تـــاج الـــذكـــر

لَا إِلَهَ إِلَّا اللَّهُ، وَحْدَهُ لَا شَرِيكَ لَهُ، لَهُ المُلْكُ
وَلَهُ الحَمْدُ، وَهُوَ عَلَى كُلِّ شَيْءٍ قَدِيرٌ

NOTEBOOK

subject: genetics test bank
AI generated

name: Tala Majed

1. Which statement best explains why DNA is in a decondensed state during interphase?

A. To facilitate chromosome segregation
B. To allow access for transcription and replication machinery
C. To reduce mutation rates
D. To increase chromosomal stability

2. During which phase are chromosomes visible as distinct condensed structures?

A. G1 phase
B. S phase
C. G2 phase
D. M phase

3. A failure of sister chromatid separation during mitosis would most directly lead to:

A. Reduced transcription
B. Genetic variation
C. Chromosomal abnormalities in daughter cells
D. DNA replication errors

4. Which structure is formed by DNA wrapped around histone proteins?

A. Chromatid
B. Nucleosome
C. Centromere
D. Scaffold

5. What distinguishes meiosis I from meiosis II?

A. DNA replication occurs only in meiosis II
B. Homologous chromosomes separate in meiosis I
C. Sister chromatids separate in meiosis I
D. Chromosome number doubles in meiosis I

6. Why must chromosomes remain partially associated after crossing over in prophase I?

A. To allow DNA replication
B. To ensure proper alignment in metaphase I
C. To prevent mutation
D. To increase chromosome number

7. Which of the following best describes a chromatid?

A. A single-stranded DNA molecule
B. A protein complex only
C. One double-stranded DNA molecule with associated proteins
D. Two homologous chromosomes joined

8. What is the primary purpose of chromosome condensation during mitosis?

A. Enhance transcription
B. Facilitate accurate segregation
C. Increase DNA replication speed
D. Promote recombination

9. Which phase of meiosis is responsible for genetic recombination?

A. Prophase I
B. Metaphase I
C. Anaphase II
D. Telophase II

10. What is the result of meiosis II?

A. Two diploid cells
B. Four diploid cells
C. Four haploid cells with duplicated chromosomes
D. Four haploid cells with unduplicated chromosomes

11. Independent assortment contributes to genetic variation because:

A. Chromosomes replicate randomly
B. Chromosomes align randomly during metaphase
C. DNA mutates frequently
D. Cells divide asymmetrically

12. Which chromosome structure is absent in humans?

A. Metacentric
B. Submetacentric
C. Acrocentric
D. Telocentric

13. What happens during anaphase of mitosis?

A. Chromosomes condense
B. Nuclear envelope reforms
C. Sister chromatids separate and move apart
D. DNA replication occurs

14. The centromere is essential because it:

A. Initiates DNA replication
B. Holds sister chromatids together
C. Produces RNA
D. Forms the nucleolus

15. Which phase includes DNA synthesis?

A. G1
B. S
C. G2
D. M

16. In meiosis, reduction of chromosome number occurs during:

A. Meiosis I
B. Meiosis II
C. Both phases
D. Interphase

17. What is a key feature of metaphase I?

A. Chromosomes replicate
B. Homologous pairs align at the equator
C. Sister chromatids separate
D. Nuclear membrane reforms

18. Crossing over involves exchange between:

A. Sister chromatids
B. Non-sister chromatids of homologous chromosomes
C. Non-homologous chromosomes
D. Entire chromosomes

19. What ensures genetic diversity in meiosis besides recombination?

A. Cytokinesis
B. Independent assortment
C. DNA repair
D. Chromatin condensation

20. After mitosis, daughter cells are genetically identical because:

A. DNA replication is random
B. Chromosomes are not duplicated
C. Equal segregation of identical chromatids occurs
D. Meiosis follows mitosis

Answer Key

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

5. B
6. B
7. C
8. B
9. A
10. D
11. B
12. D
13. C
14. B
15. B
16. A
17. B
18. B
19. B
20. C

1. Which clinical scenario shows the highest association with chromosomal abnormalities?

A. Healthy live births
B. Spontaneous miscarriages
C. Mild infections
D. Nutritional deficiencies

2. Why are lymphocytes commonly used in chromosomal studies?

A. They divide rapidly without stimulation
B. They lack DNA
C. They are easily accessible and contain DNA
D. They are resistant to staining

3. A karyogram primarily arranges chromosomes based on:

A. Function
B. Gene expression
C. Length and morphology
D. Replication timing

4. Which banding technique is most commonly used in cytogenetics?

A. R-banding
B. Q-banding
C. G-banding
D. C-banding

5. What is the significance of dark bands in G-banding?

A. GC-rich, gene-rich regions
B. AT-rich, gene-poor regions
C. Highly active transcription sites
D. Regions without DNA

6. Why are chromosomes typically visualized during metaphase?

A. DNA replication occurs
B. Chromosomes are most condensed and distinguishable
C. Transcription is highest
D. Telomeres elongate

7. Which structure prevents chromosome end-to-end fusion?

A. Centromere
B. Telomere
C. Kinetochore
D. Satellite DNA

8. A deletion detected as a missing band in a karyotype indicates:

A. Loss of RNA only
B. Loss of millions of nucleotides
C. Gain of chromosomes
D. Increased transcription

9. What is the main function of the centromere?

A. DNA replication
B. Chromosome segregation during division
C. Protein synthesis
D. Telomere maintenance

10. Which tissue sampling method is LEAST invasive for chromosomal analysis?

A. Bone marrow biopsy
B. Skin biopsy
C. Peripheral blood sampling
D. Chorionic villus sampling

11. What does the notation 46,XY represent?

A. Abnormal male karyotype
B. Normal male chromosomal complement
C. Female with mutation
D. Haploid male cell

12. In R-banding, dark regions correspond to:

A. Heterochromatin
B. AT-rich regions
C. Euchromatin (GC-rich regions)
D. Non-DNA regions

13. What is the purpose of adding a mitogen such as PHA in cell culture?

A. Arrest cells in mitosis
B. Stimulate cells to divide
C. Stain chromosomes
D. Break DNA strands

14. What is the effect of hypotonic solution during chromosome preparation?

A. Cells shrink
B. Cells swell and become fragile
C. DNA degrades
D. Chromosomes condense

15. Why is colchicine used during chromosome preparation?

A. To stimulate DNA replication
B. To arrest cells in metaphase
C. To stain chromosomes
D. To lyse cells

16. High-resolution banding increases detection of abnormalities because:

A. Chromosomes are shorter
B. Fewer bands are visible
C. More bands are visible before full condensation
D. DNA is replicated multiple times

17. Subtelomeric regions are important because they:

A. Are identical across chromosomes
B. Are gene-poor regions
C. Contain chromosome-specific sequences
D. Prevent chromosome replication

18. What is a key feature of telomeres?

A. They contain coding genes
B. They shorten with cell division
C. They are unique for each chromosome
D. They promote chromosome fusion

19. Why do cancer cells maintain telomere length?

A. To reduce mutations
B. To prevent DNA replication
C. To avoid loss of critical DNA and continue dividing
D. To increase recombination

20. Which best describes alpha-satellite DNA?

A. Coding DNA for proteins
B. Unique gene sequences
C. Repetitive non-coding DNA at centromeres
D. RNA molecules

Answer Key

1. B
2. C
3. C
4. C

5. B
6. B
7. B
8. B
9. B
10. C
11. B
12. C
13. B
14. B
15. B
16. C
17. C
18. B
19. C
20. C

1. Failure of homologous chromosome separation during meiosis I most directly results in which outcome?

A. Two normal and two abnormal gametes

B. All gametes with abnormal chromosome number

C. Only one abnormal gamete

D. No effect on chromosome number

2. Nondisjunction during meiosis II leads to which distribution of gametes?

A. 100% abnormal

B. 75% normal, 25% abnormal

C. 50% normal, 50% abnormal

D. 25% normal, 75% abnormal

3. Aneuploidy is best described as:

A. Multiple full sets of chromosomes

B. Exact multiples of haploid number

C. Gain or loss of specific chromosomes

D. Structural rearrangement only

4. A zygote with three copies of a chromosome is termed:

A. Monosomic

B. Trisomic

C. Polyploid

D. Diploid

5. Which condition involves complete extra sets of chromosomes?

A. Aneuploidy

B. Monosomy

C. Polyploidy

D. Deletion

6. Which statement about polyploidy is correct?

A. Common in animals

B. Always lethal

C. More common in plants

D. Causes missing chromosomes

7. Which structural change does NOT involve gain/loss of DNA?

A. Deletion

B. Duplication

C. Inversion

D. Monosomy

8. Balanced rearrangements are characterized by:

A. Loss of DNA

B. Gain of DNA

C. No net change in genetic material

D. Extra chromosome formation

9. Translocation differs from recombination because it:

A. Occurs in homologous chromosomes

B. Is always beneficial

C. Occurs between non-homologous chromosomes

D. Happens only in mitosis

10. The most common viable autosomal trisomy is:

A. Trisomy 13

B. Trisomy 18

C. Trisomy 21

D. Monosomy 21

11. Increased maternal age is most strongly associated with:

A. Gene mutation

B. Nondisjunction

C. Deletion

D. Duplication

12. Which feature is typical of Down syndrome?

A. Hypertonia

B. High nasal bridge

C. Hypotonia

D. Enlarged ears

13. The presence of a Y chromosome results in:

A. Female development

B. Male development

C. No sexual development

D. Hermaphroditism

14. STR markers are useful because they:

A. Code for proteins

B. Are identical in all individuals

C. Vary in repeat number

D. Prevent mutations

15. In trisomy 21, most cases arise from:

A. Paternal errors

B. Maternal errors

C. Environmental toxins

D. Mitotic recombination

16. Which condition shows clenched fists and rocker-bottom feet?

A. Trisomy 21

B. Trisomy 18

C. Trisomy 13

D. Turner syndrome

17. Syndactyly and polydactyly are associated with:

A. Trisomy 13

B. Trisomy 18

C. Trisomy 21

D. Monosomy X

18. Which is TRUE about monosomy?

A. Less harmful than trisomy

B. Always viable

C. More severe than trisomy

D. Common in newborns

19. Partial trisomy 21 results from:

A. Extra full chromosome

B. Loss of chromosome arm

C. Extra q arm material

D. Duplication of p arm only

20. In gel electrophoresis for trisomy 21, the proband shows:

A. One band

B. Two bands

C. Three bands

D. No bands

Answer Key:

1-B, 2-C, 3-C, 4-B, 5-C, 6-C, 7-C, 8-C, 9-C, 10-C,

11-B, 12-C, 13-B, 14-C, 15-B, 16-B, 17-A, 18-C, 19-C, 20-C

1. Which region of the Y chromosome shares homology with the X chromosome?

A. Entire q arm

B. Entire p arm

C. Terminal pseudoautosomal regions

D. Centromeric region

2. The primary function of the SRY gene is to:

A. Regulate meiosis

B. Initiate male development

C. Control recombination

D. Suppress X chromosome genes

3. A 46,XY individual developing as female is most likely due to:

A. Duplication of X chromosome

B. Deletion of SRY gene

C. Presence of PAR regions

D. Extra Y chromosome

4. Deletion of AZF regions primarily affects:

A. Sexual differentiation

B. Hormone production

C. Fertility

D. Chromosome pairing

5. Which region of the Y chromosome lacks clinical significance when deleted?

A. SRY region

B. AZF region

C. Distal heterochromatic q arm

D. PAR region

6. Which condition results from deletion of chromosome 5?

A. Down syndrome

B. Cri du chat

C. Turner syndrome

D. Klinefelter syndrome

7. The Philadelphia chromosome results from translocation between:

A. 13 and 21

B. 9 and 22

C. 14 and 21

D. X and Y

8. The oncogenic effect of BCR-ABL is primarily due to:

A. Loss of gene function

B. Increased gene expression

C. Reduced transcription

D. Chromosome deletion

9. Robertsonian translocation typically involves:

A. Any chromosomes

B. Only sex chromosomes

C. Acrocentric chromosomes

D. Only chromosome 21

10. A carrier of balanced Robertsonian translocation usually has:

A. 44 chromosomes

B. 45 chromosomes

C. 46 chromosomes

D. 47 chromosomes

11. Loss of p arms in Robertsonian translocation has minimal effect because:

A. They contain essential genes

B. They are highly repetitive and non-essential

C. They code for proteins

D. They regulate SRY

12. Triploidy most commonly results from:

A. Endomitosis

B. Dispermy

C. Deletion

D. Inversion

13. Tetraploidy arises due to:

A. Double fertilization

B. Meiotic failure

C. Endomitosis

D. Translocation

14. A complete mole is characterized by:

A. Maternal chromosomes only

B. Paternal chromosomes only

C. Triploid genome

D. Balanced translocation

15. Partial mole is associated with:

A. No fetal development

B. Only maternal DNA

C. Presence of fetal tissue

D. Diploid genome

16. Mosaicism arises from:

A. Fusion of two zygotes

B. Mitotic nondisjunction

C. Meiotic recombination

D. Polyploidy

17. Severity of mosaic disorders depends mainly on:

A. Type of chromosome

B. Timing of mutation

C. Gender

D. Parental origin

18. Chimera formation involves:

A. Single zygote mutation

B. Multiple gametes from one parent

C. Fusion of two zygotes

D. Meiotic error

19. Trisomy 14 is not viable because:

A. Too few genes

B. Excess genetic material incompatible with life

C. Lack of centromere

D. Presence of SRY

20. Which outcome is possible for carriers of reciprocal translocation?

A. Only abnormal offspring

B. Only normal offspring

C. Both normal and abnormal offspring

D. No offspring

Answer Key:

1-C, 2-B, 3-B, 4-C, 5-C, 6-B, 7-B, 8-B, 9-C, 10-B,

11-B, 12-B, 13-C, 14-B, 15-C, 16-B, 17-B, 18-C, 19-B, 20-C

Lecture 6:

سبحـانَ اللهِ،

1. Which statement best explains why Mendelian inheritance is often insufficient?

A. Genes are always linked

B. Most traits involve multiple genes or interactions

C. Alleles do not segregate

D. Chromosomes do not assort independently

2. Complete dominance is characterized by:

A. Intermediate phenotype in heterozygotes

B. Expression of both alleles equally

C. Identical phenotype in heterozygote and dominant homozygote

D. Only recessive phenotype expressed

3. In incomplete dominance:

A. One allele masks the other

B. Phenotype is intermediate

C. Both alleles are silent

D. Only one allele is expressed

4. Codominance occurs when:

A. One allele suppresses the other

B. Both alleles are expressed distinctly

C. Neither allele is expressed

D. Only recessive allele is expressed

5. In Tay-Sachs disease, the inheritance pattern is:

A. Dominant

B. Recessive

C. Codominant

D. Polygenic

6. At the biochemical level in Tay-Sachs, heterozygotes show:

A. Full enzyme activity

B. No enzyme activity

C. Intermediate enzyme activity

D. Variable enzyme absence

7. At the molecular level, Tay-Sachs alleles are:

A. Recessive

B. Dominant

C. Codominant

D. Epistatic

8. Which statement about dominant alleles is correct?

A. Always more common

B. Always harmful

C. Not necessarily more common

D. Always expressed

9. ABO blood group is an example of:

A. Polygenic inheritance

B. Multiple alleles

C. Epistasis

D. Incomplete dominance

10. An individual can have how many alleles for a gene?

A. One

B. Two

C. Three

D. Four

11. Pleiotropy refers to:

A. Multiple genes affecting one trait

B. One gene affecting multiple traits

C. Gene-environment interaction

D. Mutation of multiple genes

12. Cystic fibrosis demonstrates pleiotropy because:

A. It affects only lungs

B. It affects multiple systems

C. It is dominant

D. It is polygenic

13. Epistasis involves:

A. One gene masking another

B. Multiple alleles at one locus

C. Environmental effects

D. Gene duplication

14. In Labrador coat color, genotype ee results in:

A. Black coat

B. Brown coat

C. White coat

D. Mixed coat

15. Polygenic inheritance is characterized by:

A. Single gene effect

B. Discrete traits

C. Continuous variation

D. Dominant traits only

16. Skin color variation is due to:

A. Single gene mutation

B. Epistasis

C. Polygenic inheritance

D. Codominance

17. Norm of reaction refers to:

A. Genetic mutation rate

B. Range of phenotypes from one genotype

C. Dominant allele frequency

D. Epistatic interaction

18. Multifactorial traits result from:

A. Single gene only

B. Environment only

C. Gene-environment interaction

D. Chromosomal abnormalities

19. A pedigree is used to:

A. Identify mutations

B. Trace inheritance patterns

C. Sequence DNA

D. Measure enzyme activity

20. Probability rules in genetics help to:

A. Determine gene structure

B. Predict offspring outcomes

C. Alter gene expression

D. Prevent mutations

Answer Key:

1-B, 2-C, 3-B, 4-B, 5-B, 6-C, 7-C, 8-C, 9-B, 10-B,

11-B, 12-B, 13-A, 14-C, 15-C, 16-C, 17-B, 18-C, 19-B, 20-B

والحمدُللهِ،

1. Which scenario best explains why pedigree analysis is favored in human genetics research?

A. Humans produce large numbers of offspring
B. Controlled breeding experiments are feasible
C. Ethical constraints limit experimental crosses
D. Short generation time allows rapid study

2. In pedigree construction, which practice ensures accurate interpretation of inheritance patterns?

A. Placing younger generations at the top
B. Using Arabic numerals for generations
C. Arranging siblings randomly
D. Listing siblings from oldest to youngest

3. A proband is best described as:

A. The oldest individual in a pedigree
B. Any affected family member
C. The first individual seeking medical attention
D. A heterozygous carrier

4. Which statement best reflects the concept of locus?

A. The observable trait in an individual
B. The position of a gene on a chromosome
C. The number of alleles present
D. The mutation type in DNA

5. A compound heterozygote is an individual who:

A. Has two identical mutant alleles
B. Has one normal and one mutant allele
C. Has two different mutations in the same gene
D. Has mutations in different genes

6. Which condition must be met for expression of an autosomal recessive trait?

A. Presence of one dominant allele
B. Homozygosity for the mutant allele
C. Presence of two different alleles
D. Mutation in only one parent

7. Which feature distinguishes autosomal dominant inheritance from recessive inheritance?

A. Skipping generations
B. Equal sex distribution

C. Expression in heterozygotes
D. Association with enzyme defects

8. A pedigree showing affected individuals in every generation most likely represents:

A. Autosomal recessive inheritance
B. X-linked recessive inheritance
C. Autosomal dominant inheritance
D. Multifactorial inheritance

9. Which principle explains separation of alleles during gamete formation?

A. Independent assortment
B. Segregation
C. Codominance
D. Penetrance

10. Which chromosomal event underlies Mendel's law of segregation?

A. Crossing over
B. Independent chromosome alignment
C. Separation of homologous chromosomes
D. DNA replication

11. Which statement best describes independent assortment?

A. Genes on same chromosome always inherited together
B. Alleles segregate randomly within a gene
C. Chromosomes assort independently during meiosis
D. Mutations occur independently

12. Which inheritance pattern explains a male expressing an X-linked recessive disorder with one mutant allele?

A. Homozygous dominance
B. Hemizygosity
C. Codominance
D. Incomplete dominance

13. Which characteristic is typical of autosomal recessive disorders?

A. Vertical transmission
B. Expression in heterozygotes
C. Horizontal clustering within siblings
D. Equal expression only in males

14. Why are carriers of recessive disorders usually unaffected?

A. They lack the gene entirely
B. The normal allele compensates for the mutant allele

C. They have two mutant alleles
D. The gene is inactive

15. Which situation increases the likelihood of autosomal recessive disorders?

A. Large population size
B. Random mating
C. Consanguinity
D. Low mutation rates

16. In autosomal dominant disorders, homozygous individuals are typically:

A. Less affected than heterozygotes
B. Equally affected as heterozygotes
C. More severely affected
D. Always unaffected

17. Which feature is consistent with variable expressivity?

A. Trait appears only in males
B. Individuals show different severity of the same disorder
C. Trait skips generations
D. Only one organ system is affected

18. Pleiotropy is best defined as:

A. Multiple genes affecting one trait
B. One gene affecting multiple systems
C. One allele masking another
D. Multiple mutations in one gene

19. In a cross between two heterozygous carriers (Aa x Aa), what is the probability of an affected offspring?

A. 50%
B. 75%
C. 25%
D. 0%

20. Why might an unaffected child of carrier parents still be a carrier?

A. Dominant allele is absent
B. Carrier probability exceeds affected probability
C. Two-thirds of unaffected offspring are carriers
D. Mutation always occurs spontaneously

Answer Key

1. C
2. D
3. C
4. B
5. C
6. B
7. C
8. C
9. B
10. C
11. C
12. B
13. C
14. B
15. C
16. C
17. B
18. B
19. C
20. C