomeres are:
    a. In the middle of chromosomes
    b. At the end of chromosomes
    c. Get shorter with age
    d. Enzymes
    e. Both b and c

42. If you discovered a bacterial cell that had no restriction enzyme, which of the following would you expect to happen?
    a. the cell would be unable to replicate its DNA
    b. the cell would create incomplete plasmids
    c. the cell would be easily infected and lysed by viruses
    d. the cell would become a parasite
    e. both A and D would occur

43. The principle component of *Agrobacterium tumefaciens* used in plant transformation is:
    a. LacZ
    b. The golgi apparatus
    c. Ti Plasmid
    d. The plastid
    e. Chromosomal DNA

44. Using microbes to clean up pollutants is called:
    a. Microbial degradation
    b. Biomass conversion
    c. Microbiological mining
    d. Bioremediation
    e. Debugging

45. A human product that is being made in genetically engineered microorganisms:
    a. Human growth hormone.
    b. Insulin.
    c. Tissue plasminogen activator.
    d. Clotting factor VIII.
    e. All of the above.

46. Which is the process that synthesizes mRNA?
    a. translation
    b. transcription
    c. transposition
    d. transformation
    e. none of the above

47. Which of the following nucleotide bases is found only in RNA, not in DNA?
    a. guanine
    b. adenine
    c. thymine
    d. uracil
    e. cytosine

48. An intervening sequence in a eukaryotic gene that is not an active part of the gene is called a(n):
    a. exon
    b. intron
    c. replicon
    d. neutron
    e. none of the above

49. Plants are expected to be genetically engineered to have:
    a. a requirement for more fertilizer.
    b. an increase water requirement.
    c. the ability to produce all the essential amino acids.
    d. increased susceptibility to herbicides.
    e. all of the above.

50. Xenotransplants into humans are most commonly from pigs because:
    a. They have the exact same cells as humans
    b. They have organs that differ from humans
    c. Their organs have a similar physiology status to humans
    d. They have the same number of toes
    e. None of the above

51. It is essential that plasmid vectors used in genetic engineering contain selectable markers because:
    a. plasmid vectors are unable to produce antibiotics without them.
    b. plasmid vectors are unable to replicate in bacteria without them.
    c. it is difficult to specifically identify transformed cells without them.
    d. plasmid vectors can not be transferred into recipient cells without them.
    e. all of the above

52. Agrobacterium and the "gene gun" are used in plant transformation because they both:
    a. deliver DNA into plant cells.
    b. cause the disease called crown gall.
    c. can be used to select genetically engineered cells.
    d. can only be used on dead plants
    e. all of the above.

53. Early embryonic Stem cells are usually thought to be:
    a. Omnipotent
    b. Plastic
    c. Totipotent
    d. Pluripotent
    d. None of the above

54. Human Therapeutic Cloning may be principally used to
    a. Manipulate Embryos
    b. Repair faulty tissues and organs
    c. Create complete organism copies
    d. Reproductive cloning
    e. Provide organs for xenotransplantation

55. For "DNA fingerprinting" to associate a blood sample with the criminal, what is minimally required?
    a. one sample of DNA, PCR amplification, restriction enzymes, and gel electrophoresis
    b. one sample of DNA, restriction enzymes, a DNA synthesizer, and gel electrophoresis
    c. two samples of DNA, PCR amplification, restriction enzymes, and gel electrophoresis
    d. two samples of DNA, PCR amplification, a DNA synthesizer, and gel electrophoresis
    e. two samples of DNA, PCR amplification, restriction enzymes, and a DNA synthesizer

56. Which best describes a transgenic organism?
    a. one that acts as the donor for DNA to be moved into another organism
    b. one produced by cloning a mutant cell
    c. one that contains a foreign gene and is free living in the environment
    d. one produced by the polymerase chain reaction
    e. any genetically modified organism resulting from laboratory research

57. The accuracy of DNA fingerprinting can be increased by comparing:
    a. segments of DNA that tend to vary the least from person to person.
    b. noncoding segments where the DNA repeats over and over.
    c. DNA from identical twins.
    d. repeat patterns at only one or two sites in the genome
    e. none of the above

58. One of the goals of the Human Genome Project is to:
    a. increase the number of genes in he human genome.
    b. map the location of only the most important genes on each chromosome.
    c. clone the entire intact human genome in bacteria.
    d. determine the nucleotide sequence of the entire human genome.
    e. none of the above

59. The process that separates DNA fragments according to their size and charge is:
    a. gel electrophoresis
    b. RFLP analysis
    c. polymerase chain reaction
    d. the isolation of a gene
    e. none of the above

60. To obtain bacteria that produce insulin, genetic engineers:
    a. remove repressor proteins that inhibit the expression of the bacterial insulin gene.
    b. insert a vector containing the human gene for insulin into bacteria.
    c. search for bacteria that can grow in a medium that lacks insulin.
    d. grow normal bacteria in a nutrient medium that contains a large amount of sugar.
    e. none of the above

61. Translation involves:
    a. mapping genes in bacteria using a viral carrier
    b. reading an mRNA to yield an amino acid sequence in a protein
    c. taking up DNA into a cell and changing its genetic makeup
    d. reading a DNA strand and making an mRNA copy
    e. none of the above

62. Which of the following is NOT a property of the genetic code:
    a. non-overlapping
    b. redundant
    c. almost universal
    d. four stop codons
    e. triplet

63. The polymerase chain reaction represented a major advance in which of the following:
    a. Ability to quickly make many copies of a specific region from a small amount of DNA.
    b. Protein synthesis in a test tube.
    c. Binding of tRNAs to ribosomes in a test tube.
    d. Production of large quantities of RNA polymerase in the laboratory.
    e. none of the above

64. Polyploidy refers to:
    a. extra copies of a gene adjacent to each other on a chromosome
    b. an individual with complete extra sets of chromosomes
    c. a chromosome which has replicated but not divided
    d. multiple ribosomes present on a single mRNA
    e. an inversion which does not include the centromere

65. Choose the correct statement about the genetic code.
    a. includes 61 codons for amino acids and 3 stop codons
    b. almost universal; exactly the same in most genetic systems
    c. three bases per codon
    d. some amino acids are coded by multiple codons
    e. all of the above

66. Short tandem repeat polymorphisms in humans are most useful for:
    a. solving criminal and paternity cases
    b. reconstructing the relationships of humans and chimps.
    c. estimating relationships of humans and Neanderthals
    d. transferring disease resistance factors into bone marrow cells
    e. estimating matches for blood transfusions

67. The animal cloning technique that is most equivalent to naturally-occurring twinning is _____.
    a. embryo splitting
    b. colony hybridization
    c. nuclear transfer involving embryonic cell nuclei
    d. nuclear transfer involving adult cell nuclei
    e. none of the above

68. What is meant by the term recombinant DNA?
    a. DNA from bacteria or viruses
    b. DNA produced by restriction enzyme digestions
    c. DNA produced by combining genetic material from two different species
    d. DNA from chromosomes that were involved in a reciprocal translocation
    e. DNA isolated from the chromosomes that are undergoing recombination events during meiosis

69. Upon completion of the human genome, it was surprising to discover that:
    a. almost all the DNA encodes genes.
    b. there are many fewer human proteins than genes.
    c. there are many fewer genes than expected.
    d. there are many more genes than expected.
    e. almost all humans genes are not similar to genes in any other organism.

70. Which of the following presents an accurate list of the various steps involved in cloning?
    a. i) cutting plasmid DNA and foreign DNA with the same restriction enzyme; ii) mixing the cut DNA in thepresence of DNA ligase; and iii) inserting the ligated DNA into bacterial cells
    b. i) cutting the foreign DNA with a restriction enzyme; ii) inserting the cut DNA into bacterial cells that contain aplasmid; and iii) treating the cells with DNA ligase
    c. i) cutting plasmid DNA with one restriction enzyme, and the foreign DNA with another; ii) inserting the cut DNAinto bacterial cells; and iii) inducing the expression of DNA ligase in the cells.
    d. i) treating the foreign DNA with DNA ligase; ii) cutting the plasmid DNA with restriction enzymes; and iii)inserting the ligase-treated foreign DNA and digested plasmid DNA into bacterial cells.
    e. none of the above

71. Telomeres are:
    a. In the middle of chromosomes
    b. At the end of chromosomes
    c. Get shorter with age
    d. Enzymes
    e. Both b and c

72. Totipotent means:
    a. Capable of making an entire organism
    b. Is just like pluripotent
    c. Incapable of making an entire organism
    d. Have an unusual chromosome number
    e. None of the above

73. A short repeated polymorphism that can identify 1 person out of 10^{18} using PCR:
    a. SRP
    b. STR
    c. EST
    d. PGC
    e. BBC

74. The rapidly expanding field of data analysis using information gathered from the genome projects:
    a. proteomics
    b. nutriomics
    c. bioinformatics
    d. totalomics
    e. metabolomics

75. Alternative versions of the same gene are called
    a. Copies
    b. Replicates
    c. Homologues
    d. Alleles
    e. Rads

76. For "DNA fingerprinting" to associate a crime scence blood sample with the criminal, what is minimally required?
    a. one sample of DNA, PCR amplification, restriction enzymes, and gel electrophoresis
    b. one sample of DNA, restriction enzymes, a DNA synthesizer, and gel electrophoresis
    c. two samples of DNA, PCR amplification, restriction enzymes, and gel electrophoresis
    d. two samples of DNA, PCR amplification, a DNA synthesizer, and gel electrophoresis
    e. two samples of DNA, PCR amplification, restriction enzymes, and a DNA synthesizer

77. Telomeric DNA
    a. is found at the ends of chromosomes
    b. is always expressed
    c. shortens in length as you age
    d. makes cells stick together
    e. both a and c

78. Which of the following is true of proteins:
    a. They are made up of DNA.
    b. They are complex carbohydrates
    c. They are made up of amino acids
    d. They are direct products of Photosynthesis
    e. All of these are true

79. Which of the following is not one of the tools used in DNA profiling?
    a. PCR technology
    b. SNPs
    c. RFLPS
    d. Monoclonal antibodies
    e. mtDNA

80. Changing the DNA sequence of a gene often changes the corresponding phenotype primarily because:
    a. the gene itself may have a different 3-D structure
    b. the protein coded for by the gene may have an altered amino acid sequence and different 3-D structure
    c. the gene may be cut into different sized DNA fragments by restriction enzymes
    d. none of the above
    e. all of the above

THE END