CHAPTER 9: GENETICS

Part 1: Meiosis

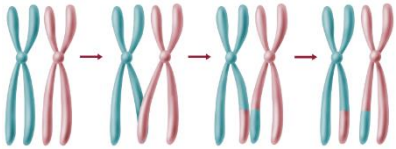
Chromosomes and Chromosome Number

Human body cells have 46 chromosomes, Each parent contributes 23 chromosomes
Homologous chromosomes—one of two paired chromosomes, one from each parent,
Same length, Same centromere position, Carry genes that control the same inherited traits

Meiosis

Characteristics: Halves the number of chromosomes, happens to sex cells to produce gametes, leads to genetic diversity, happens over two consecutive stages.

- *Product:* produces 4 haploid (n) gametes
- *Stages*: two consecutive stages of cell division (Meiosis I and II)

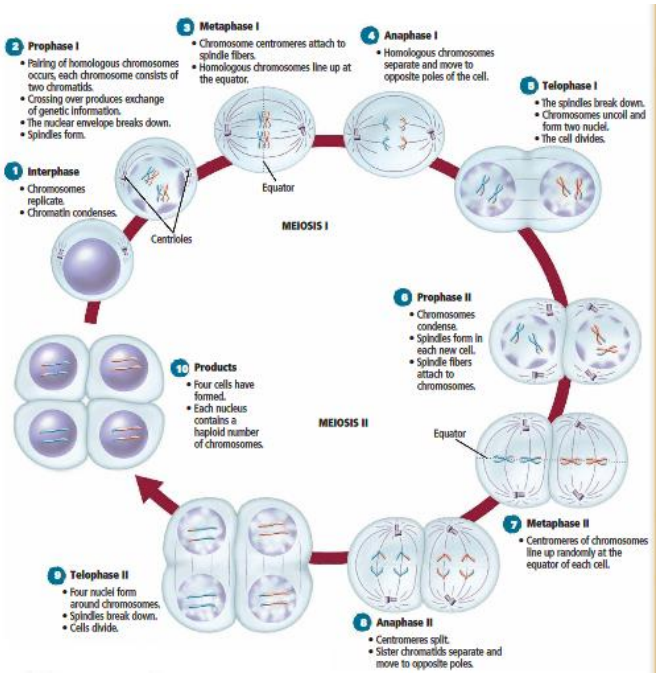


Meiosis I

Prophase I: homologous chromosomes get closer and undergo crossing-over, nuclear envelope breaks down and spindle fibers form.

Crossing over: A process during which chromosomal segments are exchanged between a pair of homologous chromosomes. Happened in prophase I.

- Metaphase I: Homologous chromosomes line up at the equator of the cell.
- Anaphase I: Homologous chromosomes separate and move to opposite poles of the cell.
- Telophase I: chromosomes uncoil and form two nuclei with half the number of chromosomes of the original cell. then cell divides.



Meiosis II:

- Prophase II: chromosomes condense
- Metaphase II: Chromosomes align at the equator of the cell.
- Anaphase II: sister chromatids separate and move to opposite poles of the cell.
- Telophase II: 4 nuclei form, cells divide.

---

1 **In which of the following cycles does the chromosome number get reduced by half?**

CH 9

A Meiosis **B** Mitosis
C Multiple fission **D** Nuclear fission

Meiosis Halves the number of chromosomes, happens to sex cells to produce gametes, leads to genetic diversity, happens over two consecutive stages. →A

---

2 **Which of the following cells undergoes meiosis?**

CH 9

A Skin cell **B** Liver cells
C Ovarian cells **D** Zygote

Meiosis, happens to sex cells to produce gametes, leads to genetic diversity. →C

---

3 **Crossing over occurs during the stage of …….. in meiosis**

CH 9

A Prophase I **B** Prophase II
C Metaphase l **D** Metaphase II

Crossing over: A process during which chromosomal segments are exchanged between a pair of homologous chromosomes. Happened in prophase I. →A

---

4 **A sex cell has 18 chromosomes, how many chromosomes does it have after telophase I?**

CH 9

A 9 **B** 12 **C** 18 **D** 36

Telophase I: chromosomes uncoil and form two nuclei with half the number of chromosomes of the original cell. then cell divides. →A

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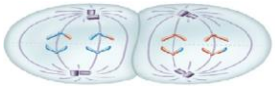
5 **Which stage of meiosis is shown in the following figure?**



CH 9

A Metaphase I **B** Metaphase II
C Anaphase I **D** Anaphase II

Anaphase II: sister chromatids separate and move to opposite poles of the cell. →D

---

6 **The process where homologous chromosomes exchange different segments of their genetic material…**

CH 9

A Crossing over **B** Cross-link
C Union **D** Homogeneity

Crossing over: A process during which chromosomal segments are exchanged between a pair of homologous chromosomes. →A

---

7 **During meiosis, in which stage do sister chromatids separate?**

CH 9

A Anaphase I **B** Anaphase II
C Telophase I **D** Telophase II

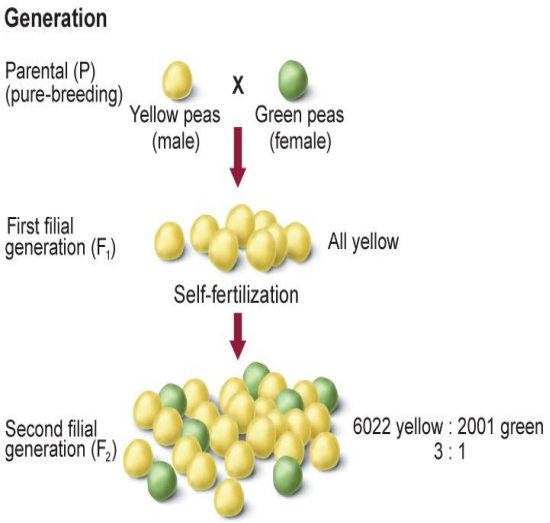
Anaphase II: sister chromatids separate and move to opposite poles of the cell. →B

CHAPTER 9: GENETICS

Part 2: Mendelian Genetics

Inheritance: the passing of traits to the next generation
Gregor Mendel: First scientist to study inheritance, he conducted his experiments on pea plants.

- The law of segregation
- Mendel fertilized yellow plants' seeds with green plants' seeds.
- The first generation were all yellow seeds.
- He self-fertilized the first generation of plants.
- The second generation produces 1 green seed and 3 yellow seeds.
- **The dominant trait:** trait that appeared in the first generation (Yellow seeds)
- **The recessive trait**: Its effect did not appear on the first generation (green seeds).



The genotype: The organism's allele pairs. The genotype for the yellow seeds for instance are either homozygous (YY) or heterozygous (Yy)

- Heterozygous (Yy): have two different alleles for a trait (Y or y)
- Homozygous (yy): have the same alleles for a trait. (Y)
- During fertilization: Gametes fuse creating new individual(s).
- **The phenotype:** The observable characteristics or outward expressions of an allele pair
- **Dihybrid cross**: when there are two pairs of characteristics, each allele is distributed independently.
- **Mendel's law of independent assortment**: Random distribution of alleles occurs during gamete formation. Genes on separate chromosomes sort independently during meiosis.

8 **First scientist to study inheritance is.**

CH 9

A Mendel **B** Griffith
C Bennet **D** Watson

Gregor Mendel: First scientist to study inheritance. →A

9 **Mendel conducted his experiments on which the following plants?**

CH 9

A Corn **B** Beans
C Wheat **D** Pea

Gregor Mendel: conducted his experiments on pea plants. →D

10 **According to the law of segregation, the ratio between offspring of the second generation is.**

CH 9

A 1 dominant : 1 recessive
B 3 dominant : 1 recessive
C 3 recessive : 1 dominant
D 0 dominant : 1 recessive

→B

11 **In the following table, which statements are true about the first generation when pollinating a long-stemmed red-flowered plant RRTT with a short-stemmed white-flowered plant rrtt**

number	Genotype	Homozygous	Heterozygous
1	RrTT	✓	×
2	RRTT	✓	×
3	RrTt	×	✓
4	rrtt	×	✓

CH 9

A 1 **B** 2
C 3 **D** 4

.

	RT	RT
rt	RrTt	RrTt
rt	RrTt	RrTt

→C

12 **In Mendel's experiments, the effect of the ..... trait did not appear in the first generation but appeared in the second generation.**

CH 9

A Dominant **B** Phenotype
C Recessive **D** Genotype

The recessive trait: Its effect did not appear in the first generation (green seeds). →C

13 **Pairs of alleles in a living organism are called**

CH 9

A Appearance **B** Phenotype
C External **D** Genotype

The genotype: The organism's allele pairs. →D

14 **Pollination was done between two plants, it resulted the production of red flowers and white flowers. What is the genotype for these two plants?**

CH 9

A RR & rr **B** RR & RR
C rr & rr **D** Rr & Rr

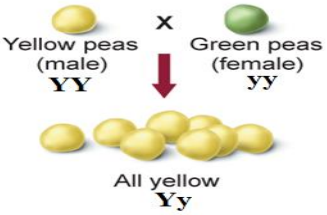
	R	r
r	RR	Rr
r	Rr	rr

→D

15 **Crossing the green pea, yy, with the yellow pea, YY, the first generation results are…**

CH 9

A YY **B** yy
C Yy **D** YY yy



→C

CHAPTER 9: GENETICS

Part 3: Genetic Recombination & pedigree

Genetic Recombination

The possible combination of genes due to independent assortment can be calculated by using the formula (2^n), where (n) is the number of chromosome pairs.

Recessive Genetic Disorders

Cystic fibrosis: Caused by a defective gene responsible for the production of membrane protein. It affects mucus secretions, hinders digestion, clogs, and obstructs respiratory pathways in the lungs.

- **Albinism:** Caused by the absence of melanin pigment in skin, hair, and eyes. Resulting in no color in the skin and hair.
- **Tay-Sachs disease (TSD):** The gene responsible for it is located on the 15th chromosome, it inhibits the enzymes from breaking down fatty acids called gangliosides. Consequently, gangliosides accumulate in the brain inflating brain nerve cells and causing mental deterioration.
- **Galactosemia:** The body's inability to digest galactose.
- **Carrier (trait carrier):** An individual who is heterozygous for a recessive disorder

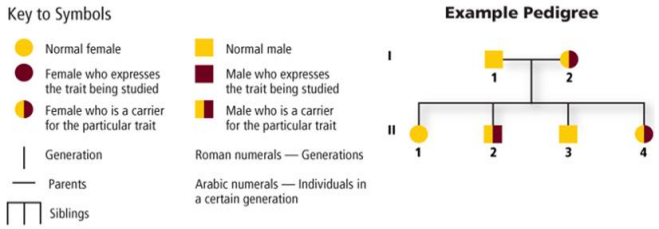
Dominant Genetic Disorders

- **Huntington's disease:** Affects the nervous system
- **Achondroplasia:** Affects bone growth

A **pedigree** diagram that traces the inheritance of a particular trait through several generations.

- **Significance:** Used to study inheritance patterns in humans.

Example: The following diagram represents the outcome of a normal male conceiving with a female trait carrier



16 **An organism has 4 pairs of chromosomes, what is the possible combination of genes for this organism?**

CH 9

A 8 **B** 16 **C** 28 **D** 32

The possible combination of genes due to independent assortment can be calculated by using the formula (2^n), where (n) is the number of chromosome pairs. →B

17 **The possible combination of genes can be calculated by using which equation?**

CH 9

A n^4 **B** 2^n **C** $4n$ **D** n^2

The possible combination of genes due to independent assortment can be calculated by using the formula (2^n), where (n) is the number of chromosome pairs. →B

18 **A genetic disorder affecting mucus secretions and sweat production…**

CH 9

A Cystic fibrosis **B** Albinism

C Tay-Sachs **D** Galactosemia

Cystic fibrosis: It affects mucus secretions. →A

19 **A recessive disease afflicting membrane protein.**

CH 9

A Cystic fibrosis **B** Albinism

C Tay-Sachs **D** Galactosemia

Cystic fibrosis: Caused by a defective gene responsible for the production of membrane protein. →A

20 **A genetic disorder that results from the absence of the melanin pigment in both skin and hair**

CH 9

A Cystic fibrosis **B** Albinism

C Tay-Sachs **D** Galactosemia

Albinism: Caused by the absence of melanin pigment in skin, hair, and eyes. Resulting in no color in the skin and hair. →B

21 **The gene that is responsible for Tay-Sachs disease is present on which chromosome …**

CH 9

A 21 **B** 22 **C** 15 **D** 16

Tay-Sachs disease (TSD): The gene responsible for it is located on the 15th chromosome. →C

22 **A heritable, genetic disorder resulting in the body's inability to digest galactose.**

CH 9

A Cystic fibrosis **B** Albinism

C Tay-Sachs **D** Galactosemia

Galactosemia: The body's inability to digest galactose. →D

23 **An individual who is heterozygous for a recessive disorder**

CH 9

A Disease carrier **B** Pedigree carrier

C Trait carrier **D** Gene carrier

Galactosemia: The body's inability to digest galactose. →D

24 **An individual who is heterozygous for a recessive disorder**

CH 9

A Disease carrier **B** Pedigree carrier

C Trait carrier **D** Gene carrier

Carrier (trait carrier): An individual who is heterozygous for a recessive disorder →C

25 **Huntington's disease affects which system?**

CH 9

A Nervous system **B** Reproductive system

C Digestive system **D** Respiratory system

Huntington's disease: Affects the nervous system. →C

26 **The number of males and females affected in this Pedigree**

CH 9

A 1 male, 2 female **B** 1 male, 1 female

C 2 male, 1 female **D** 2 male, 2 female

Normal female — Normal male

Female who expresses the trait being studied — Male who expresses the trait being studied

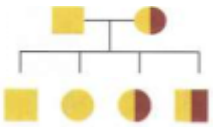
→A

27 **In the following figure, the ancestry diagram of a trait in the parents, which of the following options represents the genotype of the parents**

CH 9

A  **B** 

C **D**



→A

28 **Which is the genotype of a person who is a carrier of a recessive genetic disorder?**

CH 9

A DD **B** dd

C Dd **D** DE

Carrier (trait carrier): An individual who is heterozygous for a recessive disorder →C

29 **A phenotype that results from a dominant allele must have at least _____ dominant allele(s) present in the parent(s).**

CH 9

A One **B** Three

C Two **D** Four

A phenotype that results from a dominant allele must have at least one dominant allele(s) present in the parent(s). →A

30 **A pea plant homozygous for the trait of smooth seeds is crossed with a pea plant that is homozygous for the trait of wrinkled seeds. The first generation produces seeds that are all smooth. What percent of the second-generation plants will have smooth seeds when the F1 generation is self-fertilized?**

CH 9

A 100% **B** 75%

C 50% **D** 25%

Smooth is the dominant allele. The first generation would be heterozygous, Rr. In the second generation, 75% would have the genotype Rr or RR, or smooth seeds, whereas 25% would have the recessive genotype, rr, and be wrinkled. →B

31 **What is the probability that a cross between a heterozygous dominant yellow-seeded pea plant and a green-seeded pea plant will produce green-seeded offspring**

CH 9

A 1:1 **B** 1:2 **C** 1:4 **D** 1:8

If one of the parent's is hetero dominant and the other one is recessive the ratio between possible offspring is 1:1 →B

32 **Which is the ratio of pea plant offspring with green seeds if both parents are hybrids?**

CH 9

A 1:1 **B** 1:2 **C** 1:3 **D** 1:6

If both parent's are hetero dominant and the other one is recessive the ratio between possible offspring is 1:3 →C

33 **What are the possible gamete types that can be produced from a parent who is YyRr? Meiosis produces eggs and sperm that are alike.**

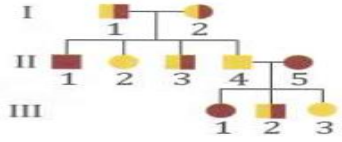
CH 9

A All YR **B** All Yr

C YR, Yr, yR, and yr **D** Half YR and half yr

YyRr can form 4 types of gametes →C

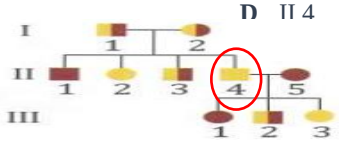
34 **In the following phylogeny chart, which individuals are not carriers of the disease and have an affected offspring?**



CH 9

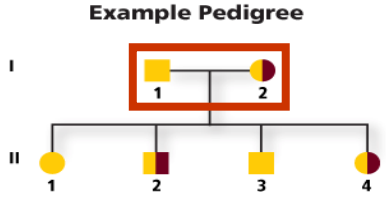
A I 2 **B** II 1

C III 2 **D** II 4



→D

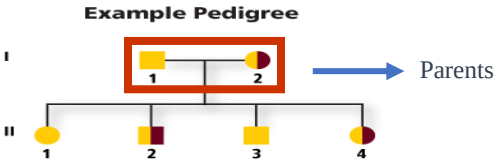
35 **What does the top horizontal line between numbers 1 and 2 in the figure indicates?**



CH 9

A **1 and 2 are siblings** **B** 1 and 2 are parents

C 1 and 2 are offspring **D** 1 and 2 are carriers



→B

36 **Bb x Bb this cross will produce what phenotypic ratio?**

CH 9

A 1:1 **B** 1:2

C 1:3 **D** 1:6

If both parent's are hetero dominant and the other one is recessive the ratio between possible offspring is 1:3 →C

CHAPTER 9: GENETICS

Part 4: Complex Inheritance and Human Heredity

Incomplete dominance: heterozygous phenotype is an intermediate phenotype between the two homozygous phenotypes.

- ***Codominance:*** Occurs when a gene is not dominant to another gene, as in sickle-cell anemia.
- ***Multiple alleles:*** When traits are determined by more than two alleles, just like blood types in humans.
- The blood type system ABO has three forms of alleles: I^A, I^B, i

The gene i is recessive.

The genes I^A, I^B are codominant, in which AB is produced from both alleles.

The ABO blood type system is considered an example of both Multiple alleles and codominance.

- Determines the fur color in rabbits are four genotypes:

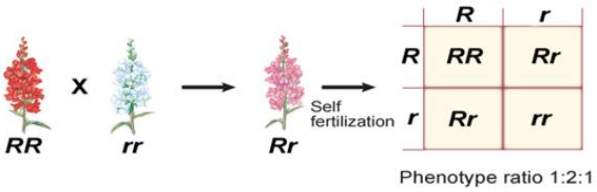
C, c^{ch} , c^h ,c

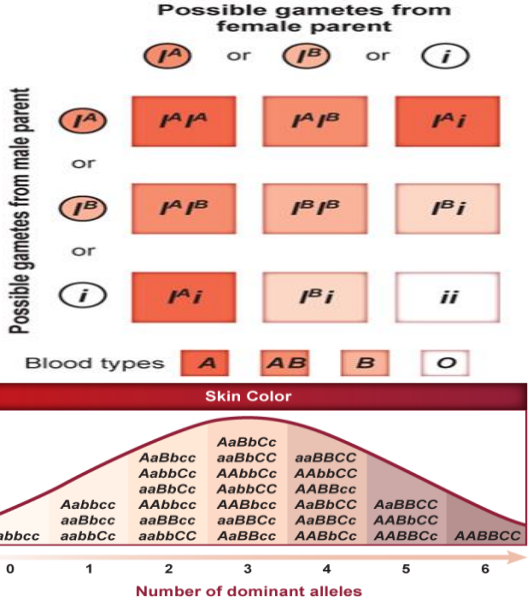
- The dominance sequence is:

C > c^{ch} > c^h > c

- Gene C is the dominant gene
- Gene c is the recessive gene
- Phenotypes:

Gene C is for Black color, gene c is for white color, gene **c^{ch}** is for Chinchilla, gene **c^h** is for Himalayan





Polygenic Traits

Polygenic traits arise from the interaction of multiple pairs of genes.

Sex chromosomes determine an individual's gender.

The **X chromosome** carries a variety of genes that are necessary for the development of both females and males.

The **Y chromosome** mainly has genes that relate to the development of male c

In females, one X chromosome is inactivated in each cell. The **inactivated X chromosome** is visible in stained cells as a ***Barr body.***

Nondisjunction

- Cell division during which sister chromatids fail to separate properly
- Down syndrome, also called trisomy 21

37 **Sickle-cell disease follows the inheritance of**

CH 9

A Complete dominance **B** Incomplete dominance
C Codominance **D** Mendelian dominance

Codominance: Occurs when a gene is not dominant to another gene, as in sickle-cell anemia. →C

38 **If the mother's blood type is A and the father's blood type is AB, which of the following is cannot be one their offspring?**

CH 9

A AB **B** A **C** B **D** O

If one of the parents AB blood type, No one of his offspring will be O blood type. →D

39 **In a hospital, four families disputed over their newborn's kinship, if the newborn's blood type is O, then which family cannot be related to the newborn?**

CH 9

A Father A, mother B **B** Father AB, mother O
C Father B, mother O **D** Father O, mother A

If one of the parents is AB no one of offspring could be O blood type →B

40 **The blood type I^A and I^B is an example of ……**

CH 9

A Complete dominance **B** Incomplete dominance
C Codominance **D** Mendelian dominance

The genes $I^A$and I^B are codominant. →C

41 **The fur color of rabbits follow which inheritance?**

CH 9

A Multiple alleles
B Dominant lethal alleles
C Recessive lethal alleles
D Sex-linked traits

The fur color of rabbits Multiple alleles →A

42 **What is the genotype of the following figure**

CH 9

A CC **B** c^hc^h **C** $c^{ch}c$ **D** cc

Gene C is for Black color, gene c is for white color, gene cch is for Chinchilla, gene ch is for Himalaya →D

43 **The number of chromosomes in the human liver cells are…**

CH 9

A 23 **B** 44 **C** 46 **D** 92

The number of chromosomes in the human liver cells are 46 →C

44 **If the number of chromosomes in chicken Gametes is 39 then the number of chromosomes in its liver cells is**

CH 9

A 19 **B** 39 **C** 78 **D** 156

Gametes include the half number of chromosomes of the original cell →C

45 **What determines gender in humans?**

CH 9

A Chromosome number 21 **B** Chromosomes x and y

C Codominance **D** Gene dominance

Chromosomes x and y determine the gender in humans →B

46 **Where are Barr bodies found?**

CH 9

A Female body cells **B** Female sex cells

C Male body cells **D** Male sex cells

The **inactivated X chromosome** is visible in stained cells as a Barr body. →A

Part 5: Sex-linked & sex- influenced traits

Sex-linked traits are controlled by genes located on the X chromosome, by which males are affected more often than females. Examples: red-green color blindness, hemophilia.

- ***Red-green color blindness***: when a non-blind male with the genotype (X^BY) married a carrier female with the genotype (X^BX^b), the result was:

o 1 healthy female (25%) o 1 healthy male (25%)

o 1 carrier female (25%) o 1 blind male (25%)

Sex- influenced traits: traits present in autosomes (both sexes) but only expressed in one sex.

Ex: Baldness

Genotype	Man (♂♂)	Woman (♀♀)
BB	Bald	Bald
Bb	Bald	Non-bald
bb	Non-bald	Non-bald

traits that result from the interaction of multiple pairs of genes, such as skin color and height baldness is recessive in females but dominant in males.

47 **Traits controlled by genes carried on an X chromosome …**

CH 9

A Sex Linked traits

B Sex Influenced traits

C Dominant Lethal genes

D Recessive lethal genes

Sex-linked traits are controlled by genes located on the X chromosome →A

48 **A disease related to chromosomes responsible for determining the gender of the baby**

CH 9

A Short sightedness **B** Down's syndrome

C Albinism **D** Hemophilia

Hemophilia is one of the examples of sex-linked traits. →D

49 **Father diagnosed with color blindness has a healthy daughter who married a healthy man: what's the percentage, their children will be diagnosed with color blindness**

CH 9

A 0% **B** 50% **C** 25% **D** 100%

Daughter X^BX^b , her husband X^By

	X^B	y
X^B	$X^B X^B$	X^B y
X^b	$X^B X^b$	X^b y

→C

50 **Which of the following is influenced by sex?**

CH 9

A Baldness **B** Color blindness

C Hemophilia **D** Albinism

Sex- influenced traits: traits present in autosomes (both sexes) but only expressed in one sex. Ex: Baldness →A

51 **Which of the following genotypes gives a skin color similar to that of an AABBcc genotype?**

CH 9

A AaBbCc **B** aaBBcc

C AABbCC **D** AaBBCc

The genotype has the same number of dominant and recessive genes. So the genotype that has 4 dominant genes and 2 recessive genes →D

52 **Baldness is affected by sex, dominant in males and recessive in females, if B represents "Baldness" and b represents "non-bald" then which of the following represents bald female genes?**

CH 9

A bb **B** Bb **C** BB **D** DB

Genotype	Man (♂♂)	Woman (♀♀)
BB	Bald	Bald
Bb	Bald	Non-bald
bb	Non-bald	Non-bald

→C

53 **While making a karyotype for a baby, it was found that they had 3 copies of chromosomes containing number 21, this baby is diagnosed with ...**

CH 9

A Turner's syndrome

B Klinefelter's syndrome

C Down's syndrome

D Barre's syndrome

Nondisjunction - Down syndrome, also called trisomy 21 →C

54 **Which of the following genotypes is for a female Infected with turner syndrome?**

CH 9

A XX **B** XY

C XO **D** XXY

XO Female with Turner's syndrome →C

55 **Which of the following is the genotype for Klinefelter syndrome?**

CH 9

A XO **B** YO

C XY **D** XXY

XXY Male with Klinefelter's Syndrome →D

56 **Which of the following genotypes causes death?**

CH 9

A XO **B** YO **C** XY **D** XXX

YO Results in death →B

CHAPTER 9: GENETICS

Part 6: Molecular Genetics

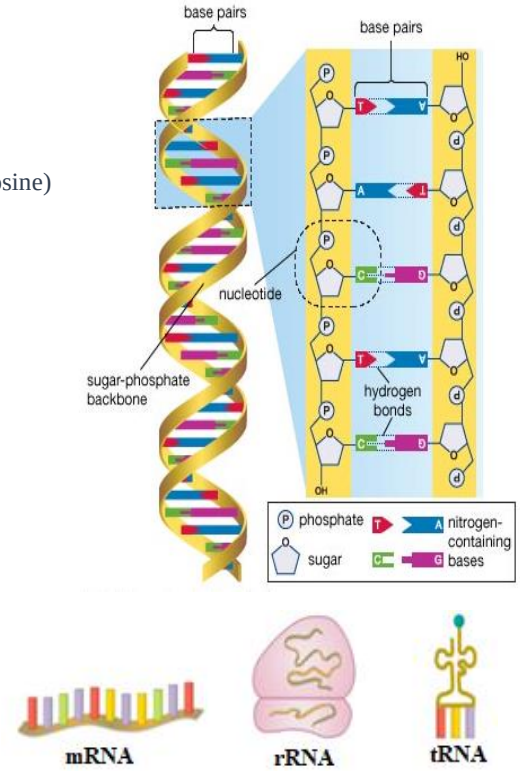
- ***Griffith:*** the first major experiment that led discovery of DNA as a genetic material was performed by him.
- ***Hershey and Chase:*** found that DNA is the genetic material and not the proteins.
- **Chargaff:** analyzed the amounts of Adenine (A), Thymine (T), Guanine (G), and Cytosine (C) for different types of DNA for different living organisms.

Nucleotides: are the subunits for nucleic acids, made of a five-carbon sugar, phosphate group, and a nitrogenous base.
- **Types of nucleic acids**: DNA and RNA.
- **Nucleotides in DNA** contains: deoxyribose sugar, phosphate group, one of the four nitrogenous bases (Thymine, Guanine, Cytosine, and Adenine).
- **Nucleotides in RNA** contains: Ribose sugar, Phosphate group, and one of the nitrogenous bases (Uracil, Adenine, Guanine, and Cytosine)

Purines: double-ringed bases, they include Guanine (G) and Adenine (A).
Pyrimidines: single-ringed bases, they include Thymine (T), Cytosine (C), and Uracil (U).
Pairs of bases: Adenine pairs with thymine or uracil. Guanine pairs with cytosine.
- **Chargaff rule states:** in a DNA; the amount of cytosine (C) equals the amount of guanine (G), and the amount of thymine is equal to the amount of adenine

Unwinding: unwinding and unzipping the double helix by the act of DNA Helicase enzyme, the RNA primase enzyme adds short segment of RNA, called RNA primer, on each DNA strand.
- **Base pairing:** each nitrogenous base pair binds to its complement. DNA Polymerases catalyzes the addition of appropriate nucleotides to the new DNA strand.
- **Joining:** DNA ligase joins the two sections

mRNA (messenger): carries genetic information from DNA in the nucleus to direct protein synthesis in the cytoplasm.
rRNA (ribosomal): Associates with protein to form the ribosome.
tRNA (transfer): transfers amino acids to the ribosome.
mRNA contains three nitrogenous bases for each amino acid that binds to it through tRNA during protein formation.



57 **The first who led to the discovery of DNA as the genetic material is:**
CH 9
A Avery **B** Griffith
C Hershey and Chase **D** Chargaff
Griffith: the first major experiment that led discovery of DNA as a genetic material was performed by him. →B

58 **Analyzed the amounts of Adenine, Guanine, Thymine, and Cytosine in the DNA:**
CH 9
A Chargaff **B** Watson
C Hershey **D** Chase
Chargaff: analyzed the amounts of Adenine (A), Thymine (T), Guanine (G), and Cytosine (C) for different types of DNA for different living organisms. →A

59 **The subunits for both DNA and RNA…**
CH 9
A Ribose **B** Purines
C Nucleotides **D** Phosphor
Nucleotides: are the subunits for nucleic acids, made of a five-carbon sugar, phosphate group, and a nitrogenous base →C

60 **The acid that carries the genetic material**
CH 9
A Amino **B** Fatty
C Nucleic **D** Glycolic
Nucleic acid carry the genetic information →C

61 **Nucleotides in RNA contain ……. sugar**
CH 9
A Glucose **B** Maltose
C Sucrose **D** Ribose
Nucleotides in RNA contains: Ribose sugar. →D

62 **The nitrogenous base that's not found on RNA**
CH 9
A Cytosine **B** Uracil
C Thymine **D** Guanine
Thymine is not available in RNA →C

63 **Which of the following nitrogenous bases isn't from pyrimidines?**
CH 9
A Cytosine **B** Uracil
C Thymine **D** Guanine
Pyrimidines: single-ringed bases, they include Thymine (T), Cytosine (C), and Uracil (U). →D

64 **Which of the following is the correct bonding between nitrogenous bases?**
CH 9
A C-T, A-G **B** A-T, C-G
C T-G, A-C **D** G-A, T-C
A-T, C-G →B

65 **If the percentage of Thymine in DNA is 29%, then what' the percentage of Adenine?**
CH 9
A 58% **B** 29%
C 21% **D** 15%
%A=%T , %C=%G →B

66 **If the percentage of Thymine in DNA is 26%, then what' the percentage of Guanine?**
CH 9
A 52% **B** 48%
C 24% **D** 26%
%A=%T , %C=%G
(%A+%T) + (%C+%G) =100% , %G= 24% →C

66 **The enzyme responsible for unwinding the DNA during DNA replication is……**

CH 9 **A** RNA primase **B** DNA Ligase **C** DNA polymerase **D** DNA Helicase

unwinding and unzipping the double helix by the act of DNA Helicase enzyme. →D

67 **If we wanted to make a protein with 60 amino acids, then the number of nitrogenous bases on the nucleic acid mRNA is …**

CH 9 **A** 60 **B** 120 **C** 360 **D** 180

mRNA contains three nitrogenous bases for each amino acid that binds to it through tRNA during protein formation. →D

68 **Carries the genetic information from the DNA in the nucleus to start protein synthesis**

CH 9 **A** RNA primase
B Messenger RNA (mRNA)
C Ribosomal RNA (rRNA)
D Transfer RNA (tRNA)

mRNA (messenger): carries genetic information from DNA in the nucleus to direct protein synthesis in the cytoplasm. →B

69 **Which of the following transfers amino acids to the ribosome?**

CH 9 **A** RNA primase
B Messenger RNA (mRNA)
C Ribosomal RNA (rRNA)
D Transfer RNA (tRNA)

tRNA (transfer): transfers amino acids to the ribosome →D

Part 7: Replication of DNA, Protein, and Mutation

Transcription: the synthesis of mRNA from DNA chains, uracil takes place of thymine when building mRNA.
- RNA polymerase: enzyme that regulates the RNA synthesis.
- Genetic code (codon): a code consists of three nitrogenous bases in the DNA and RNA, example: AUG is a starting codon, UAA is a stopping codon.
- ***Translation***: the process of binding mRNA with ribosome and synthesize protein.

Gene Regulation:
- Prokaryotic cells: regulates protein synthesis through the usage of operons.
- Eukaryotic cells: regulates protein synthesis through the usage of RNA transcription and RNA interference factors.

Mutation: a permanent change in the cell's DNA.
- **Point mutations**: involve a chemical change in just one base pair and can be enough to cause a genetic disorder.

Example: a point mutation in which one base is exchanged for another is called substitution.
- Insertion mutation: are additions of a nucleotide to the DNA sequence.
- Deletion mutation: the loss of a nucleotide from a DNA.
- Frameshift mutations: includes deletion and insertion.

Causes of mutation: chemicals and radiation that damage DNA. (mutagens)
Genetic engineering: includes techniques that are used to manipulate the DNA.
- ***Genome***: the total DNA present in the nucleus of each cell.

70 **If the sequence of the nitrogenous bases in one of the DNA strands is: 5'CTGAATTCA3'; then what's the sequence of the complementary strand?**

CH 9 **A** 3'GACTTAAGT5' **B** 3'TCAGGCCTG5' **C** 3'AGTCCGGAT 5' **D** 3'CAGTTAACG 5'

5 face 3, 3 face 5, C with G, A with T →A

71 **If the pattern of the nitrogenous base in a DNA segment is ATCAATTGG; then the mRNA is**

CH 9 **A** UAGUUAACC **B** TAGTTAACC **C** AUCAAUUGG **D** ATCAATTGG

A face U, T face A, C face G, G face C →A

72 **Which one is a starting codon?**

CH 9 **A** AUG **B** AUU **C** CAU **D** UAA

AUG is a starting codon →A

73 **Which is a stopping codon in mRNA?**

CH 9 **A** AUG **B** AUU **C** CAU **D** UAA

UAA is a stopping codon. →D

74 **Which of the following is not type of mutation?**

CH 9 **A** Substituting a base **B** RNA interference **C** Insertion **D** Frameshift

RNA interference →B

75 **A process that binds mRNA with the ribosome and protein synthesis:**

CH 9 **A** Transcription **B** Gene regulation **C** Translation **D** Insertion

Translation: the process of binding mRNA with ribosome and synthesize protein. →C

76 **A segment of the DNA holds the following sequence: CCCCGAATT is mutated then the new sequence happens to be CCTCGAATT, what type of mutation is it?**

CH 9 **A** Duplication **B** Substitution **C** Deletion **D** Insertion

A point mutation in which one base is exchanged for another is called substitution. →B

77 **A segment of the DNA has TTAGGACCC sequence, which of the following shows an insertion mutation?**

CH 9 **A** TTACGACCC **B** TTAGACCC **C** TTAGGACCCTCC **D** TTAGGACCC

Insertion mutation: are additions of a nucleotide to the DNA sequence. →C

78 **A segment of the DNA has GGG sequence and became GGA, what type of mutation is it?**

CH 9 **A** Deletion **B** Substitution **C** Insertion **D** Frameshift

Substitution →B