# 1st SEM BS.c.PSYCHOLOGY

# CALICUT UNIVERSITY

## HUMAN PHYSIOLOGY

## 2020 ADMISSION

**Prepared by**

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**BSc PSYCHOLOGY PROGRAMME**

**TITLE OF THE COURSE :PS1C01-HUMAN PHYSIOLOGY**

**FIRST SEMESTER**

**LECTURES HOURS PER WEEK:4**

**NO. OF CREDITS: 3**

**NO. OF CONTACT HOURS :72 HOURS**

**OBJECTIVES OF THE COURSE**

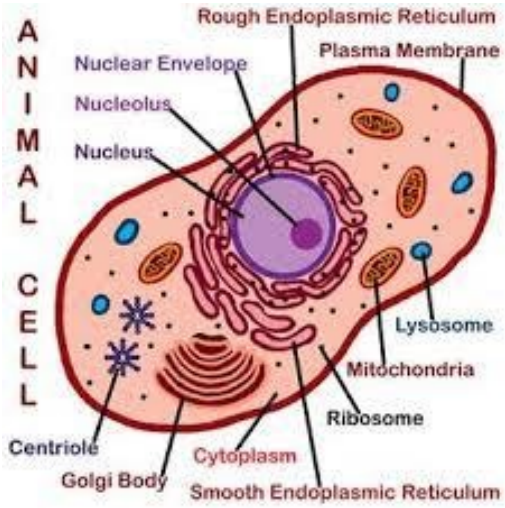
**This course familiarizes the student of Psychology with the most essential and fundamental aspects of cell biology and basics of genetics that are essential for understanding the anatomy and physiology of the nervous system in general and of the CNS that they are to master in the following semesters.**

**MODULE 1**

**CELLULAR ORGANIZATION**

**ORGANIATION OF LIVING BODY**

- **CELL:** All the living things are composed of cells. A single cell is the structural functional unit of all living body.
- **Structure of cell;**




- Structure of cell studied under 3 headings- **Cell membrane, Cytoplasm, Nucleus.**
- Cell membrane: protective sheet enveloping the cell body.
- Fluid mosaic model: The cell membrane as a two dimensional liquid that restricts the lateral diffusion of membrane components.
- Nucleus: largest and oldest known cellular organelle.
- Mitochondria: it is membrane bound cytoplasmic organelle concerned with production of energy. (power house of the cell)
- Golgi body: it is a major collection and dispatch station of protein products received from the endoplasmic reticulum.(shipping center of the cell)
- Lysosome: it contains variety of enzymes, enable the cell to break down various biomolecules.

- Ribosome: the complex molecular machine, that serves the biological protein synthesis.
- Cytoskeleton: it is a complex network of interlinking filaments and tubules that extend throughout the cytoplasm, from the nucleus to the plasma membrane.

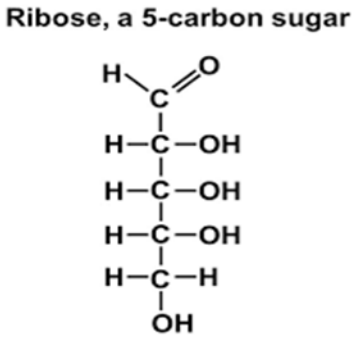
## CELL INCLUSIONS

- The chemical inclusions in cells are known as cell inclusions. They are non-living substances that are not bounded by membranes.(eg: glycogen, nutrients, secretory products, pigment granules, lipids)

- Glycogen: it is a polysaccharide made up of several glucose molecules. It is the storage form of carbohydrates in animals.

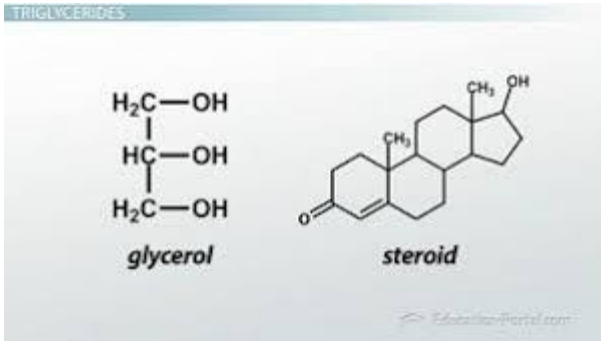
### 1. STRUCTURE OF CARBOHYDRATES:

It is made up of consisting carbon(C), hydrogen (H) and oxygen atoms (O). Carbohydrates are commonly referred to as sugar.




- Molecular formula **:** C6H12O6
- Groupings: monosaccharaides, disaccharides and polysaccharides

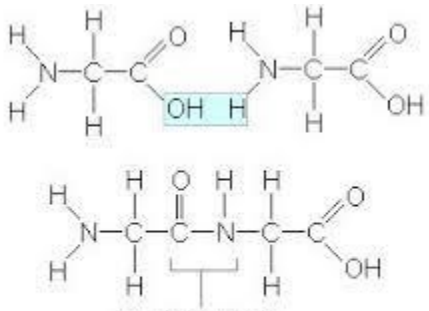
## 2. STRUCTURE OF LIPIDS:




3. It is the building blocks of the living cells.eg: fats, oil, waxes, certain vitamins.
4. It may divide in to different categories: fatty acids, gycerolipids, saccharolipids, polyketides etc.

## 3. STRUCTURE OF PROTEINS:

5. It is large biological molecules, or macro molecules, consisting of one or more chains of amino acids.
6. The functions are catalyzing metabolic reactions, replicating DNA, responding to stimuli, transporting etc.



A molecule of water is removed from two glycine amino acids to form a peptide bond.

- ❖ **THE CELL THEORY AND PRINCIPLE:** it states that the **cell** is a fundamental unit of life and has all structural and functional properties of an organism. Also according to this **principle cells** are made from pre-existing **cells** and all organisms are made up of **cells**.

## ✓ UNICELLULARITY TO MULTICELLULARITY

- Unicellularity organism is an organism that consists of a single cell.
  E.g.: bacteria, archaea, unicellular algae
- Multicellular organisms are organism that consists of more than one cell, in contrast to unicellular organisms.
- The conversion of one type of cell to another cell is known as cellular differentiation.

## ✓ TISSUES: TYPES OF TISSUES:

- Epithelial tissues: the group of cell that cover the organ surface, such as the surface of skin, the airways, reproductive tract
- Connecting tissues: the tissues are fibrous tissues made up of cells separated by non-living material
- Muscular tissues: the active contractile tissues of the body, muscle tissues functions to produce force and cause motion.

- Nervous tissues: it consist of cells forming the central nervous system and peripheral nervous systems.

**MODULE: 2**

**GENES AND CHROMOSOMES**

**CHROMOSOMES**: the genetic material in a cell is present in the nucleus in the form of multiple linear DNA molecules organized into structure called chromosomes.

- Chromosomes are composed of chromatin fiber, which is turn is made of nucleosomes.
- The structure of chromosomes varies through the cell cycle.
- A typical eukaryotic chromosomes has two, they joined by a centromere. Based on the position of centromeres, chromosomes can be of four types- metacentric, sub metacentric, acrocentric and telocentric.
- Human have 46 chromosomes (23 pairs)
- Karyotype: it is a method of arrangement of pair of homologous chromosomes of a cell in decreasing series of their size
- Ideogram: the diagrammatic representation of karyotype showing all the morphological feature of the chromosomes.
- Human karyotypes: diploid human cell contain 46 chromosomes, 44- autosomes and two sex chromosomes, which are XX females and XY in male.

**DNA (DEOXYRIBONUCLEIC ACID)**

- The genetic in chromosomes is carried by DNA. It is a molecule composed of two chains that coil around each other to form a double helix structure.
- The two DNA stands are also known as polynucleotides, composed of simpler monomeric unit called nucleotides.
- Nucleotide is composed of one of four nitrogen base- cytosine, guanine, adenine and thymine, a sugar called deoxyribose, and a phosphate group.
- DNA replication: it is the process by which DNA makes a copy of itself during cell division. Four major steps in DNA replication- replication fork formation, primer binding, elongation, termination.

**GENES**

- The physical and functional unit of heredity. Human have between 20,000 to 25000 genes.
- Alleles are the forms of the same gene with small difference in their sequence of DNA bases.
- The coding sequence of nucleotides is known as exons, the non- coding sequence is known as introns.
- Introns do not have specific function, so it called junk DNA.

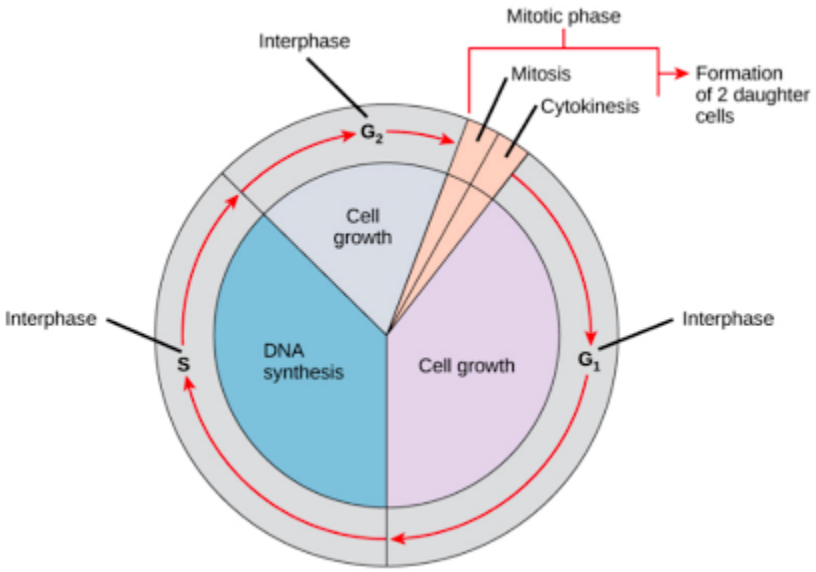
- Genetic coding: the sequence of nucleotides in DNA and RNA that determine the amino acid sequence of protein.
- RNA is single stranded and they have uracil in the place of thiamine.
- In nucleotide sequence on m RNA, the t RNA transport amino acids to the m RNA. Each amino acid has its own specific t RNA. A genetic code is a triplet code consisting of three nucleotides.

**MODULE 3**

**CELL DIVISION**

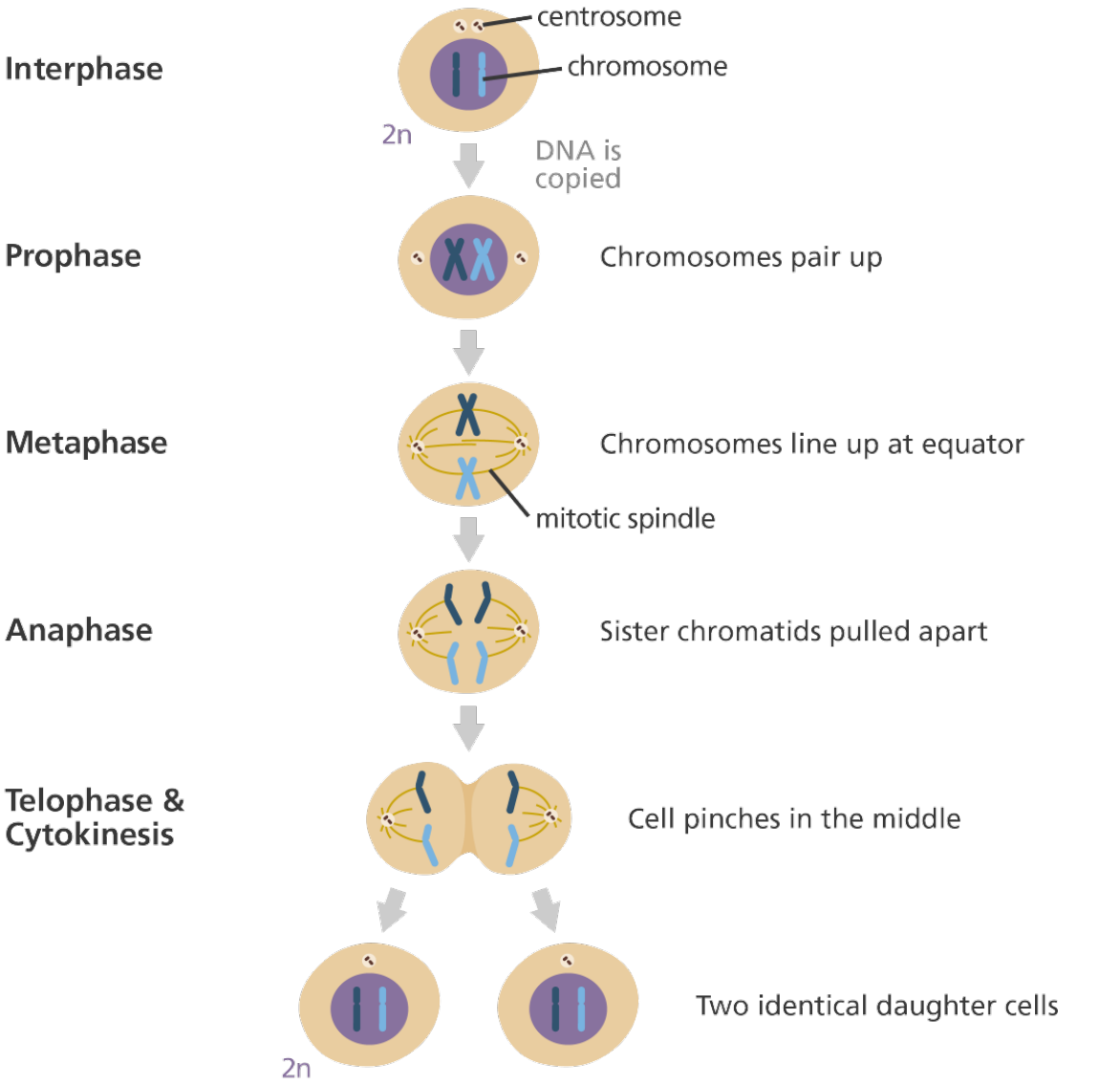
## CELL CYCLE

The cell cycle is a four-stage process in which the cell increases in size (gap 1, or G1, stage), copies its DNA (synthesis, or S, stage), prepares to divide (gap 2, or G2, stage), and divides (mitosis, or M, stage). The stages G1, S, and G2 make up interphase, which accounts for the span between cell divisions.




## MITOSIS

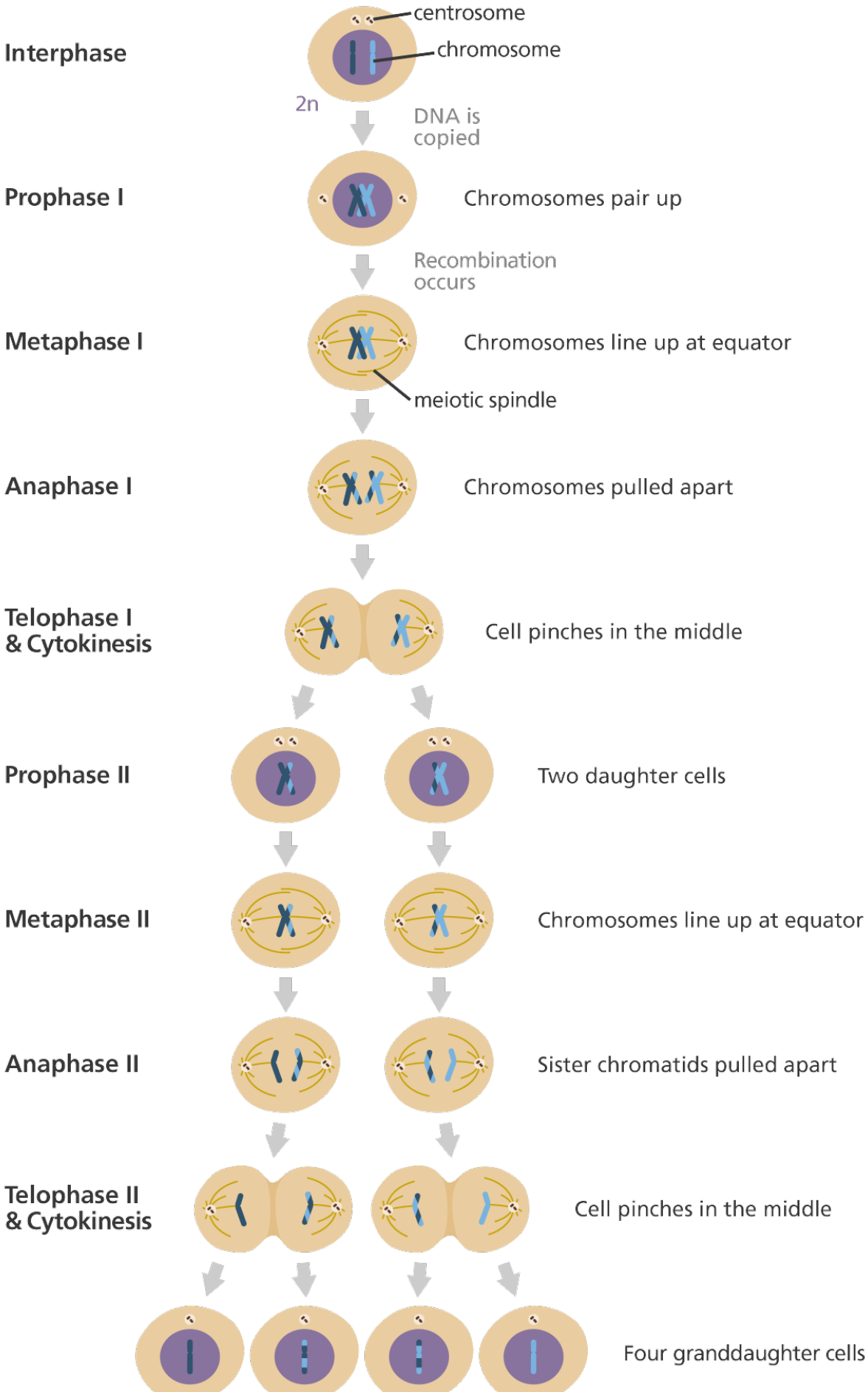
- Mitosis is a process where a single cell divides into two identical daughter cells (cell division).
- During mitosis one cell divides once to form two identical cells.
- The major purpose of mitosis is for growth and to replace worn out cells
- Mitosis, a process of cell duplication, or reproduction, during which one cell gives rise to two genetically identical daughter cells.
- The term *mitosis* is used to describe the duplication and distribution of chromosomes, the structures that carry the genetic information.




**MEOSIS**

- Meiosis is a process where a single cell divides twice to produce four cells containing half the original amount of genetic information

- These cells are our sex cells – sperm in males, eggs in females. During meiosis one cell divides twice to form four daughter cells.


Interphase
centrosome
chromosome
2n
DNA is copied
Prophase I
Chromosomes pair up
Recombination occurs
Metaphase I
Chromosomes line up at equator
meiotic spindle
Anaphase I
Chromosomes pulled apart
Telophase I & Cytokinesis
Cell pinches in the middle
Prophase II
Two daughter cells
Metaphase II
Chromosomes line up at equator
Anaphase II
Sister chromatids pulled apart
Telophase II & Cytokinesis
Cell pinches in the middle
Four granddaughter cells

**MODULE 4**

**ELEMENTS OF HEREDITY AND VARIATION**

## GENETICS

Branch of biology deals with study of inheritance and variation.

## INHERITANCE

Transmission of parental characters to offspring.

## MONOHYBRID CROSS

Cross between two parents differ in one character pair.

- Law of dominance
- Law of segregation

## TEST CROSS

Crossing F1 progeny with its recessive parent.

## DIHYBRID CROSS

Cross between two parents differ in two character pair.

- Law of independent inheritance.

**ALLELES**: Alternative forms of gene.

**HOMOZYGOUS**: The condition in which chromosome carries similar alleles for a character.

**HETEROZYGOUS**: The condition in which chromosome carries dissimilar alleles for a character.

**GENOTYPE**: Genetic makeup of an individual

**PHENOTYPE**: Physical expression of an individual.

## INCOMPLETE DOMINANCE

It is the inheritance in which heterozygous offspring show intermediate character between two parental characters.

## CODOMINANCE

It is the inheritance in which both alleles of a gene are expressed in a hybrid.

**MULTIPLE ALLELISM**

Here a character is controlled by more than two alleles.

**PLEIOTROPHY**

A single gene controls more than one phenotypic expressions.

**EPISTASIS**

This phenomenon where the phenotypic expression of one gene is affected by another gene.

**MODULE 5**

**MUTATION AND GENETINC DISORDERS**

## MUTATION

Mutations refer to changes in chromosomes and genes, which typically manifest physically.

## CLASSIFICATION OF MUTATION

- Based on cell types
  - Somatic mutations
  - Gametic mutations
- Based on expression of phenotypes
  - Dominant
  - Recessive or silent
- Point mutations
- Amplification mutations
- Deletion mutations
- Translocations
- Spontaneous mutations
- Induced mutations

## GENE MUTATION DISORDERS

- ALBINISM: A group of inherited disorders characterized by little or no melanin production.
- PHENYLKETONURIA: A birth defect that causes an amino acid called phenylalanine to build up in the body.
- ALKAPTONURIA: Genetic disorder in which a body cannot process the amino acids phenylalanine and tyrosine.
- GALACTOSEMIA: Accumulation of galactose in blood.
- BRACHYDACTYLY: Shortening of the fingers and toes due to unusually short bones.

## CHROMOSOMAL ANOMALIES

- DOWN'S SYNDROME: Genetic disorder caused by the presence of all or part of a third copy of chromosome 21.
- EDWARDS SYNDROME: Genetic disorder caused by a third copy of chromosome 18.

## SEX CHROMOSOMAL ANOMALIES

- KLINEFELTER'S SYNDROME: Set of symptoms that result from two or more X chromosomes in males.
- TURNER SYNDROME: Genetic condition in which female is partly or completely missing an X chromosome.