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# A CONCEPTUAL REVIEW OF LITERATURE OF KALA ACCORDING TO MODERN SCIENCE

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## INTRODUCTION

All living organisms are made of cells and cell products. This simple statement, called the cell theory, was first proposed more than 150 years ago. You may think of a theory as a guess or hypothesis, and sometimes this is so. A scientific theory, however, is actually the best explanation of all available evidence. All of the evidence science has gathered so far supports the validity of the cell theory. Cells are the smallest living subunits of a multicellular organism such as a human being. A cell is a complex arrangement of the chemicals discussed in the previous chapter, is living, and carries out specific activities. Microorganisms, such as amoebas and bacteria, are single cells that function independently.

Human cells, however, must work together and function interdependently. Homeostasis depends upon the contributions of all of the different kinds of cells. Human cells vary in size, shape, and function. Most human cells are so small they can only be seen with the aid of a microscope and are measured in units called micrometers (formerly called microns). One micrometer _ 1/1,000,000 of a meter or 1/25,000 of an inch (see Appendix A: Units of Measure). One exception is the human ovum or egg cell, which is about 1 millimeter in diameter, just visible to the unaided eye. Some nerve cells, although microscopic in diameter, may be quite long. Those in our arms and legs, for example, are at least 2 feet (60 cm) long.

With respect to shape, human cells vary greatly. Some are round or spherical, others rectangular, still others irregular. White blood cells even change shape as they move. Cell functions also vary, and since our cells do not act independently, based on function, there are more than 200 different kinds of human cells, though they all have certain similarities. Each type of cell is made of chemicals and carries out specific chemical reactions. Despite their many differences, human cells have several similar structural features: a cell membrane, a nucleus, and cytoplasm and cell organelles. Red blood cells are an exception because they have no nuclei when mature. The cell membrane forms the outer boundary of the cell and surrounds the cytoplasm, organelles, and nucleus.

## CONCEPTUAL REVIEW

### Modern Review On Kala

All the tissues of the body develop from the three primary germ cell layers that form the embryo:

- **Ectoderm** - develops into nervous tissue and epithelial tissue.
- **Endoderm** – develops into epithelial tissue.
- **Mesoderm** – develops into epithelial tissue, connective tissue and muscle tissue

➢ **The main derivatives from these three layers can been understood as follows**:

**The Ectoderm** is the start of a tissue that covers the body surfaces. It emerges first and forms from the outermost of the germ layers. The ectoderm forms: the central nervous system, the lens of the eye, cranial and sensory, the ganglia and nerves, pigment cells, head connective tissues, the epidermis, hair, and mammary glands.

**The Endoderm** during animal embryogenesis the specialized cells migrate inwards along the archenteron form the inner layer of the gastrula, which develops into the endoderm. The endoderm consists at first of flattened cells, which subsequently become columnar. It forms the epithelial lining of the whole of the digestive tube excepting part of the mouth and pharynx and the terminal part of the rectum (which are lined by involutions of the ectoderm).

It also forms the lining cells of all the glands which open into the digestive tube, including those of the liver and

pancreas; the epithelium of the auditory tube and tympanic cavity; the trachea, bronchi, and air cells of the lungs; the urinary bladder and part of the urethra; and the follicle lining of the thyroid gland and thymus.

The endoderm forms: the stomach, the colon, the liver, the pancreas, the urinary bladder, the lining of the urethra, the epithelial parts of trachea, the lungs, the pharynx, the thyroid, the parathyroid, and the intestines.

The Mesoderm germ layer forms in the embryos of triploblastic animals. During gastrulation, some of the cells migrating inward contribute to the mesoderm, an additional layer between the endoderm and the ectoderm

This key innovation evolved hundreds of millions of years ago and led to the evolution of nearly all large, complex animals. The formation of a mesoderm led to the development of a coelom. Organs formed inside a coelom can freely move, grow, and develop independently of the body wall while fluid cushions and protects them from shocks.

The mesoderm forms: skeletal muscle, the skeleton, the dermis of skin, the crystal lens of the eye, connective tissue, the urogenital system, the heart, blood (lymph cells), and the spleen. A tissue is a group of cells with similar structure and function.

The tissue contributes to the functioning of the organs in which it is found. These tissues can be classified into mainly four groups as epithelial, connective, muscle, and nerve tissue.

The human body is organized into structural and functional levels of increasing complexity. Each higher level incorporates the structures and functions of the previous level. We will begin with the simplest level, which is the chemical level, and proceed to cells, tissues, organs, and organ systems.

## DISCUSSION

The above four tissues can be classified appealingly as follows:

1. Epithelial: Is made of cells arranged in a continuous sheet with one or more layers, has apical & basal surfaces.

- A basement membrane is the attachment between the basal surface of the cell & the underlying connective tissue.
- Two types of epithelial tissues:

(1) Covering & lining epithelia and
(2) Glandular Epithelium.

- The number of cell layers & the shape of the cells in the top layer can classify epithelium.

1. **Simple Epithelium** - one cell layer
2. **Stratified epithelium** - two or more cell layers
3. **Pseudostratified Columnar Epithelium** - When cells of an epithelial tissue are all anchored to the basement Membrane but not all cells reach the apical surface.

**4. Glandular Epithelium**

(1) Endocrine: Release hormones directly into the blood stream and
(2) Exocrine - Secrete into ducts.

### Functions of Epithelial Tissue

**1. Protection**

Epithelial cells from the skin protect underlying tissue from mechanical injury, harmful chemicals, invading bacteria and from excessive loss of water.

**2. Sensation**

Sensory stimuli penetrate specialized epithelial cells. Specialized epithelial tissue containing sensory nerve endings is found in the skin, eyes, ears, nose and on the tongue.

**3. Secretion**

In glands, epithelial tissue is specialized to secrete specific chemical substances such as enzymes, hormones and lubricating fluids.

**4. Absorption**

Certain epithelial cells lining the small intestine absorb nutrient from the digestion of food.

**5. Excretion**

Epithelial tissues in the kidney excrete waste products from the body and reabsorb needed materials from the urine. Sweat is also excreted from the body by epithelial cells in the sweat glands.

**6. Diffusion**

Simple epithelium promotes the diffusion of gases, liquids and nutrients. Because they form such a thin lining, they are ideal for the diffusion of gases (eg. walls of capillaries and lungs).

**7. Cleaning**

Ciliated epithelium assists in removing dust particles and foreign bodies which have entered the air passages.

**8. Reduces Friction**

The smooth, tightly-interlocking, epithelial cells that line the entire circulatory system reduce friction between the blood and the walls of the blood vessels.

**2. Connective**

Contains many different cell types including: fibroblasts, macrophages, mast cells, and adipocytes. Connective Tissue Matrix is made of two materials: ground substance - proteins and polysaccharides, fiber – reticular, collagen and elastic.

**Classification of Connective Tissue**

1. **Loose Connective** - fibers & many cell types in gelatinous matrix, found in skin, & surrounding blood vessels, nerves, and organs.
2. **Dense Connective** - Bundles of parallel collagen fibers& fibroblasts, found in tendons& ligaments.
3. **Cartilage** - Cartilage is made of collagen & elastin fibers embedded in a matrix glycoprotein & cells called chondrocytes, which was found in small spaces.

**Cartilage has three subtypes**

- **Hyaline cartilage** – Weakest, most abundant type, Found at end of long bones, & structures like the ear and nose,
- **Elastic cartilage**- maintains shape, branching elastic fibers distinguish it from hyaline and
- **Fibrous Cartilage** - Strongest type, has dense collagen & little matrix, found in pelvis, skull & vertebral discs.

**3. Muscle**

is divided into 3 categories, skeletal, cardiac and smooth.

1. **Skeletal Muscle** – voluntary, striated, striations perpendicular to the muscle fibers and it is mainly found attached to bones.
2. **Cardiac Muscle** – involuntary, striated, branched and has intercalated discs
3. **Smooth Muscle** – involuntary, nonstriated, spindle shaped and is found in blood vessels & the GI tract.
4. **Nervous:** Consists of only two cell types in the central nervous system (CNS) & peripheral nervous system (PNS):

1. **Neurons** - Cells that convert stimuli into electrical impulses to the brain, and Neuroglia – supportive cells.
2. **Neurons** – are made up of cell body, axon and dendrites. There are 3 types of neurons:

A. **Motor Neuron** – carry impulses from CNS to muscles and glands,
B. **Interneuron** - interpret input from sensory neurons and end responses to motor neurons
C. **Sensory Neuron** – receive information from environment and transmit to CNS.
D. **Neuroglia** – is made up of astrocytes, oligodendrocytes, ependymal cells and microglia in the CNS, and schwann cells and satellite cells in the PNS.

### Membranes of the Body

Body membranes are thin sheets of tissue that cover the body, line body cavities, and cover organs within the cavities in hollow organs, and these are the membranes, which can be closely related to the concept of Kala. They are categorized as Epithelial Membranes and Connective tissue Membranes where all the membranes of the body fall under these two groups only. There is no any other membrane beyond these two tissues. In recent studies it has been noted that there must be inter signaling between these two membranes. These two membranes mostly present all over the body but doing different function in parts of the body. They can be classified as:

### Epithelial Membranes

Epithelial membranes consist of epithelial tissue and the connective tissue to which it is attached. The two main types of epithelial membranes are the mucous membranes and serous membranes.

### Mucous Membranes

Mucous membranes are epithelial membranes that consist of epithelial tissue that is attached to an underlying loose connective tissue. These membranes, sometimes called mucosae, line the body cavities that open to the outside. The entire digestive tract is lined with mucous membranes. Other examples include the respiratory, excretory, and reproductive tracts.

### Serous Membranes

Serous membranes line body cavities that do not open directly to the outside, and they cover the organs located in those cavities. Serous membranes are covered by a thin layer of serous fluid that is secreted by the epithelium. Serous fluid lubricates the membrane and reduces friction and abrasion when organs in the thoracic or abdominopelvic cavity move against each other or the cavity wall. Serous membranes have special names given according to their location. For example, the serous membrane that lines the thoracic cavity and covers the lungs is called pleura.

### Connective Tissue Membranes

Connective tissue membranes contain only connective tissue. Synovial membranes and meninges belong to this category.

### Synovial Membranes

Synovial membranes are connective tissue membranes that line the cavities of the freely movable joints such as the shoulder, elbow, and knee. Like serous membranes, they line cavities that do not open to the outside. Unlike serous membranes, they do not have a layer of epithelium. Synovial membranes secrete synovial fluid into the joint cavity, and this lubricates the cartilage on the ends of the bones so that they can move freely and without friction.

### Meninges

The connective tissue covering on the brain and spinal cord, within the dorsal cavity, are called meninges. They provide protection for these vital structures.

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