



#الامتحان_بالجيب

MOLECULAR GENETICS & MOLECULAR PROCESSES

BMS 23010C

Ready for the First Quiz?



Question Bank

the **MOST EXPECTED**
and **PREVIOUS QUESTIONS**



Video Explanation

key points and
step-by-step solutions



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SOURCE COVERAGE

1	CH1
2	CH2
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أهلاً عزيزي اللي عليه امتحان ، أنا دليلك الشامل
لجميع امتحاناتك ، أوفر لك كل ما تحتاجه و أكثر من أجل امتحانك
سأكون معك في رحلتك اليوم بس لا تتعبني عشان خلقي ضيق.

1

Chapter 1

01. At the molecular level, which statement best defines a gene?

- A. A DNA segment encoding a functional product
- B. An RNA segment forming a chromosomal scaffold
- C. A protein complex organizing cell division
- D. A chromosome region visible in a karyotype

02. Which sequence correctly represents gene expression?

- A. DNA -> translation -> RNA -> transcription -> protein
- B. DNA -> transcription -> RNA -> translation -> protein
- C. RNA -> replication -> DNA -> translation -> protein
- D. DNA -> replication -> RNA -> transcription -> protein

03. Which description best matches a karyotype?

- A. A sequence map of bases in one gene
- B. A diagram of proteins in one cell
- C. A display of chromosomes from a dividing cell
- D. A chart of traits in one population

04. At the population level, what may happen to a beneficial inherited trait?

- A. It must alter every gene in the species
- B. It must increase body size in each generation
- C. It remains limited to one cell type only
- D. It may spread if it improves reproductive success

05. Which set includes the three major sources of genetic variation highlighted in the lecture?

- A. Gene changes, chromosome rearrangements, chromosome-number changes
- B. RNA changes, protein folding, organelle-number changes
- C. Gene changes, cell-size changes, tissue-level changes
- D. Protein changes, chromosome staining, cell-cycle changes

06. A human skin cell has 46 chromosomes. How many chromosomes are in a human sperm cell?

- A. 46
- B. 23
- C. 92
- D. 47

07. Why is a loss-of-function mutation useful in molecular genetics?

- A. It identifies the chromosome number of a cell
- B. It proves that all genes have similar roles
- C. It can reveal the normal role of the affected gene
- D. It converts a recessive allele into a dominant one

08. Which technique is most characteristic of transmission genetics?

- A. DNA sequencing
- B. Protein purification
- C. Chromosome staining
- D. Genetic crossing

09. When DNA associates with proteins inside a cell, what structure is formed?

- A. Chromosome
- B. Nucleotide
- C. Ribosome
- D. Polypeptide

10. The base sequence within most genes directs amino-acid order according to the:

- A. Cell cycle
- B. Genetic code
- C. Karyotype pattern
- D. Population frequency

11. Which list contains the four levels of biological organization emphasized in the lecture?

- A. Atoms, molecules, tissues, organs
- B. Genes, proteins, tissues, organs
- C. Molecules, cells, organisms, populations
- D. Cells, tissues, organs, ecosystems

12. Which statement best describes the Down syndrome example in the lecture?

- A. It involves loss of one copy of chromosome 21
- B. It involves a rearrangement with 46 chromosomes
- C. It results from a mutation in a single gene
- D. It may involve 47 chromosomes with an extra 21

13. Which protein is described as assembling into microtubules?

- A. Tubulin
- B. Collagen
- C. Keratin
- D. Myosin

14. Population genetics is mainly concerned with:

- A. Protein synthesis and enzyme structure
- B. Genetic variation and its role in evolution
- C. Chromosome photography and cell counting
- D. RNA processing and protein trafficking

15. Molecular genetics primarily focuses on:

- A. Inheritance patterns across family pedigrees
- B. Trait frequencies across populations
- C. The biochemical behavior of hereditary material
- D. The anatomy of organs affected by mutations

فقدت الشغف ؟
طول بالك .. لسه بدري
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ANSWER KEY & EXPLANATIONS

01 A	A gene is a segment of DNA that contains the information needed to produce a functional product; for most genes, that product is a polypeptide. Source anchor: pp. 1-2
02 B	Gene expression proceeds from DNA to RNA by transcription, then from RNA to protein by translation. Source anchor: p. 8
03 C	A karyotype is a photographic representation of the chromosomes present in an actively dividing somatic cell. Source anchor: p. 4
04 D	A trait that promotes reproductive success can become more common in a population over generations. Source anchor: p. 12
05 A	The lecture groups inherited variation into changes within genes, major chromosome-structure alterations, and changes in chromosome number. Source anchor: p. 14
06 B	Human somatic cells are diploid with 46 chromosomes, whereas sperm cells are haploid with 23. Source anchor: p. 15
07 C	Removing or disrupting a gene function lets researchers infer what the normal, nonmutant gene usually does. Source anchor: p. 18
08 D	Transmission genetics commonly uses genetic crosses: selected individuals are bred and their offspring are analyzed for inheritance patterns. Source anchor: p. 17
09 A	DNA associates with proteins to form chromosomes, which are located in the nucleus of eukaryotic cells. Source anchor: p. 3

10 B	The genetic code relates nucleotide sequence information to the order of amino acids in a polypeptide. Source anchor: p. 7
11 C	The lecture connects genetics across molecular, cellular, organismal, and population levels. Source anchor: p. 9
12 D	The example given is trisomy 21: an extra copy of chromosome 21 produces a total of 47 chromosomes. Source anchor: p. 14
13 A	Tubulin assembles into microtubules, which contribute to internal cellular structure and organization. Source anchor: p. 5
14 B	Population genetics focuses on genetic variation within populations and how that variation relates to evolution and the environment. Source anchor: p. 18
15 C	Molecular genetics studies hereditary material at the molecular level, including DNA features, gene expression, and mutant gene function. Source anchor: p. 18

16. Which property of genetic material explains phenotypic differences within a species?

- A. Information
- B. Replication
- C. Transmission
- D. Variation

17. What did Griffith infer from his *Streptococcus pneumoniae* experiments?

- A. Material from dead S cells could transform R cells
- B. Protein from R cells could destroy S cells
- C. RNA from S cells could prevent transformation
- D. Carbohydrate from R cells could enter S cells

18. What did Avery, MacLeod, and McCarty identify as the transforming substance?

- A. RNA
- B. DNA
- C. Protein
- D. Carbohydrate

19. Which result from Hershey and Chase supported DNA as the phage genetic material?

- A. 35S entered cells while 32P stayed outside
- B. Both isotopes remained outside bacterial cells
- C. 32P entered cells while 35S stayed outside
- D. Both isotopes entered bacterial cells equally

20. Which three components make up a nucleotide?

- A. Sugar, amino acid, phosphate
- B. Base, lipid, phosphate
- C. Sugar, base, peptide
- D. Phosphate, pentose sugar, base

21. Which pair correctly distinguishes DNA from RNA?

- A. DNA: deoxyribose/thymine; RNA: ribose/uracil
- B. DNA: ribose/uracil; RNA: deoxyribose/thymine
- C. DNA: deoxyribose/uracil; RNA: ribose/thymine
- D. DNA: ribose/thymine; RNA: deoxyribose/uracil

22. Which bases are purines?

- A. Thymine and cytosine
- B. Adenine and guanine
- C. Uracil and cytosine
- D. Adenine and thymine

23. A phosphodiester linkage connects which carbons of adjacent nucleotides?

- A. 2' to 4'
- B. 3' to 3'
- C. 3' to 5'
- D. 5' to 5'

24. In the DNA double helix, where are the sugar-phosphate backbones and bases located?

- A. Backbones inside; bases outside
- B. Backbones and bases both outside
- C. Backbones and bases both inside
- D. Backbones outside; bases inside

25. Which relationship is consistent with Chargaff's rules?

- A. A = T and C = G
- B. A = G and C = T
- C. A = C and G = T
- D. A = U and C = G

26. Why does pairing one purine with one pyrimidine help the DNA helix?

- A. It makes both strands run in the same direction
- B. It maintains a relatively uniform helix width
- C. It replaces covalent bonds with ionic bonds
- D. It allows uracil to replace thymine in DNA

27. What does antiparallel mean for the two DNA strands?

- A. Both strands run 5' to 3' in parallel
- B. Both strands run 3' to 5' in parallel
- C. One runs 5' to 3'; the other 3' to 5'
- D. One strand lacks a defined chemical direction

28. Which bonds primarily connect the DNA backbone and the paired bases, respectively?

- A. Hydrogen bonds; covalent bonds
- B. Ionic bonds; peptide bonds
- C. Peptide bonds; ionic bonds
- D. Covalent bonds; hydrogen bonds

29. Which base pairs can form within RNA?

- A. A-U and G-C
- B. A-T and G-C
- C. A-G and C-U
- D. A-C and G-U only

30. During transcription, how is RNA usually synthesized?

- A. Two RNA strands are copied from both DNA strands
- B. One RNA strand is copied from one DNA template
- C. One DNA strand is copied from an RNA template
- D. Two DNA strands are copied from one RNA template



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كمل برضو
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ANSWER KEY & EXPLANATIONS

16 D	Variation is the criterion requiring genetic material to differ in ways that account for phenotypic differences within a species. Source anchor: p. 1
17 A	Griffith observed that something from heat-killed type S bacteria transformed live type R bacteria into type S. Source anchor: p. 2
18 B	Their biochemical experiments showed that DNA was the substance responsible for bacterial transformation. Source anchor: p. 3
19 C	³² P labeled DNA and was found mainly inside the bacteria, whereas ³⁵ S labeled protein and remained mainly outside. Source anchor: p. 4
20 D	A nucleotide consists of at least one phosphate group, a five-carbon sugar, and a nitrogenous base. Source anchor: p. 7
21 A	DNA contains deoxyribose and thymine, while RNA contains ribose and uracil. Source anchor: p. 8
22 B	Adenine and guanine are the double-ring purines; thymine, cytosine, and uracil are pyrimidines. Source anchor: p. 8
23 C	The phosphate links the 3' carbon of one sugar to the 5' carbon of the next nucleotide. Source anchor: p. 9
24 D	Watson and Crick described the sugar-phosphate backbones on the outside and the paired bases on the inside. Source anchor: p. 11
25 A	Chargaff found that in DNA the amount of adenine equals thymine and the amount of cytosine equals guanine. Source anchor: p. 12

26

B

A double-ring purine paired with a single-ring pyrimidine produces the even width suggested by Franklin's X-ray data.

Source anchor: p. 12

27

C

The two strands have opposite directionalities: one 5'→3' and the other 3'→5'.

Source anchor: p. 13

28

D

The sugar-phosphate backbone is held by covalent bonds, whereas complementary bases are connected by hydrogen bonds.

Source anchor: p. 13

29

A

RNA can form complementary base pairs between A and U and between G and C, within one molecule or between molecules.

Source anchor: p. 16

30

B

In most cases, one of the two DNA strands serves as the template for synthesis of a single complementary RNA strand.

Source anchor: p. 15

31. Which mapping method expresses distance as the number of base pairs?

- A. Cytogenetic mapping
- B. Linkage mapping
- C. Physical mapping
- D. Recombination mapping

32. Which replication model produces daughter molecules containing one parental and one new strand?

- A. Conservative
- B. Dispersive
- C. Bidirectional
- D. Semiconservative

33. How does bacterial chromosome replication proceed from its origin?

- A. From one origin in two directions
- B. From many origins in one direction
- C. From one origin in one direction
- D. From many origins in two directions

34. What is the main role of the DnaA boxes in *E. coli* oriC?

- A. They bind DNA polymerase I
- B. They bind DnaA proteins
- C. They bind RNA primers
- D. They bind Okazaki fragments

35. What happens at the AT-rich region of oriC during initiation?

- A. RNA primers are removed
- B. DNA fragments are ligated
- C. The DNA strands separate
- D. GATC sites are demethylated

36. Which enzyme methylates GATC sites in *E. coli* oriC?

- A. DNA polymerase I
- B. DNA helicase
- C. DNA ligase
- D. Dam methyltransferase

37. Which protein directly separates the parental DNA strands at a bacterial replication fork?

- A. DnaB helicase
- B. DNA ligase
- C. DNA polymerase I
- D. Single-strand binding protein

38. What is the main role of DNA gyrase during replication?

- A. Remove RNA primers
- B. Relieve positive supercoiling
- C. Synthesize RNA primers
- D. Join Okazaki fragments

39. What do single-strand binding proteins do after DNA is unwound?

- A. Create phosphodiester bonds
- B. Methylate the origin sequence
- C. Prevent separated strands from re-forming DNA
- D. Remove mismatched bases during proofreading

40. What is the main function of primase during DNA replication?

- A. Remove RNA primers
- B. Synthesize daughter DNA
- C. Join DNA fragments
- D. Make short RNA primers

41. Which E. coli DNA polymerase carries out most chromosomal DNA synthesis?

- A. DNA polymerase III
- B. DNA polymerase I
- C. DNA polymerase II
- D. DNA polymerase V

42. Which function is characteristic of E. coli DNA polymerase I?

- A. Open the origin of replication
- B. Remove RNA primers and fill gaps
- C. Relieve positive supercoiling
- D. Attach adjacent Okazaki fragments

43. Which enzyme covalently joins adjacent Okazaki fragments?

- A. DNA helicase
- B. DNA primase
- C. DNA ligase
- D. DNA gyrase

44. In which direction does DNA polymerase extend a growing strand?

- A. 3' to 5' by adding to the 5' end
- B. 3' to 5' by adding to the 3' end
- C. 5' to 3' by adding to the 5' end
- D. 5' to 3' by adding to the 3' end

45. Which enzyme solves the end-replication problem in eukaryotic chromosomes?

- A. Telomerase
- B. Primase
- C. DnaA
- D. Tus

نمنا ولا لسه صاحيين ؟

السهرة صباحي

بعد الامتحان بتنام .. كمل

ANSWER KEY & EXPLANATIONS

31 C	Physical mapping uses cloning and/or sequencing data and expresses distances directly as numbers of base pairs. Source anchor: p. 1
32 D	Semiconservative replication preserves one parental strand in each newly formed double-stranded DNA molecule. Source anchor: p. 6
33 A	Bacterial chromosomes have a single origin, and two replication forks move in opposite directions from it. Source anchor: p. 7
34 B	The five DnaA boxes are specific sequences bound by DnaA proteins during initiation. Source anchor: p. 8
35 C	DnaA binding promotes strand separation at the AT-rich region, helping open the origin. Source anchor: p. 8
36 D	DNA adenine methyltransferase (Dam) methylates the GATC sites involved in replication regulation. Source anchor: p. 9
37 A	DNA helicase DnaB disrupts base pairing and unwinds double-stranded DNA. Source anchor: pp. 8, 11
38 B	Topoisomerase II (DNA gyrase) works ahead of the fork to remove positive supercoiling generated by unwinding. Source anchor: pp. 10-11
39 C	Single-strand binding proteins stabilize exposed single-stranded DNA and prevent reannealing. Source anchor: p. 10
40 D	Primase synthesizes short RNA primers, typically about 10-12 nucleotides long, to start DNA synthesis. Source anchor: pp. 10-11

41 A	DNA polymerase III performs most normal DNA replication in E. coli. Source anchor: p. 13
42 B	DNA polymerase I removes RNA primers and replaces the vacant regions with DNA. Source anchor: pp. 10, 13
43 C	DNA ligase seals the remaining nicks and covalently attaches adjacent Okazaki fragments. Source anchor: p. 10
44 D	DNA polymerase adds nucleotides to the 3' end of the growing chain, so synthesis proceeds 5'→3'. Source anchor: p. 12
45 A	Telomerase extends chromosome ends and helps solve the inability of conventional DNA polymerase to fully replicate linear DNA ends. Source anchor: p. 17

46. What does the term genome refer to?

- A. The protein content of a single chromosome
- B. The complete genetic material of an organism
- C. The RNA molecules present in one nucleus
- D. The genes expressed in one cell type

47. Which feature is typical of a eukaryotic chromosome?

- A. One circular DNA molecule with one origin
- B. One linear RNA molecule with many origins
- C. One linear DNA molecule with many origins
- D. Many circular DNA molecules with one origin

48. What is the key role of the centromere in chromosome segregation?

- A. It synthesizes the RNA primer
- B. It protects DNA from exonucleases
- C. It initiates DNA transcription
- D. It provides the site for kinetochore formation

49. Where are telomeres located on a linear eukaryotic chromosome?

- A. At both chromosome ends
- B. Only at the centromere
- C. At every replication origin
- D. Only within coding regions

50. Which function is associated with telomeres?

- A. Initiating transcription of rRNA genes
- B. Reducing harmful chromosome-end rearrangements
- C. Joining Okazaki fragments during replication
- D. Recruiting ribosomes to messenger RNA

51. How do telomeres help protect chromosome ends from degradation?

- A. By activating RNA splicing enzymes
- B. By recruiting DNA gyrase to the ends
- C. By limiting access of exonucleases to DNA ends
- D. By converting linear DNA into circular DNA

52. Approximately what fraction of the human genome is described as unique sequence?

- A. About 2%
- B. About 15%
- C. About 24%
- D. About 41%

53. Approximately what fraction of the human genome consists of protein-encoding regions?

- A. About 2%
- B. About 15%
- C. About 24%
- D. About 41%

54. Which is an example of a moderately repetitive sequence?

- A. Most single-copy protein genes
- B. Genes encoding ribosomal RNA
- C. Centromeres in every chromosome
- D. All coding exons in the genome

55. Which statement best describes the Alu family?

- A. A single-copy gene family encoding histones
- B. A tandem repeat limited to centromeres
- C. A highly repetitive family about 300 bp long
- D. A bacterial origin sequence rich in adenine

56. What is transposition?

- A. Removal of introns from a newly made RNA
- B. Pairing of homologous chromosomes during meiotic division
- C. Replication of DNA from several chromosomal origins
- D. Movement of a DNA element to another site

57. What characterizes simple transposition?

- A. The element moves by a cut-and-paste mechanism
- B. The element moves through an RNA intermediate
- C. The element is copied only during mitosis
- D. The element remains fixed at its original site

58. What distinguishes retrotransposition from simple transposition?

- A. It requires a chromosome centromere
- B. It uses an RNA intermediate and reverse transcriptase
- C. It removes introns before DNA replication
- D. It occurs only in bacterial chromosomes

59. Which description matches a nucleosome?

- A. About 30 bp of DNA around four histones
- B. About 80 bp of DNA around eight histones
- C. About 146-147 bp of DNA around eight histones
- D. About 300 bp of DNA around one histone

60. Where does linker histone H1 bind?

- A. Within each histone core protein
- B. At the chromosome centromere
- C. At the telomeric repeat sequence
- D. In the linker DNA between nucleosomes

وصلنا للنهاية يا صديقي
فخور بك ، وداعًا .. أراك ف الاختبار القادم
كل التوفيق ❤️

ANSWER KEY & EXPLANATIONS

46 B	The genome is the entire complement of genetic material in an organism or species. Source anchor: p. 1
47 C	Eukaryotic chromosomes are usually linear, very long DNA molecules and contain many origins of replication. Source anchor: pp. 2-3
48 D	The centromere is the chromosomal region where kinetochore proteins assemble, allowing proper chromosome segregation. Source anchor: p. 3 + supplemental image
49 A	Telomeres are specialized regions at both ends of linear eukaryotic chromosomes. Source anchor: p. 3 + supplemental image
50 B	Telomeres stabilize chromosome ends and help prevent rearrangements such as end-to-end fusion or translocation-related events. Source anchor: supplemental image
51 C	The supplemental image notes that telomeres protect chromosome ends from digestion by exonucleases that recognize DNA ends. Source anchor: supplemental image
52 D	The lecture states that unique sequences make up roughly 41% of the human genome. Source anchor: p. 5
53 A	Protein-encoding regions account for about 2% of the human genome in the lecture breakdown. Source anchor: p. 5
54 B	Moderately repetitive DNA can include multiple copies of the same gene, such as genes encoding rRNA. Source anchor: p. 6
55 C	The Alu family is a widely studied highly repetitive sequence family in humans and other primates, with copies about 300 bp long. Source anchor: p. 6

56

D

Transposition is movement of a transposable DNA element to a new genomic location.

Source anchor: p. 7

57

A

In simple transposition, the transposable element is excised from its original site and inserted into a new site.

Source anchor: p. 8

58

B

Retrotransposons are transcribed into RNA, and reverse transcriptase uses that RNA to make DNA that integrates at a new site.

Source anchor: p. 9

59

C

A nucleosome contains about 146-147 bp of DNA wrapped around an octamer of core histone proteins.

Source anchor: pp. 10-11

60

D

Histone H1 binds the linker region of DNA that connects adjacent nucleosomes.

Source anchor: p. 11

FINAL CHECK

Section	Score	/ 15
Section 1 — Foundations of Genetics	—	15
Section 2 — DNA as Genetic Material & Nucleic Acid Structure	—	15
Section 3 — Chromosome Mapping & DNA Replication	—	15
Section 4 — Chromosomes, Genomes & Chromatin	—	15

