

# **HUMAN PHYSIOLOGY (Minor Elective)**

**B.A. IV Semester (NEP 2020)**

## **Unit I**

मानव शरीर की संरचनात्मक एवं क्रियात्मक इकाई कोशिका होती है। एक प्रकार की कोशिकाएं मिलकर उत्तक का निर्माण करती हैं तथा ऊतकों से विभिन्न अंगों का निर्माण होता है। ये अंग एक तंत्र का निर्माण करते हैं तथा विभिन्न शारीरिक तंत्र मिलकर सम्पूर्ण मानव शरीर की रचना करते हैं।

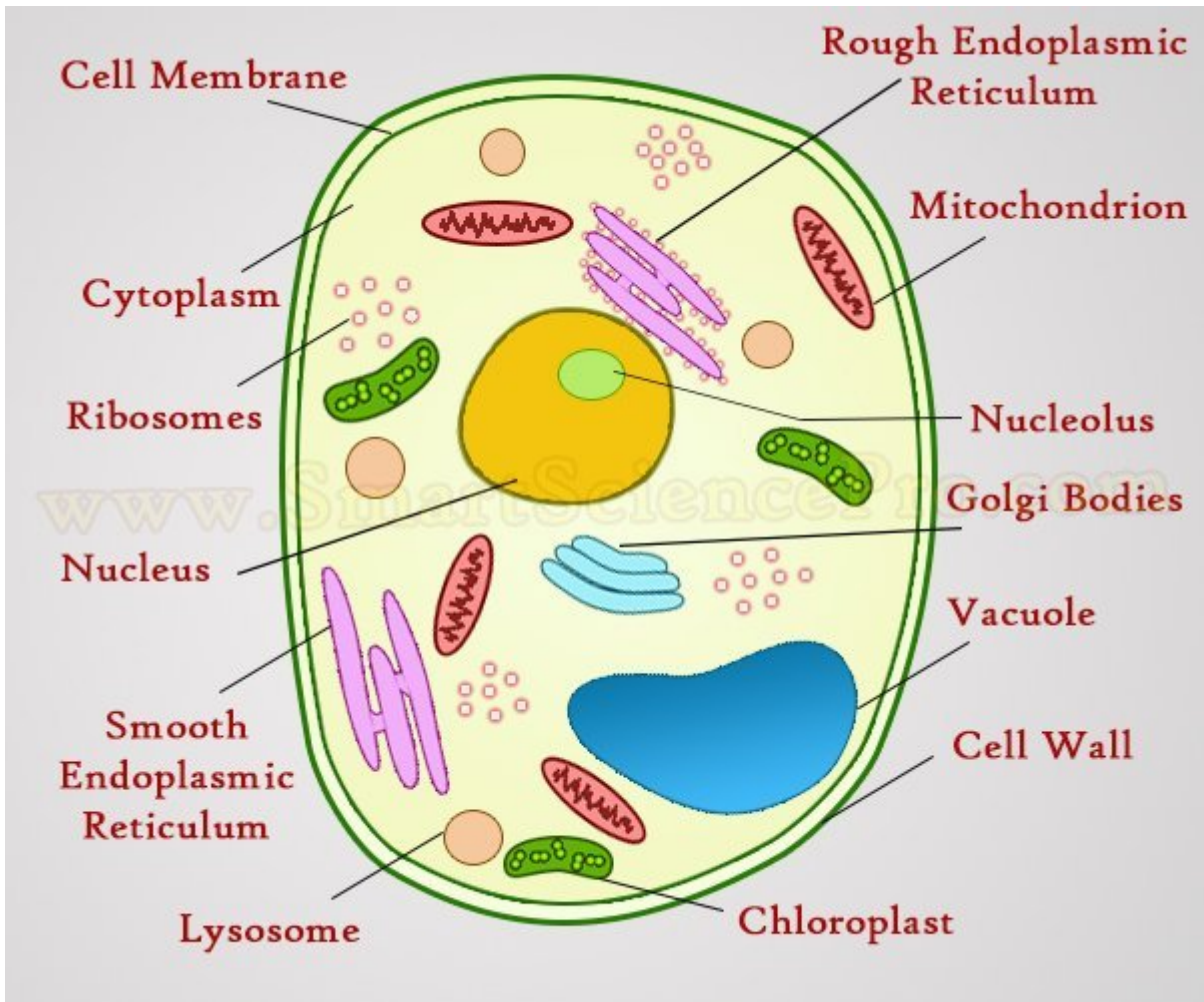
### **About Human Body**

If we were to “break apart” the human body at the microscopic level, then the cell would constitute its most basic unit.

The average adult has somewhere between 30 – 40 trillion cells, and an estimated 242 billion new cells are produced every day. When a select group of cells with similar functions come together, it forms a tissue.

Tissues cumulate into organs, group of organs form organ systems and eventually, a complete organism.

**Cells -> Tissues -> Organs -> Organ System -> Organism**

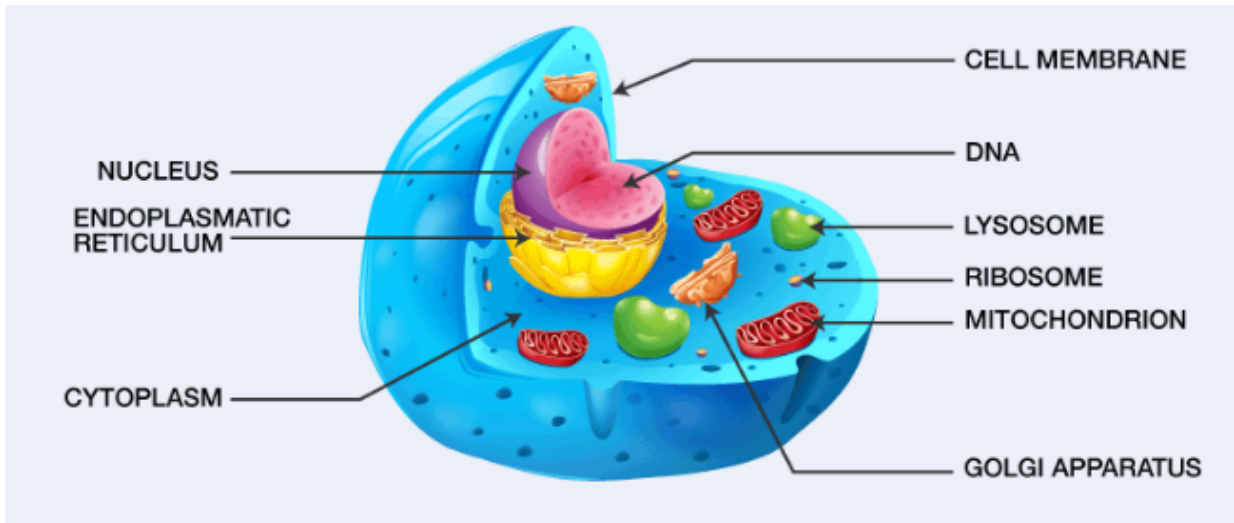


## Cell Definition

***“A cell is defined as the smallest, basic unit of life that is responsible for all of life’s processes.”***

Cells are the structural, functional, and biological units of all living beings. A cell can replicate itself independently. Hence, they are known as the building blocks of life.

Each cell contains a fluid called the cytoplasm, which is enclosed by a membrane. Also present in the cytoplasm are several biomolecules like proteins, nucleic acids and lipids. Moreover, cellular structures called cell organelles are suspended in the cytoplasm.



### **कोशिका का अर्थ (Meaning of Cell):**

संसार में अलग-अलग प्रकार के जीव हैं जो एक-दूसरे से बहुत भिन्न दिखाई देते हैं । परन्तु सभी का शरीर अनेक छोटी-छोटी इकाईयों से बना होता है, प्रत्येक इकाई को कोशिका कहते हैं । कोशिका शरीर की रचनात्मक एवं कार्यात्मक इकाई है । परन्तु इनकी संख्या जीवों में अलग-अलग होती है, जैसे अमीबा, पैरामीशियम चित्र 5.1, यूग्लीना जैसे जीव एक ही कोशिका से बने होते हैं तथा वे एक कोशिकीय जीव कहलाते हैं ।

### **कोशिका की आकृति एवं आकार (Shape and Size of Cell):**

कोशिकाओं की एक विशेषता यह भी है कि उसकी आकृति एवं आकार एक समान नहीं होता है जैसे: अमीबा अनियमित आकृति का जीव है जबकि पैरामीशियम की आकृति अंडाकार (चप्पल) जैसी होती है । बहुकोशिकीय जीवों के शरीर में उपस्थित कोशिकाएं चपटी गोल अंडाकार घनाकार या अनियमित आकृति की भी हो सकती हैं साथ ही कुछ कोशिकाएं छोटी तथा कुछ बड़ी भी हो सकती हैं । इस प्रकार कोशिका की आकृति एवं आकार में काफी विविधता होती है ।

### **कोशिका की संरचना (Structure of Cell):**

कोशिका की संरचना का अध्ययन करने के लिए एक सूक्ष्मदर्शी यंत्र की आवश्यकता होती है । कोशिका का अध्ययन सर्वप्रथम वैज्ञानिक राबर्ट हुक ने सन् 1665 में किया था । इन्होंने स्वयं के बनाए हुए सूक्ष्मदर्शी से कोशिका को देखा था ।

सामान्यतः एक कोशिका में कोशिका झिल्ली केन्द्रक तथा कोशिका द्रव्य नामक तीन भाग होते हैं । साथ ही इन तीनों के अतिरिक्त कोशिका में अनेक कोशिकांग भी होते हैं । संरचनात्मक दृष्टि से पौधों एवं जंतुओं की कोशिकाएं अलग-अलग होती हैं । इनके भीतर के कोशिकांगों की उपस्थिति एवं संख्या में अंतर होता है ।

## Characteristics of Cells

Following are the various essential characteristics of cells:

- Cells provide structure and support to the body of an organism.
- The cell interior is organised into different individual organelles surrounded by a separate membrane.
- The nucleus (major organelle) holds genetic information necessary for reproduction and cell growth.
- Every cell has one nucleus and membrane-bound organelles in the cytoplasm.
- Mitochondria, a double membrane-bound organelle is mainly responsible for the energy transactions vital for the survival of the cell.
- Lysosomes digest unwanted materials in the cell.
- Endoplasmic reticulum plays a significant role in the internal organisation of the cell by synthesising selective molecules and processing, directing and sorting them to their appropriate locations.

## Cell Organelles

Cells are composed of various cell organelles that perform certain specific functions to carry out life's processes. The different cell organelles, along with its principal functions, are as follows:

<i>Cell Organelles and their Functions</i>
<b>Nucleolus</b>
The nucleolus is the site of ribosome synthesis. Also, it is involved in controlling cellular activities and cellular reproduction.
<b>Nuclear membrane</b>
The nuclear membrane protects the nucleus by forming a boundary between the nucleus and other cell organelles.
<b>Chromosomes</b>
Chromosomes play a crucial role in determining the sex of an individual. Each human cells contain 23 pairs of chromosomes.
<b>Endoplasmic reticulum</b>
The endoplasmic reticulum is involved in the transportation of substances throughout the cell. It plays a primary

role in the metabolism of carbohydrates, synthesis of lipids, steroids and proteins.

### **Golgi Bodies**

Golgi bodies are called the cell's post office as it is involved in the transportation of materials within the cell.

### **Ribosome**

Ribosomes are the protein synthesisers of the cell.

### **Mitochondria**

The mitochondrion is called "the powerhouse of the cell." It is called so because it produces ATP – the cell's energy currency.

### **Lysosomes**

Lysosomes protect the cell by engulfing the foreign bodies entering the cell and help in cell renewal. Therefore, they are known as the cell's suicide bags.

### **Chloroplast**

Chloroplasts are the primary organelles for photosynthesis. It contains the pigment called chlorophyll.

### **Vacuoles**

Vacuoles store food, water, and other waste materials in the cell.

Blood is one of the most important components of life. Almost any animal that possesses a circulatory system has blood. From an evolutionary perspective, blood was speculated to have risen from a type of cell that was responsible for phagocytosis and nutrition. Billions of years later, blood and the circulatory system have drastically helped the evolution of more complex lifeforms.

# BLOOD



## **What is Blood?**

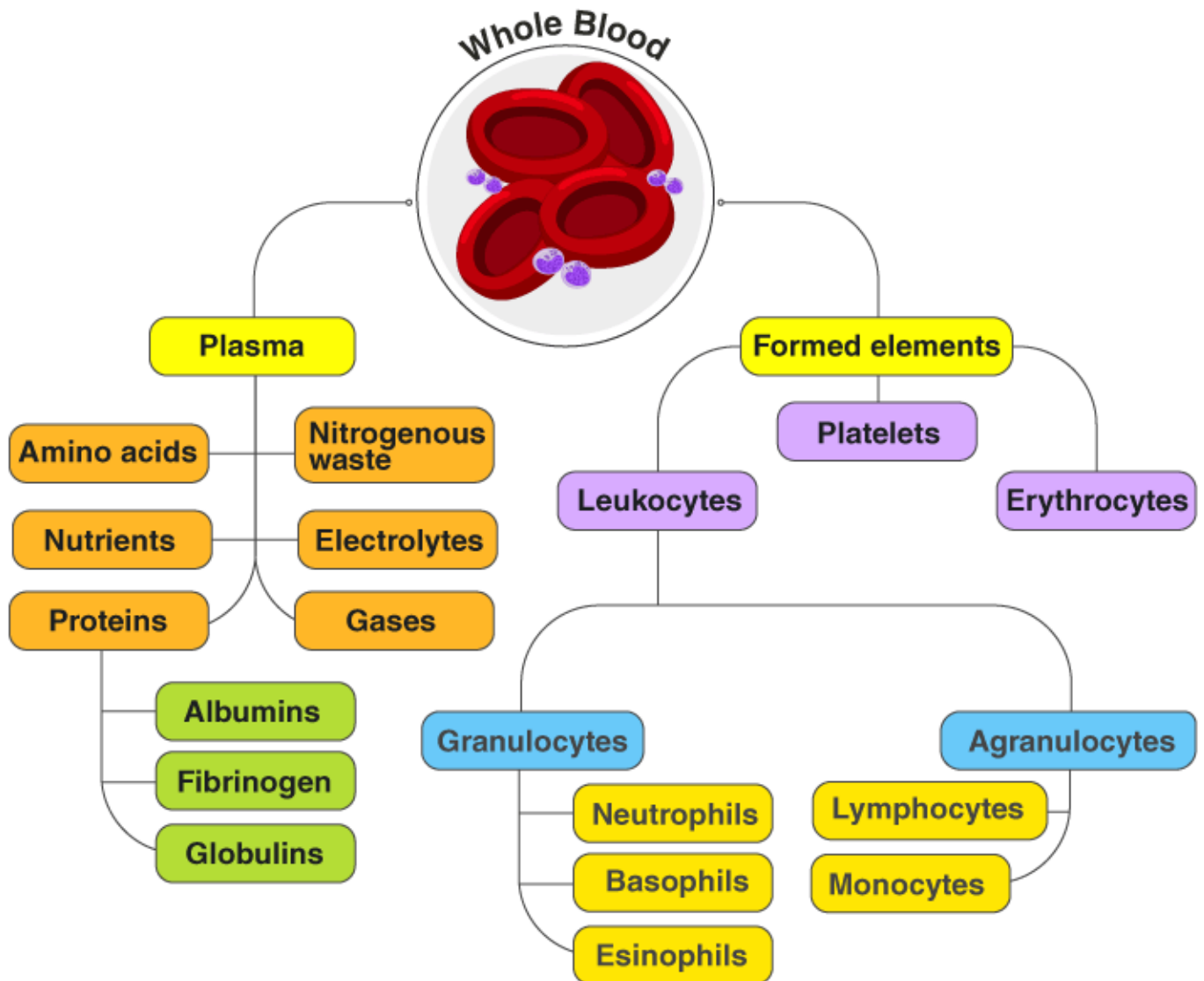
Blood is a fluid connective tissue that consists of plasma, blood cells and platelets. It circulates throughout our body delivering oxygen and nutrients to various cells and tissues. It makes up 8% of our body weight. An average adult possesses around 5-6 litres of blood.

## **Types of Blood Cells**

We have seen blood consist of cells known as formed elements of blood. These cells have their own functions and roles to play in the body. The blood cells which circulate all around the body are as

follows:

## COMPOSITION OF BLOOD



### Red blood cells (Erythrocytes)

RBCs are biconcave cells without nucleus in humans; also known as erythrocytes. RBCs contain the iron-rich protein called haemoglobin; give blood its red colour. RBCs are the most copious blood cells produced in bone marrows. Their main function is to transport oxygen from and to various [tissues](#) and organs.



## White blood cells (Leucocytes)

Leucocytes are colourless blood cells. They are colourless because it is devoid of haemoglobin. They are further classified as granulocytes and agranulocytes. WBCs mainly contribute to immunity and defence mechanism.

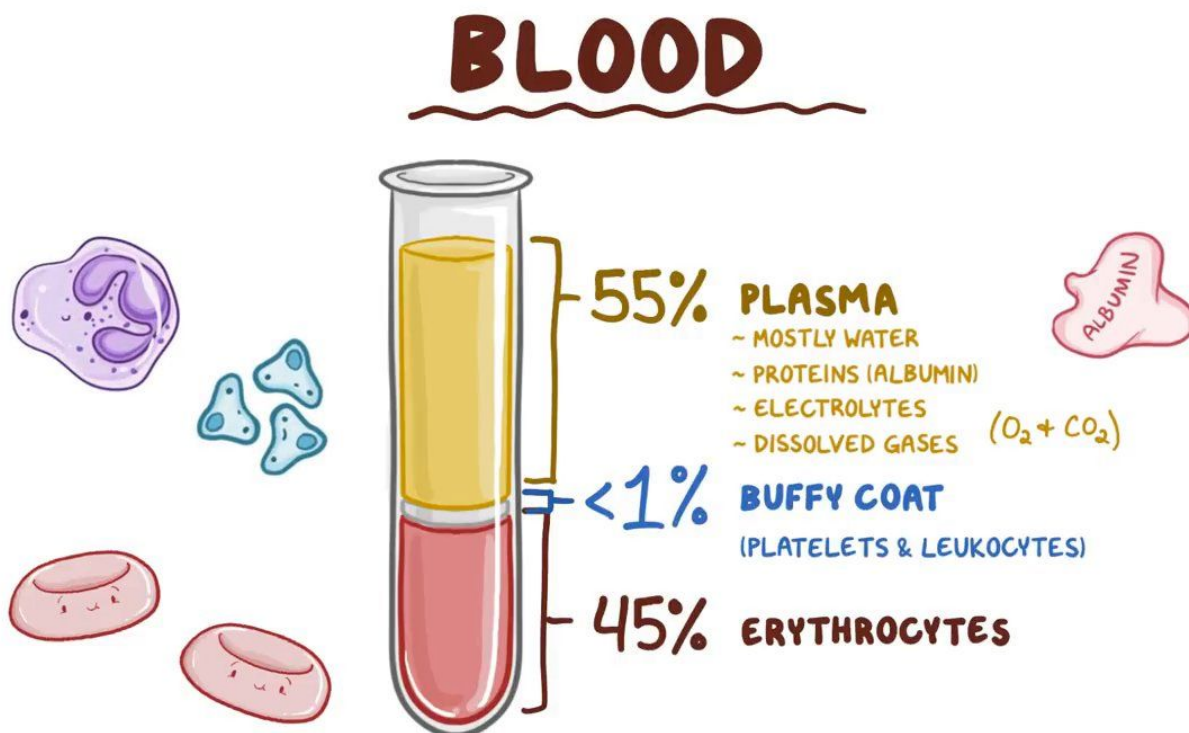
## Types of White Blood Cells

There are five different types of White blood cells and are classified mainly based on the presence and absence of granules.

- Granulocytes
- Agranulocytes

## Components of Blood

There are many cellular structures in the composition of blood. When a sample of blood is spun in a centrifuge machine, they separate into the following constituents: Plasma, buffy coat and erythrocytes. Thus blood contains RBC, WBC, platelets and plasma.





## Plasma

The liquid state of blood can be contributed to plasma as it makes up ~55% of blood. It is pale yellow in colour and when separated. Blood plasma consists of salts, nutrients, water and enzymes. Blood plasma also contains important proteins and other components necessary for overall health. Hence, blood plasma transfusions are given to patients with liver failure and life-threatening injuries.

### Components of Blood Plasma

Blood plasma has several protein components. Proteins in blood plasma are:

- Serum globulin
- Serum albumin
- Fibrinogen

The serum contains only globulin and albumin. Fibrinogen is absent in serum because it is converted into fibrin during blood clotting.

# FUNCTIONS OF BLOOD

Transports oxygen and nutrients

Helps regulate pH temperature, water concentration, and osmotic function

Clot formation/ coagulation to prevent excessive blood loss

Immunological functions and prevention of infection

Transports hormones and signals tissue damage

Helps remove waste products like CO<sub>2</sub>, urea, and lactic acid

