

OBAFEMI AWOLOWO UNIVERSITY, ILE – IFE, NIGERIA.
FACULTY OF SCIENCE
DEPARTMENT OF MICROBIOLOGY

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B.Sc. (Microbiology) Degree Examination.

SEMESTER: Harmattan 2010/2011 Session

Date: July 28, 2011

COURSE CODE: MCB 301

Time allowed: 3 Hrs.

COURSE TITLE: Molecular Genetics and Cell Biology

INSTRUCTION: Answer all questions with each section in a separate booklet.

SECTION A

- 1a. Describe the binary fission in *E. coli*.
- b. How is binary fission exhibited in this microorganism in relation to the mitotic cell division?

- 2a. Explain in detail the evidences confirming that DNA is the genetic material coding for inheritable characteristics of microorganism.

- b. Write briefly on the function of the molecular alphabets in the determination of characteristic traits of organisms.

SECTION B

- 1(a) Write short notes (not more than a page) on the following:
 - i. Genotype versus Phenotype (5 Marks)
 - ii. Polymerase Chain Reaction (5 Marks)

- (b) Describe fully the procedure for the extraction of bacterial DNA (10 Marks)

- (c) How would you verify the purity and determine the concentration of the DNA obtained in "1b" above? (5 Marks)

- 2.

SECTION C

For each of the following questions pick **only one** of the choice answers by shading appropriate letter on the answer sheet provided. You will lose $\frac{1}{4}$ of a point for every wrong answer, so do not guess!

1. The point at which the double-stranded DNA molecule unwinds is called
(a) polymerase b) replication fork c) hydrogen bonding d) ribosomes

2. Protein synthesis begins with the
(a) transcription process b) translation process c) polypeptide process d) genotyping

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3. Expressed properties such as whether you have blue eyes and curly hair
(a) genotype (b) exons (c) introns (d) phenotype
4. Which of the following is not a type of RNA? (a) rRNA (b) uRNA (c) tRNA (d) mRNA
5. What is RNA polymerase?
(a) An enzyme used in the synthesis of RNA (b) An enzyme used in the synthesis of ribosomes
(c) An enzyme used in the synthesis of protein (d) An enzyme used in the synthesis of pre-DNA
6. What is the promotor site?
(a) The site where RNA polymerase binds to DNA
(b) The site where RNA polymerase binds to protein
(c) The site where RNA polymerase binds to free nucleotides
(d) The site where RNA polymerase binds to AAA
7. The mRNA language consists of three nucleotides called
(a) amino acid (b) codons (c) introns (d) exons
8. What do repressors do?
(a) They activate transcriptions. (b) They increase synthesis.
(c) They increase gene expression. (d) They stop the initiation of transcription.
9. An operon consists of
(a) structural genes (b) regulatory genes (c) control genes (d) all of above
10. Spontaneous mutation occurs as a result of laboratory intervention in DNA replication.
(a) True (b) False (c) May be true (d) May be false
11. The product of transcription is
A. DNA. B. protein. C. mRNA. D. a ribosome.
12. A section of DNA has the following sequence of nitrogenous bases: CGATTACAG.
Which of the following sequences would be produced as a result of transcription?
A. CGTUUTCTG B. GCTAATGTC C. CGAUUACAG D. GCUAAUGUC
13. mRNA is produced in the process called
A. respiration. . translation. . replication. . transcription.
14. A function of transfer RNA (tRNA) is to
A. stay in the nucleus and be copied by DNA. B. carry amino acids to the growing polypeptide chain.
C. copy DNA and carry the information to the ribosome.
D. read the codons and provide the site for protein synthesis.
15. Which of the following best describes the function of mRNA? It

- A. is in the nucleus and copied by DNA. B. carries amino acids to the growing polypeptide chain
C. makes up the ribosomes and provides the site for protein synthesis.
D. is transcribed from the DNA and carries the information to the ribosome.

16. The molecule that is responsible for carrying amino acids to ribosomes is
A. DNA. B. tRNA. C. rRNA. D. mRNA.

17. A polypeptide found in the cytoplasm of a cell contains 12 amino acids. How many nucleotides would be required in the mRNA for this polypeptide to be translated?
A. 4 B. 12 C. 24 D. 36

18. If the nucleotide sequence of an anticodon was AUC, then the DNA triplet would be
A. ATC. B. TAG. C. AUC. D. UAG.

19. If the code for an amino acid is AGC on the DNA molecule, the anticodon on the tRNA would be

A. AGC B. TGC C. UCG D. UGC

20. During protein synthesis, peptide bonds are formed at the

A. nucleus. B. nucleolus. C. lysosomes. D. ribosomes.

21. Determine the sequence of amino acids produced by this DNA sequence: GGAGTTTTTC

A. Proline, Valine, Lysine. B. Glycine, Valine, Leucine.

C. Proline, Glutamine, Lysine. D. Glycine, Glutamic acid, Leucine.

22. Use the following information to answer the question:

1. Uracil bonds with adenine.

2. Complementary bonding between codon and anticodon.

3. DNA unzips.

4. mRNA joins with ribosome.

The correct order of the above during protein synthesis is

A. 1, 2, 4, 3 B. 1, 3, 2, 4 C. 3, 1, 4, 2 D. 3, 2, 1, 4

23. The tRNA anticodon for the DNA sequence AGT would be

A. UCA. B. AGU. C. TCA. D. AGT.

24. A change in the sequence of bases in a strand of DNA that occurs as a result of exposure to X-rays is an example of

A. mutation. B. denaturation. C. transcription. D. protein synthesis.

25. For a substance to be classified as a mutagen, it must cause

A. a change in DNA. B. enzymes to denature.

C. hydrolysis of proteins. D. mRNA to be produced.

26. Which of the following would be a result of the substitution of one base pair in DNA by a different base pair during replication?

A. A mutation would occur. B. tRNA would bond to DNA.

C. Phosphate would join with adenine. D. Uracil would appear in the DNA strand.

27. Recombinant DNA is defined as DNA produced from
- A. RNA and a protein. B. DNA and hemoglobin.
C. viral DNA and glucose. D. DNA of two different organisms.
28. When a foreign gene is incorporated into an organism's nucleic acid, the resulting molecule is called
- A. **ATP**. B. recombinant **DNA**. C. transfer **RNA** (tRNA). D, messenger **RNA** (mRNA).
29. If the triplet code on a DNA molecule changes from ACT to AGC, the result is called
- A. mutation. B. metastasis. C. translation. D.transcription.
30. Use the following events to answer the question.
1. mRNA is formed. 2. DNA segment opens (unzips).
3. mRNA attaches to ribosomes. 4.amino acids form peptide bonds.
5. tRNA carries amino acids to mRNA.
- The correct order of events required for protein synthesis is
- A. 1, 2,3, 4, 5. B. 2, 1, 3, 4, 5. C. 2, 1, 3, 5, 4. D. 2, 1, 4, 5, 3.
31. Which of the following terms describes the process shown below? DNA to mRNA
- A. Unzipping. B. Translation. C. Replication. D.Transcription.
32. One of the functions of DNA is to
- A. secrete vacuoles. B. make copies of itself. C. join amino acids to each other.
D. carry genetic information out of the nucleus.
33. A **role** of mRNA in protein synthesis is to
- A. form ribosomes. B. form the p otein's tertiary structure.
C. carry appropriate amino acids into place. D. carry genetic information out of the nucleus.
34. The centromere
- (a) "unzips" DNA molecules.
b) appears between two daughter cells during binary fission.
(c) determines the location of the nucleus in a cell.
(d) divides chromosomes into two arms of varying lengths.
35. Genes that are found on the same chromosome are said to be
- (a) linked. (b) bound. (c) intertwined. (d) bipolar.
36. Mapping chromosomes reveals
- (a) genetic abnormalities. (b) their location in the cell nucleus.
(c) what kind of cell is being examined. (d) where specific genes are located.
37. DNA can be read as a code for producing a chain of
- (a) cells. (b) sugars. (c) amino acids. (d) salts.
38. A codon is
- (a) one three-letter "word" in the genetic code. (b) a protein cap on the end of a chromosome.

- (c) the enzyme that makes DNA replication possible.
(d) a special kind of RNA that provides energy for cell fission.

39. Transcription is

- (a) the exchange of genetic information between the members of a chromosome pair.
(b) another word for binary fission.
(c) the entering of DNA sequences into a computer for analysis.
(d) the process of copying the genetic information from DNA to mRNA.

40. Translation is

- (a) another word for binary fission. (b) the conversion of cell organelles into DNA.
(c) the process of building chains of amino acids from the genetic information copied into mRNA
(d) the process of rearranging a cell's DNA to change the cell's function.

41. Ribosomes are

- (a) tiny structures in the cell cytoplasm that provide energy for all cell functions.
(b) tiny structures in the cell cytoplasm that control the process of building amino-acid chains.
(c) tiny structures in the cell nucleus that have their own DNA separate from the nuclear DNA.
(d) tiny structures in the cell membrane that control the flow of proteins through the cell wall.

42. The physical expression of genetic information in an organism is called its

- (a) phenotype. (b) genotype. (c) trait indicator. (d) protein display.

43. Polygenic traits are those determined by

- (a) non-nuclear DNA. (b) sex. (c) more than one gene. (d) only one gene.

44. The nucleotide genome consists of the sequence of nucleic acid that encodes genetic information on DNA.

- (a) True (b) False (c) May be true (d) May be false

45. What enables scientists to take nucleotide fragments from other DNA and reassemble fragments into a new nucleotide sequence?

- (a) Enzyme DNA technology (b) Enzyme technology
(c) Recoinbinant DNA technology (d) Recombinant enzyme technology

46. What is used to cut DNA double-helix strand DNA along the exterior of the strand?

- (a) Overhang (b) Restriction enzymes (c) Restriction fragment
(d) Recognition sequence

47. What is the particular nucleotide sequence of a double-helical segment called?

- (a) Overhang (b) Restriction enzymes (c) Restriction fragment
(d) Recognition sequence

48. What results when two incisions are made in a double-helical segment?

- (a) Overhang (b) Restriction enzymes (c) Restriction fragment
(d) Recognition sequence

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49. The four nucleotides are adenine (A), cytosine (C), guanine (G) and thymine (T).
(a) True (b) False (c) May be true (d) May be false

50. What is another name for a restriction enzyme?
(a) Vector (b) Plasmid (c) Restriction endonucleases (d) Agarose gel

51. Scientists synthesize fragments of DNA and RNA using a process known as polymerase chain reaction (PCR).
(a) True (b) False (c) Fallacy (d) Redundancy

52. The product of transcription is
A. DNA. B. protein. C. mRNA. D. a ribosome.

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Which of the following sequences would be produced as a result of transcription?
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A. respiration. B. translation. C. replication. D. transcription.

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A. stay in the nucleus and be copied by DNA.
B. carry amino acids to the growing polypeptide chain.
C. copy DNA and carry the information to the ribosome.
D. read the codons and provide the site for protein synthesis.

56. Which of the following best describes the function of mRNA?
A. It stays in the nucleus and is copied by DNA.
B. It carries amino acids to the growing polypeptide chain.
C. It makes up the ribosomes and provides the site for protein synthesis.
D. It is transcribed from the DNA and carries the information to the ribosome.

57. The molecule that is responsible for carrying amino acids to ribosomes is
A. DNA. B. tRNA. C. rRNA. D. mRNA.

58. If the nucleotide sequence of an anticodon was AUC, then the DNA triplet would be
A. ATC. B. TAG. C. AUC. D. UAG.

59. If the code for an amino acid is AGC on the DNA molecule, the anticodon on the tRNA would be
A. AGC B. TGC C. UCG D. UGC

60. A nucleoside consists of

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- (A) Nitrogenous base (B) Purine or pyrimidine base + sugar
(C) Purine or pyrimidine base + phosphorous
(D) Purine + pyrimidine base + sugar + phosphorous

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62. A nucleotide consists of

- (A) A nitrogenous base like choline (B) Purine + pyrimidine base + sugar + phosphorous
(C) Purine or pyrimidine base + sugar (D) Purine or pyrimidine base + phosphorous

63. A purine nucleotide is

- (A) AMP (B) UMP (C) CMP (D) TMP

64. A pyrimidine nucleotide is

- (A) GMP (B) AMP (C) CMP (D) IMP

65. Adenine is

- (A) 6-Amino purine (B) 2-Amino-6-oxypurine
(C) 2-Oxy-4-aminopyrimidine (D) 2, 4-Dioxypyrimidine

66. 2, 4-Dioxypyrimidine is

- (A) Thymine (B) Cytosine (C) Uracil (D) Guanine

67. The chemical name of guanine is

- (A) 2,4-Dioxy-5-methylpyrimidine (B) 2-Amino-6-oxypurine
(C) 2-Oxy-4-aminopyrimidine (D) 2, 4-Dioxypyrimidine

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68 Nucleotides and nucleic acids concentration are often also expressed in terms of

- (A) ng (B) mg (C) meq (D) OD at 260 nm

69 The pyrimidine nucleotide acting as the high energy intermediate is

- (A) ATP (B) UTP (C) UDPG (D) CMP

70 The carbon of the pentose in ester linkage with the phosphate in a nucleotide structure is

- (A) C1 (B) C3 (C) C4 (D) C5

71. The main difference between prokaryotes and eukaryotes is

- (a) eukaryote cells have a nucleus; prokaryote cells don't.
(b) eukaryotes practice photosynthesis; prokaryotes don't.
(c) prokaryotes live longer. (d) prokaryotes are much rarer than eukaryotes.

72 The bacterial chromosome is

- (a) a single linear strand of DNA. (b) two double-helix strands twisted together.
(c) a single ring-shaped DNA molecule. (d) scattered throughout the bacteria in fragments.

73. The function of DNA gyrase is to

- (a) twist bacterial DNA very tightly together.

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- (b) keep bacterial DNA from twisting so much that it can't replicate.
- (c) make bacteria spin in place to fight off viruses.
- (d) attract other bacteria for conjugation.

74 Under ideal conditions, bacteria can replicate

- (a) once a day.
- (b) twice a day.
- (c) every two hours.
- (d) every 20 minutes.

75 A polycistronic length of mRNA contains codes for

- (a) sugar.
- (b) more than one gene.
- (c) cell walls in Gram-positive species.
- (d) disease toxins.

76 Bacteria that can incorporate naked DNA are called:

- (a) hungry.
- (b) brave.
- (c) competent.
- (d) modest.

77 When two bacteria join together so that one can give the other a copy of some of its genetic information, the process is called

- (a) confrontation.
- (b) conjugation.
- (c) confabulation.
- (d) commitment.

78 A small DNA molecule that is outside of the bacterial chromosome and replicates autonomously is called a

- (a) plasmid.
- (b) plasmon.
- (c) extrasome.
- (d) parasite chromosome.

79 Proteins that must be present in order for genes to activate are called

- (a) activists.
- (b) accountants.
- (c) provokers.
- (d) activators.

80. Substances that trigger the shutdown of gene transcription are called:

- (a) co-conspirators.
- (b) co-repressors.
- (c) conquerors.
- (d) controllers.

81 A haploid cell contains

- (a) only half the full complement of chromosomes.
- (b) the usual complement of chromosomes.
- (c) twice the full complement of chromosomes.
- (d) damaged chromosomes.

82 Oswald Avery's work confirmed that

- (a) DNA is the organizing principle of heredity.
- (b) sex in humans is determined by the X and Y chromosomes.
- (c) fruit flies and humans share the same genetic material.
- (d) some diseases are caused by substances smaller than bacteria.

83 The backbones of the DNA double helix are made of

- (a) amino acids.
- (b) RNA.
- (c) sugars and phosphates.
- (d) lipids.

84 A nucleotide is

- (a) one piece of DNA backbone with a base attached.
- (b) a strand of DNA labeled with a radioactive tag.
- (c) a short strand of RNA used to transfer information between DNA strands.
- (d) a special type of chromosome.

88 A replication fork is

- (a) the split caused by binary fission in cells.
- (b) a laboratory instrument used to stimulate the replication of DNA;
- (c) the point at which replication is taking place in a DNA strand.
- (d) a genetic defect found in some gametes.

89. Enzymes are

- (a) proteins that act as catalysts, allowing biochemical reactions to take place without themselves being changed.
- (b) small subsections of chromosomes that can be stained and tracked throughout the process of cell division.
- (c) sections of DNA that do not seem to serve any hereditary purpose.
- (d) toxins that break down cell structures, eventually killing the cell.

90 Sex cells have

- (a) the same number of chromosomes as body cells.
- (b) half as many chromosomes as body cells.
- (c) twice as many chromosomes as body cells.
- (d) one quarter as many chromosomes as body cells.

91 The term for something that induces mutations is

- (a) mutational multiplier. (b) mutator. (c) mutagen. (d) genesplicer.

92 What do we call a mutation that changes a single base pair?

- (a) a point mutation (b) a pair mutation (c) a base deletion (d) a nucleotide nullification

93 A mutation that removes a base pair and thus offsets the reading frame of the genetic sequence by one letter is called

- (a) a basal disruption. (b) a frameshift mutation.
- (c) a bump-and-run mutation. (d) a sliding sequence mutation.

94 Stretches of DNA that can move from place to place in the genome are called

- (a) wandering sequences. (b) genomic gypsies. (c) transposons. (d) quarks.

95 DNA that serves no function except to reproduce itself is called

- (a) greedy DNA. (b) selfish DNA. (c) rowdy DNA. (d) self-indulgent DNA.

96 A suppressor mutation is

- (a) a mutation that cancels out or works around the change produced by a previous mutation.
- (b) a mutation that prevents any other mutations from ever happening.
- (c) a mutation that suppresses the desire for food.
- (d) a mutation that results in serious mental depression.

97. Wild-type versions of genes are

- a) those that cause organisms to act wildly.
- (b) those found only in wild animals, as opposed to domestic ones.
- (c) those that most often occur naturally. (d) mutated versions of normal genes.

98. Ionizing radiation, ultraviolet radiation, and some chemicals are all
(a) causes of mutations. (b) things you're likely to find in a genetics lab.
(c) used in cooking. (d) fun for young and old.
100. Gametic mutations are those that occur
(a) in body cells, excluding the sex cells. (b) in sex cells.
(c) in skin cells. (d) in eye cells.
101. Transposons
(a) delete entire chromosomes. (b) replace one codon with a different one.
(c) can move from place to place in the genome.
(d) remove a base pair, offsetting the reading frame of the genetic sequence by one letter.
102. A mutation that cancels out or works around the change produced by a previous mutation is called a
(a) detrimental mutation. (b) neutral mutation. (c) benevolent mutation.
(d) suppressor mutation.
103. The versions of genes that most often occur naturally are called
(a) natural genes. (b) wild-type genes. (c) HF (high-frequency) genes.
(d) LM (low-mutation) genes.
104. Cancer cells have the ability to divide indefinitely. They have become
(a) immortalized. (b) desensitized. (c) transduced. (d) indestructible.
105. When cancer cells gain the ability to move independently and invade other tissues, they are said to have
(a) evolved. (b) metastasized. (c) metamorphed. (d) mobilized.
106. Non-cancer-causing genes that, when altered, can cause cancer are called
(a) prenarcogenes. (b) neogenes. (c) protooncogenes. (d) noncosomes.
107. Carcinogens are
(a) genes that can cause cancer. (b) cancers that cause additional mutations.
(c) mutagens that can turn cells cancerous. (d) toxic waste products produced by cancerous cells.
108. "A single ring-shaped DNA molecule" is a description of
(a) the only genetic material in a cancer cell. (b) the bacterial chromosome.
(c) the viral chromosome. (d) a transposon.
109. Enzymes that can break the bonds that hold the DNA backbones together are called
(a) nucleases. (b) fissionases. (c) backbreakers. (d) debasers.
110. "Sticky end" refers to
(a) a cellular adhesive that holds cells together to form tissues.
(b) a short, complementary, single-stranded DNA segment at each end of a DNA fragment.

- (c) geneticist slang for a laboratory accident that spoils a DNA sample.
- (d) the tail of a phage used as a genetic engineering vector.

111. The first genetically engineered organism was
(a) a sheep. (b) yeast. (c) the Haemophilus influenzae Rd virus. (d) E. coli.

112. A clone is
- (a) a genetically identical copy of another organism.
 - (b) a genetically modified copy of another organism.
 - (c) a genetic mixture of two different organisms.
 - (d) a bacterium modified to produce a human hormone.

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113. PCR (polymerase chain reaction) is used to
(a) grow E. coli in the laboratory. (b) power cell activity.
(c) make many copies of a DNA sequence quickly. (d) clean dried DNA from laboratory glassware.

114. A genetically engineered organism that can pass on its new genes to its offspring is said to be
(a) photogenic. (b) transgenic. (c) hygienic. (d) bionic.

115. Competent bacteria can
(a) cause disease. (b) remain dormant for thousands of years.
(c) incorporate naked DNA. (d) survive antibiotics.

116. In conjugation, two bacteria
(a) kill each other. (b) exchange genetic information.
(c) join into one giant cell. (d) join forces to fight viruses.

117. Plasmids are
(a) small DNA molecules outside of the bacterial chromosome that can replicate on their own.
(b) benign viruses that invade bacteria but do not harm them.
(c) proteins used in the construction of bacterial cell membranes.
(d) virulent viruses that quickly kill most bacterial cells.

118. Co-repressors
(a) trigger the shutdown of gene translation.
(b) trigger the shutdown of gene transcription.
(c) trigger the shutdown of cell replication.
(d) trigger the shutdown of the immune system.

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119. The endosymbiont theory suggests
(a) that organelles have evolved from bacteria.
(b) that Eubacteria evolved from organelles in Archaea.
(c) that organelles are bacterial parasites. (d) that viruses and organelles can crossbreed.

120. Chloroplasts are plant organelles that contain
(a) chloroform. (b) chlorophyll. (c) chlorine. (d) tumor-causing agents.

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