




The Basic Units of Life


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The Basic Units of Life

Introduction -- The Cells (The Cellular Anatomy)


Cells are the microscopic fundamental units of all living things. Some organisms (eg; bacteria, protozoa) have one cell (**unicellular organism** – ဧကကလာပ်သတ္တဝါ) but animals, including human beings are **multicellular** ဗဟုကလာပ်သတ္တဝါ. An adult human body is composed of about **one hundred trillion cells** in about **two hundred types**. An organism as a whole can be understood through the collective activities and interactions of its cells.

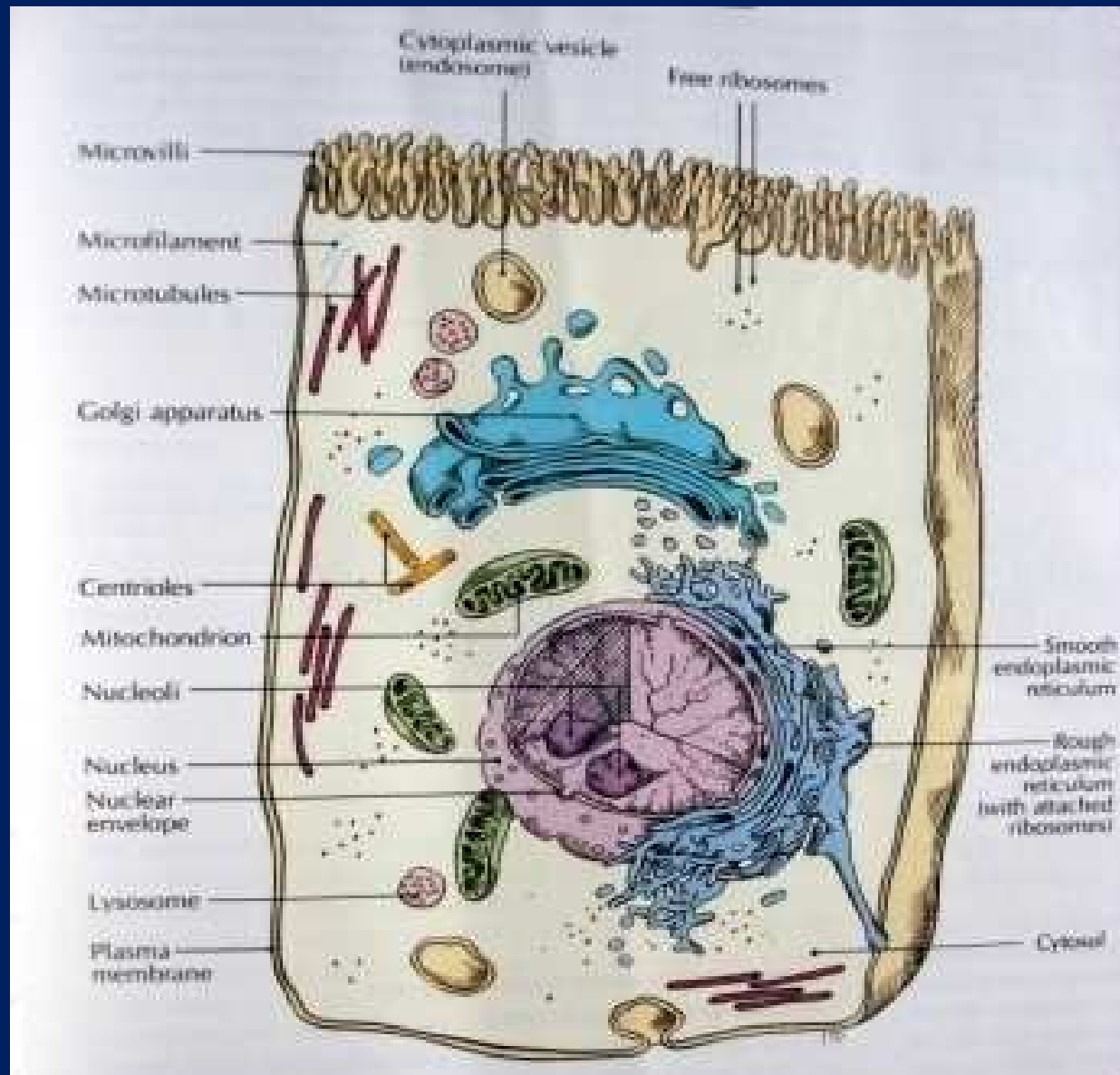
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- **Aims** -- To promote the basic fundamental principles of Myanmar Traditional Medical Education
 - -- To facilitate and support Myanmar Traditional Medical Healthcare System in the modern perspectives
 - Number of cells -- It is noteworthy about **changing figures** of cells due to the continuous medical research and advanced technology.

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- In 1961 -----10 billions (The Science of life)
 - In 1990 -----50 trillions (The Human Physiology and Anatomy)
 - In 1992 -----70 trillion (Life)
 - In 2011 -----100 to 105 trillion (8.8.2011, Wikipedia)
 - All these trillion number of cells derived from a **single cell**, known as **zygote**.

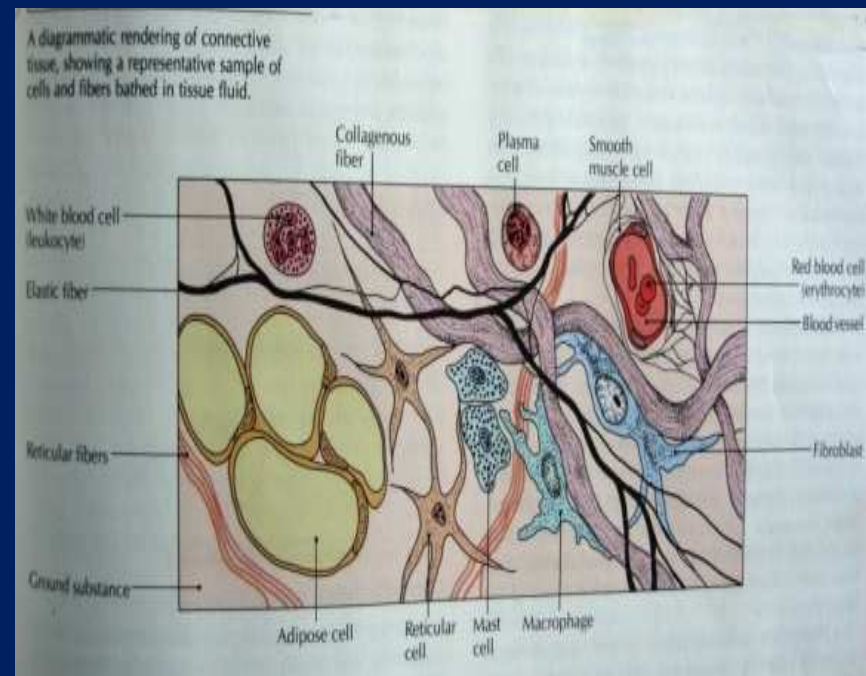
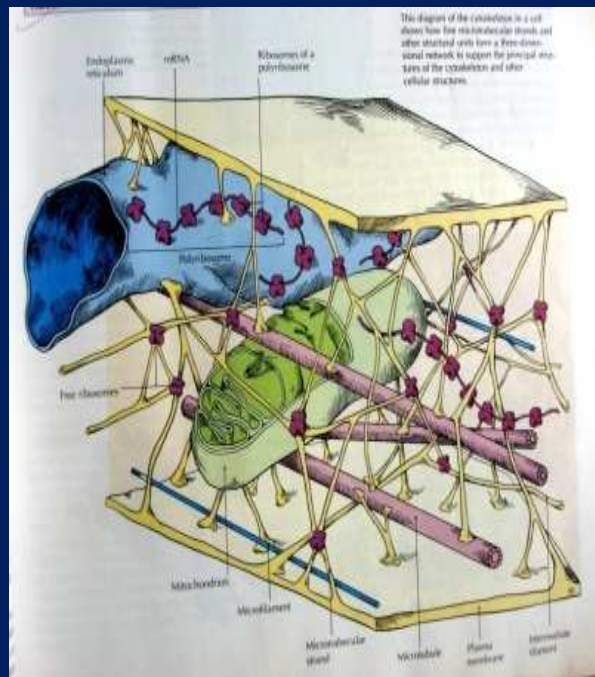
- **Cell -- Organism**
- Each cell is an amazing creature.



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- **Cell Organization**
 - Two general categories of cells; PROKARYOTES and EUKARYOTES.
 - **Eukaryotic Organism**
 - Nucleus and specialized subcellular structures, called organelles.
 - **Cell Structures -- The Basics**



- **Plasma Membrane - A cell's protective coat**
- **The Cytoskeleton -- A cell's Scaffold**




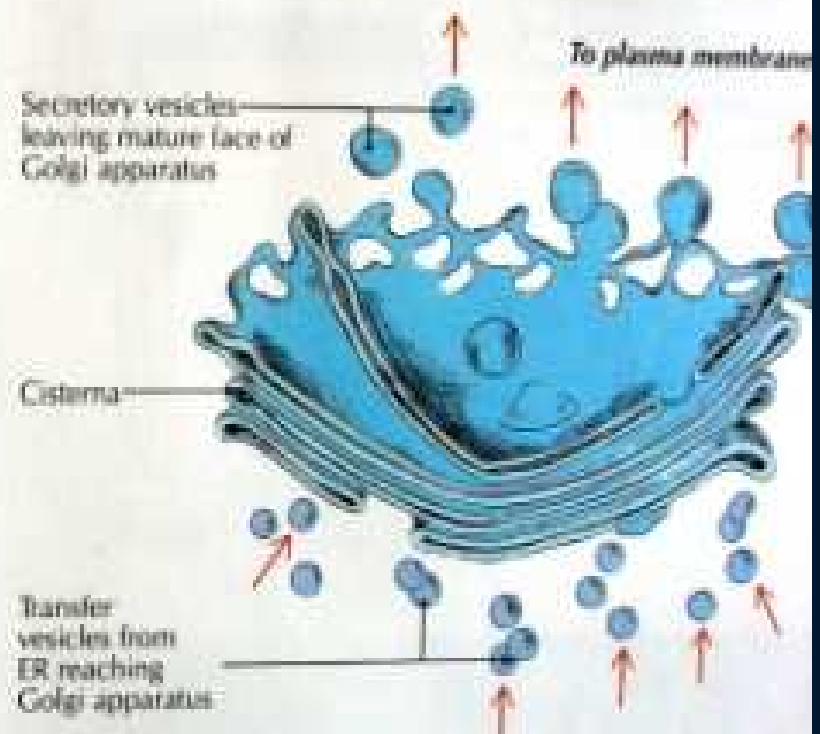
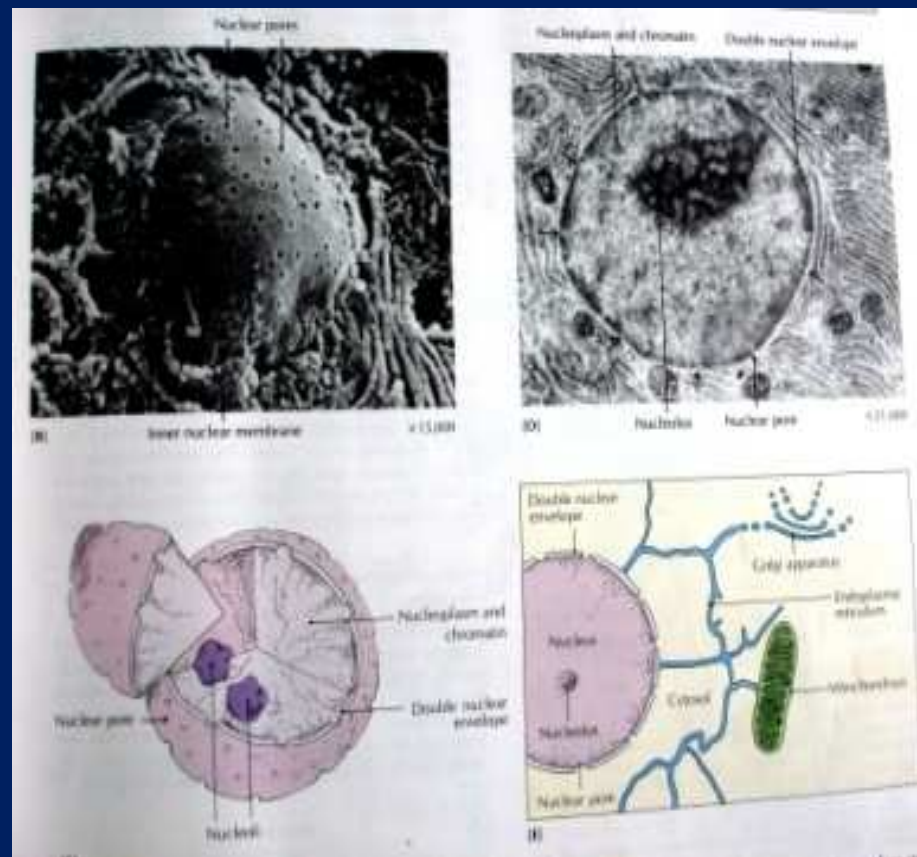
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- **The Cytoplasm -- A cell's Inner Space**
(അപ്പാ, ജലം- Inner Apa, Jala)
 - In eukaryotes, the cytosol is the "soup " within which all the organelles and subcellular structures reside. Moves materials around the cell through a process called **cytoplasmic streaming**.

FIGURE 3.14

Golgi apparatus. (A) A simplified diagram of a cell, cut open to show the position of a Golgi apparatus. (B) An electron micrograph of a Golgi apparatus, showing secretory vesicles. (C) A drawing of a Golgi apparatus in three dimensions, showing how the transfer vesicles from the ER merge with the Golgi apparatus, and how secretory vesicles bud off from the opposite side of the Golgi apparatus on their way to delivering secretions. [© L. S. Khawkinsa/Biophoto Associates/Photo Researchers.]



- **Organelles -- Little Organs**
- **The Nucleus -- A Cell's Center**





controlling center

- **The Ribosomes -- The Protein Production Machine**
- Ribosomes are found in both prokaryotes and eukaryotes.
- **Mitochondria -- The Power Generators (Chloroplasts)**
- Mitochondria play a critical role in generating energy in the cell.



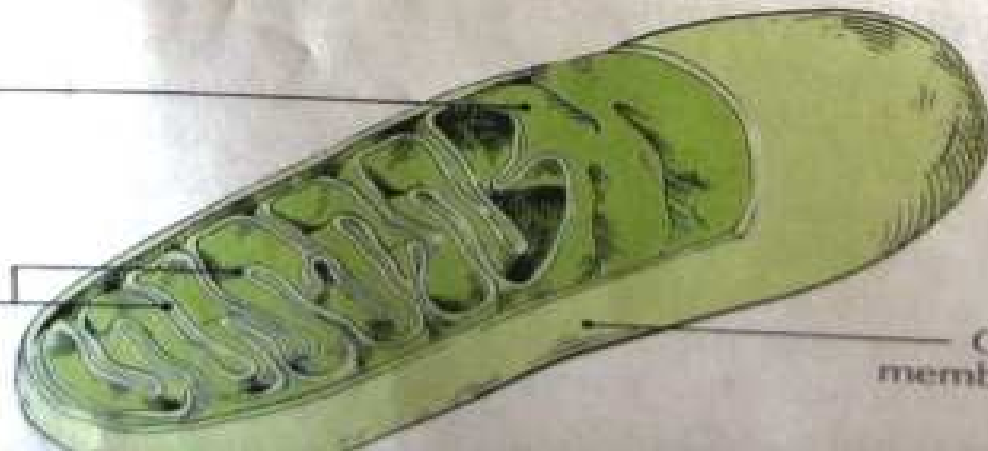
(B)

× 95,000

Inner membrane

Cristae

Outer membrane




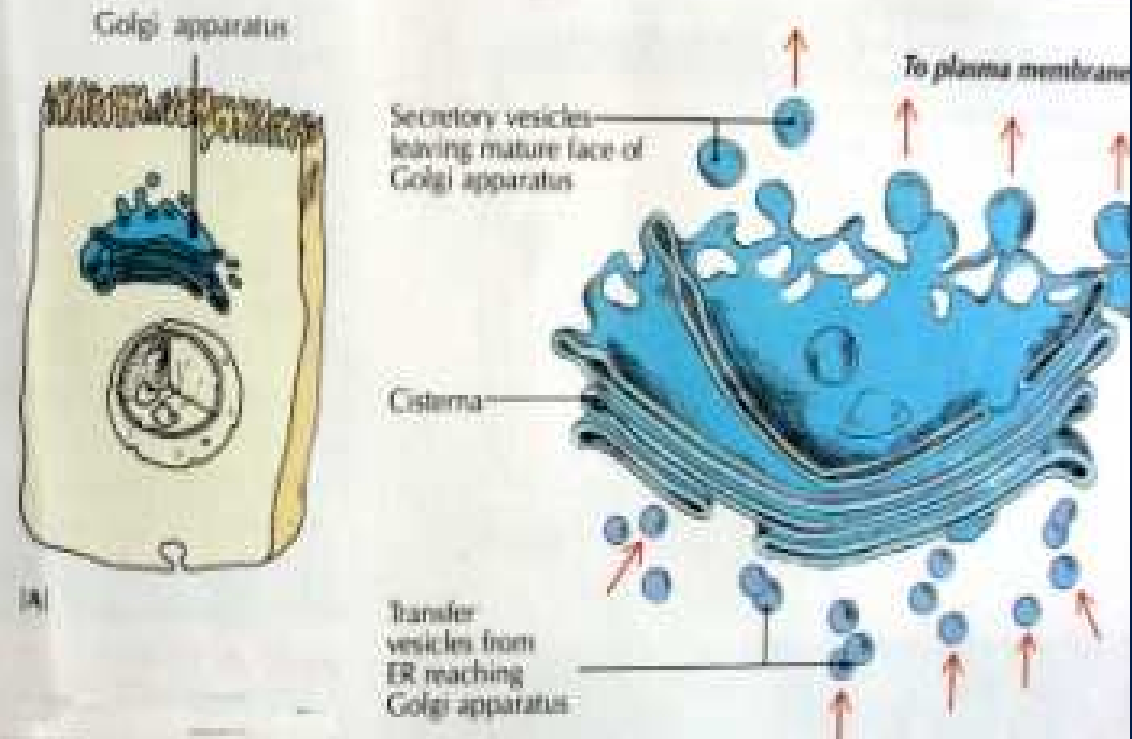

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- **The Endoplasmic Reticulum and the Golgi Apparatus -- The Macromolecule Managers**
 - the transport network for molecules targeted for certain specific destination. Those proteins to be exported are passed to the Golgi apparatus (Golgi body or Golgi complex) for further processing, packaging and transport to a variety of other cellular location.

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- **Lysosomes and Peroxisomes -- The Cellular Digestive System**
 - Lysosomes and Peroxisomes are often referred to as a garbage disposal system of a cell.
 - Functions of a lysosome include digesting foreign bacteria, helping to recycle receptor proteins and degrading worn out organelles.
 - Peroxisomes function to rid the body of toxic substances, such as hydrogen peroxide, or other metabolites and contain enzymes concerned with oxygen utilization.




- **Inclusion Bodies**

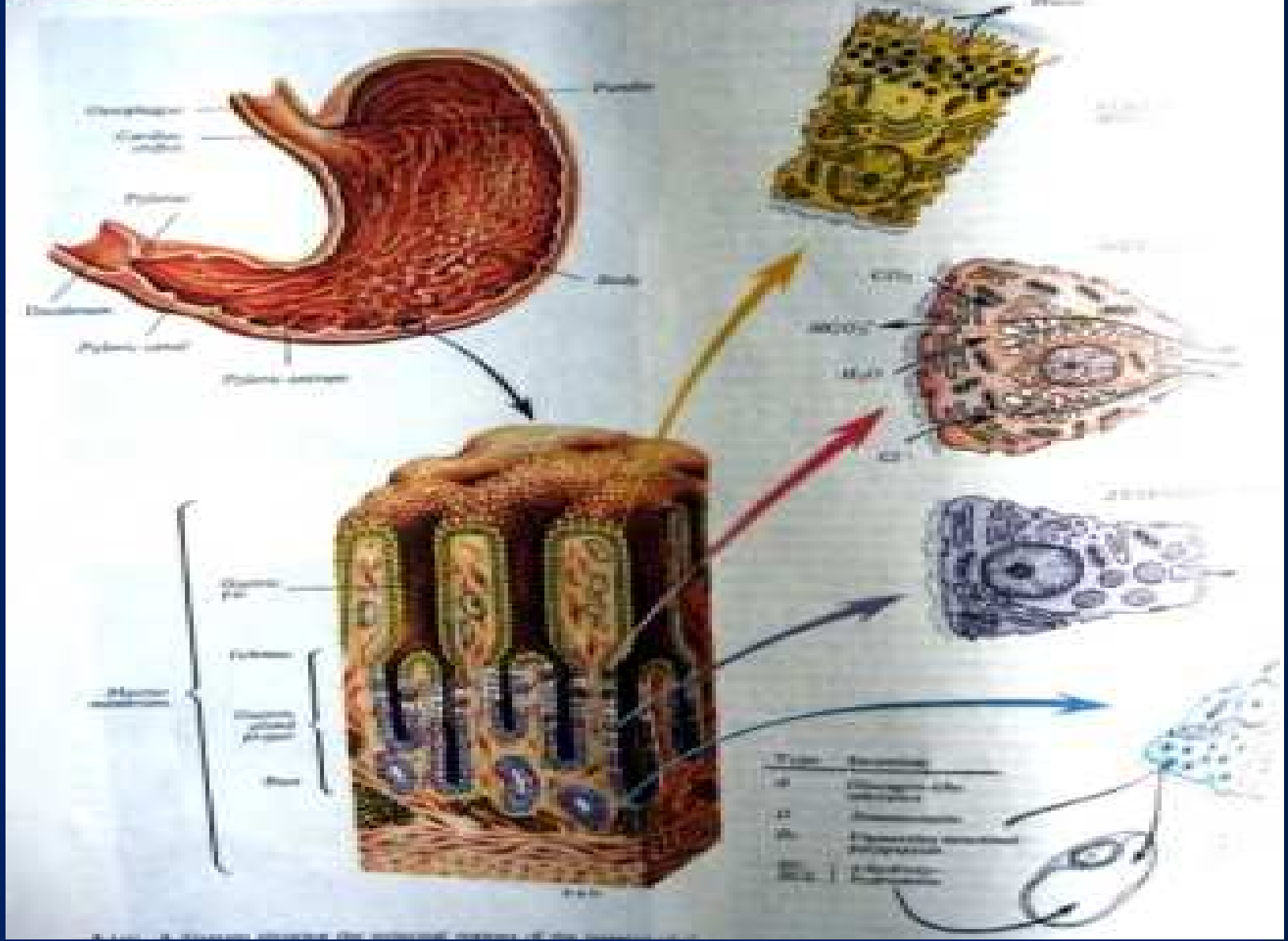
- There are some inclusion bodies in the cytoplasm of the cells. They are glycogens, lipids, some pigments and foreign materials.

- **Ayurvedic Anatomy and Physiology**
- **Concept of a cell**
- Human physiology is designated by the term ' Sarira Vicaya ' in Ayurvedic literature. Ayurveda (Sanskrit for 'knowledge of life ' or ' knowledge of longevity) ' should start with the understanding of innumerable minute individual living units called ' Sarira paramanus ' or ' Anu Strotamsi '. These units are now known as cells.
- **Tissues (Dhatu)**
- A group of such functionally and structurally similar units is called ' A Dhatu '. These Dhatu are almost equivalent to the tissues of body in Science Medicine. Seven such Dhatu have been innumeraled.

- **Systems (Sthula Strotamsi)**
- the individual systems in the body ; thirteen such ' Strotamsi ' have been described by ' Caraka ' . ' **Anna vaha Strota** =.the digestive system and ' **Rasavaha** ' = the cardiovascular system.
- **Concept of Tri-Dosha**
- the five elements (pancha Mahabhuta) combine in pairs to form these dynamic forces. Dosha means ' **that which changes** ' . Basically three Doshas - ' Vita ' , ' Pitta ' and ' Kapha '

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- In generalized term, the nervous, indocrine and immune mechanism can be equated to 'Vita ', 'Pitta ', and 'Kapha' respectively. The state of equilibrium of the different tissues is known as ' Dhatusamya ' (Homeostasis). A healthy body is, thus , maintain by **these three opposing forces** (factors) called 'Vita ', 'Pitta' and 'Kapha'. A '**Doshic** ' imbalance is '**Vrikrit**'.


5. SPLANCHNOLOGY



Subdoshas

- There are five subdoshas, for each of the three dosha, which govern the various organs and systems of the body. The characters of the subdoshas can be felt in the pulse.
- In Ayurvedic Anatomy and Physiology, the human being is not considered in terms of material parts such as tissues and organs but in terms of the field of the unmanifest through the subtle level of existence to the gross material levels. Ayurveda is, therefore, a bio-chemical, bio-energetic, bio-spiritual system of medicine.

- **Concept of a cell in Myanmar Traditional Medicine**
- In Desananaya Myanmar Traditional Medicine, understanding the various aspects of Rupa; is the prime importance and it is the fundamental principle of Anatomy and Physiology in Desananaya. A nearest equivalent of Rupa is a 'matter'. But, Rupa comprises the characteristics of matter as well as those of energy according to Desananaya. Rupa changes state, form and colour on account of heat and cold (Tezo) as matter does. In the ultimate sense, Rupa is formless, shapeless and massless just as energy is. Scientists now know that matter and energy are interconvertible and identical in the ultimate sense.


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- But, unlike the laws of Science, in Myanmar Traditional Medicine Philosophy that Rupa arises and perishes incessantly at very short intervals. Rupa is very short lived. Rupa is incessantly produced from many sources namely, kamma, Citta, Utu (heat) and Ahara (nutriment). The rate of formation and the rate of dissolution of Rupa remains in equilibrium making Homeostasis of Rupas in a healthy body. Besides Rupa and Nama are interdependence and intertwined.

- What is Rupa?
- Rupa has been translated as 'matter', 'corporeality', 'material', 'body', 'form', 'mass', ect, but none is exact. Out of the different terms for Rupa, the most suitable and the nearest equivalent is 'matter'.
- **Enumeration of Rupa - Rupa Sammuddesa**
- Rupa is two fold ;
 - 1. Bhuta-rupa -- essentials (also called mahabhuta, great essentials)
 - 2. Upadaya-rupa -- derivatives

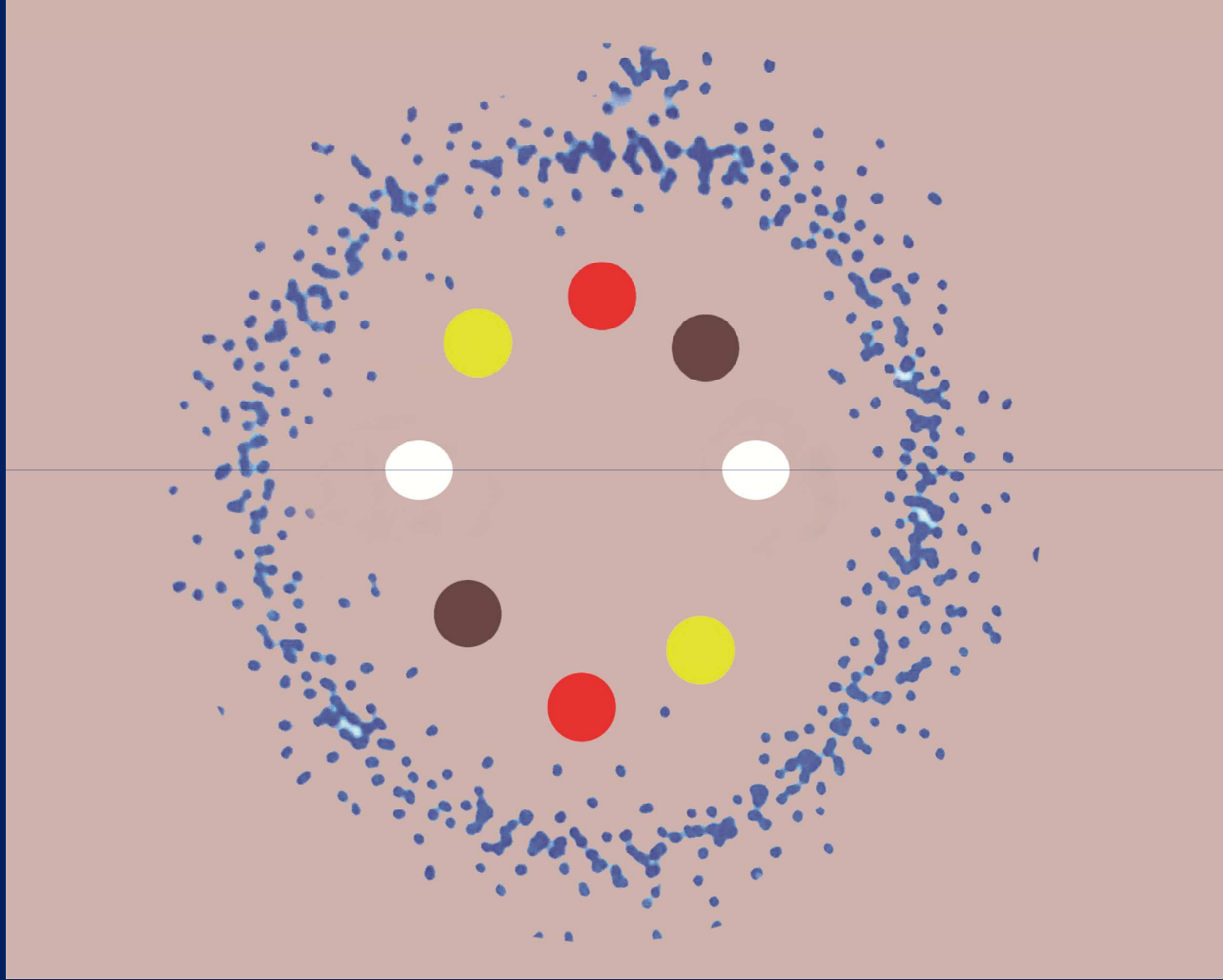
The four Mahabhutas (The Four Great Essentials)

- 1. Pathavi ; the element of extension with the characteristics of ' **hardness and softness** ' (Extension means occupation in space). Pathavi serves as a support for the other coexisting Rupas.
- 2. Apo ; the element of **cohesion** with the characteristics of cohesiveness and fluidity.
- 3. Tezo ; the element of heat or heat energy with the characteristics of hotness and coldness.
- 4. Wayo ; the element of **motion or kinetic energy, potential energy** with the characteristics of supporting, pushing, rotation, pressing, vibration.

- These four great essentials are the fundamental material elements which exist together and which are inseparable. Every material substance as well as every living thing, is made of the four essentials.
- One interesting Rupa, **Pariccheda - rupa** is also an essential component. It is the inter - atomic or intra - atomic; inter - cellular or intra - cellular space that limit or separate material groups (Rupa - kalapas). Pariccheda - rupa is also called **akasha - dhatu**. Akasha is space, which in itself **nothingness**, in **non - entity** (Nijjiva) but it is always present in and around all rupas in nature.

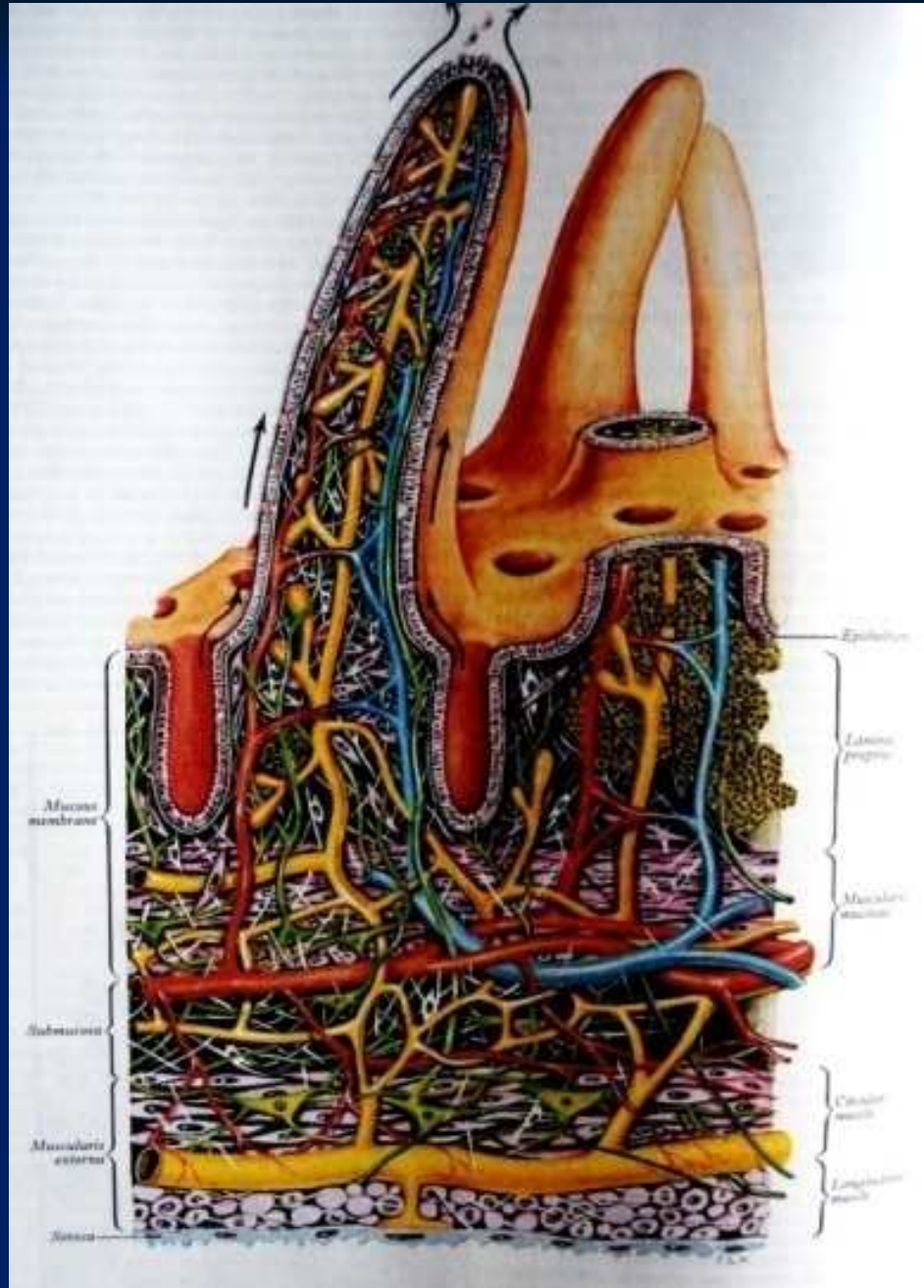
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- **Twentyfour Derivatives (24 Upada - rupas)**
 - There are **twenty four derivatives** or secondary material properties dependent on these four mahabhutas. These four mahabhutas together with the twentyfour derivatives make up **twenty eight kinds of rupas** with different properties.

- Concept of Rupa (Rupa - vibhaga)
- Avinibbhoga - Rupa -- It is **this rupa** basically applied in Desananaya. The **fundamental eight rupas** comprising pathavi, apo, tezo, vayo, vanna, gandha, rasa and oza are bound together and are **inseparable and indivisible**. So, they are called **avinibbhoga - rupas** where as the rest are called **vinibbhoga - rupas**.
- The definition of avinibbhoga – rupa sounds like the original definition of the **atom**, **but atoms** are now found to be **divisible**.



The Causes of Material Phenomena (Rupa – samutthana)

- There are four causes which produce rupa. They are kamma, citta, utu and ahara.
- The rupa produced by kamma is called **kammaza-rupa**.
- The rupa produced by citta is called **cittaza-rupa**.
- The rupa produced by utu is called **utuza-rupa**.
- The rupa produced by ahara is called **aharaza-rupa**.
- The number of rupas produced by the above four causes is **25806**, although the total number of rupas of the body is innumerable.



Grouping of Material Qualities (Rupa-Kalapa)

- The **twenty eight types of rupas** are not found separately in nature. They are produced by the above four causes in the **form of tiny material groups, called kalapas**. All kalapas have the following **four common features**;
 1. All the rupas in a kalapa arise together (a common genesis)
 2. They also cease or dissolve together (a common cessation)
 3. They all depend on the four mahabhutas present in the kalapa for their arising (a common dependence)

4. They are so thoroughly mixed that they cannot be distinguished (they always co-exist)
- It should be noted that kalapas are so small that they are invisible even under the electron microscopes. So , kalapas, are comparable to electrons, protons, neutrons and neutrinos. There are **twenty one types of kalapa** and **forty number of kauthasas (organs)** in the body. The total number of kalapas in a human body is innumerable. In all kalapas, **the eight avinibbhoga-rupas** form the base-matters (the nucleus). **All the kammaza - rupas contain jivita-rupa** which is the physical life and found in all living thing. It is called **jivita-navaka-kalapa** meaning '**group of nine rupas** including jivita '. In short it is called '**jivita - nonad**'. Few examples are as follows;

---cakkhu – dasaka kalapa = 8 avinibbhoga-rupas + jivita-rupa+cakkhu-pasada

---sota – dasaka kalapa = 8 avinibbhoga-rupas + jivita – rupa+sota-pasada

Life-time of Rupa (The cell cycle)

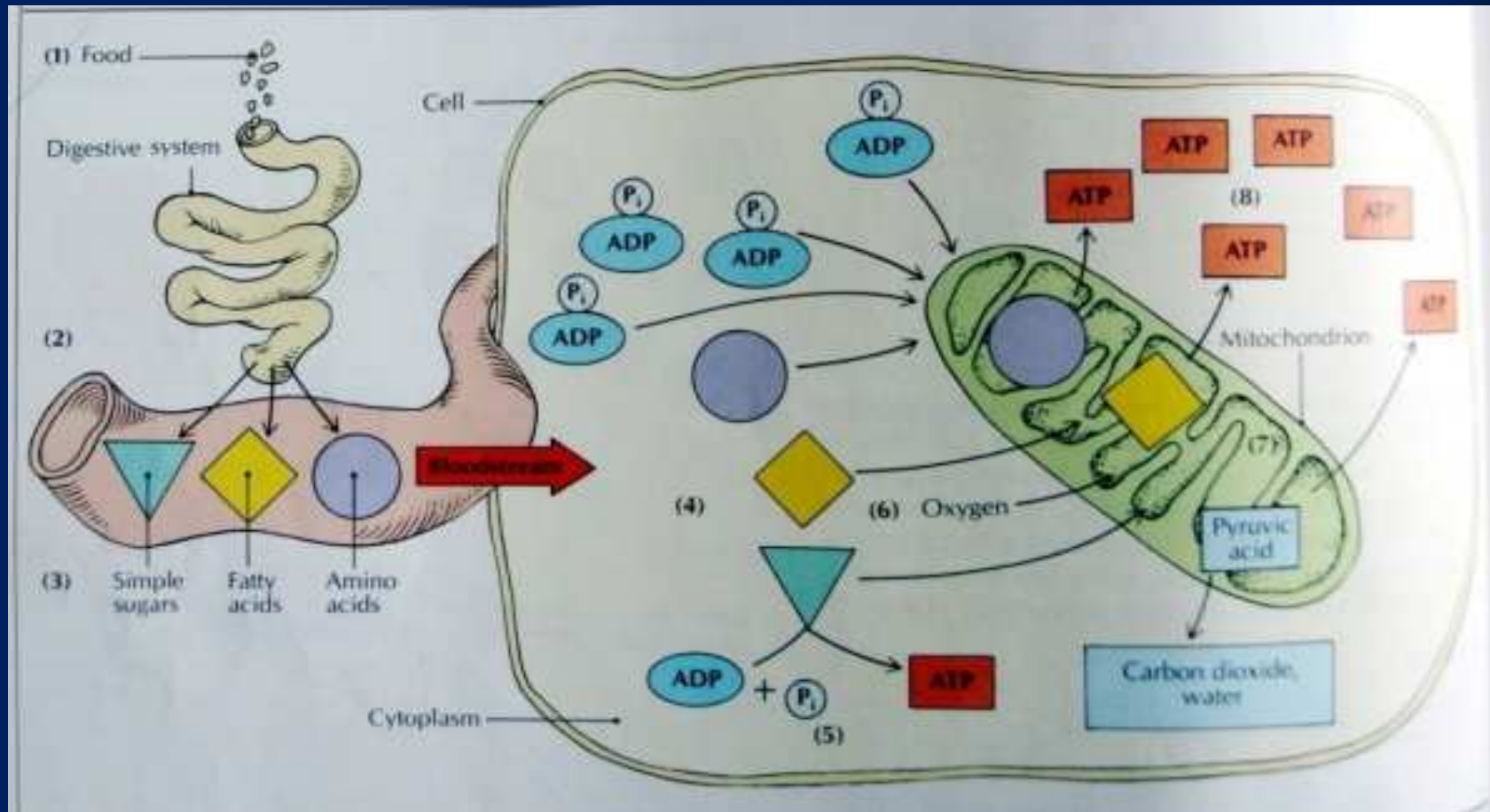
According to the Western Anatomy, a human body comprises of hundred trillion cells. In every minute, about three billion cells will die and the same number and kind of new cells will be replaced in the same time by the existing healthy cells. This process of cell division is known as Mitosis.


In our Desananaya concept, similar phenomenon of arising and dissolution of kalapas had been explained vividly in the Essence of Abhidama. The life time of rupa is measured by three short instants of the distinct features with arising and passing away of rupa. These are;

1. Uppada = the genetic instant (cytokinesis)
2. Thiti = the existing instant (interphase)
3. Bhanga = the dissolving instant (mitosis)

There are 21 rupa kalapas inside the body. They are called **Ajjhatta kalapas** (internal or within the individual). In the **Bahiddha** (external) world, **only two utuja kalapas** are found. (utuja-suddhatthaka kalapas, utuja-sadda-navaks kalapas).

Oja



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- **Energy** is essential for every kalapa. Every kalapa, therefore, contain **Oja**, the nutritive essence. As new groups of material qualities are incessantly produced, old groups dissolved and disappear when their life time is over.
 - Thus, the material phenomena go on uninterruptedly in the sense-sphere till the end of life, like the flame of a lamp, or the bubble of water.

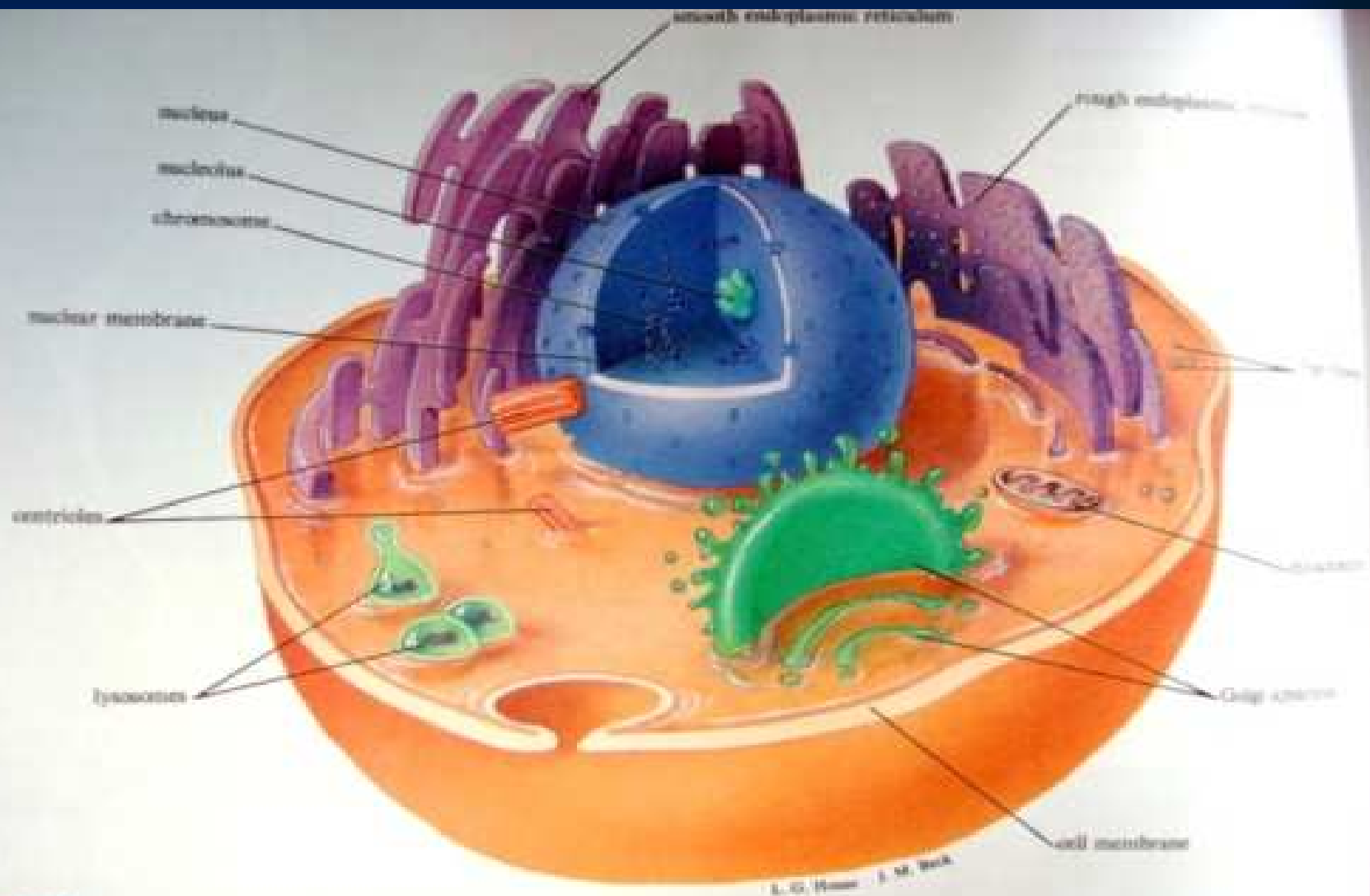


Figure 4.10

An animal cell is a eukaryotic cell. Note the appearances of the different organelles when viewed in cross section.

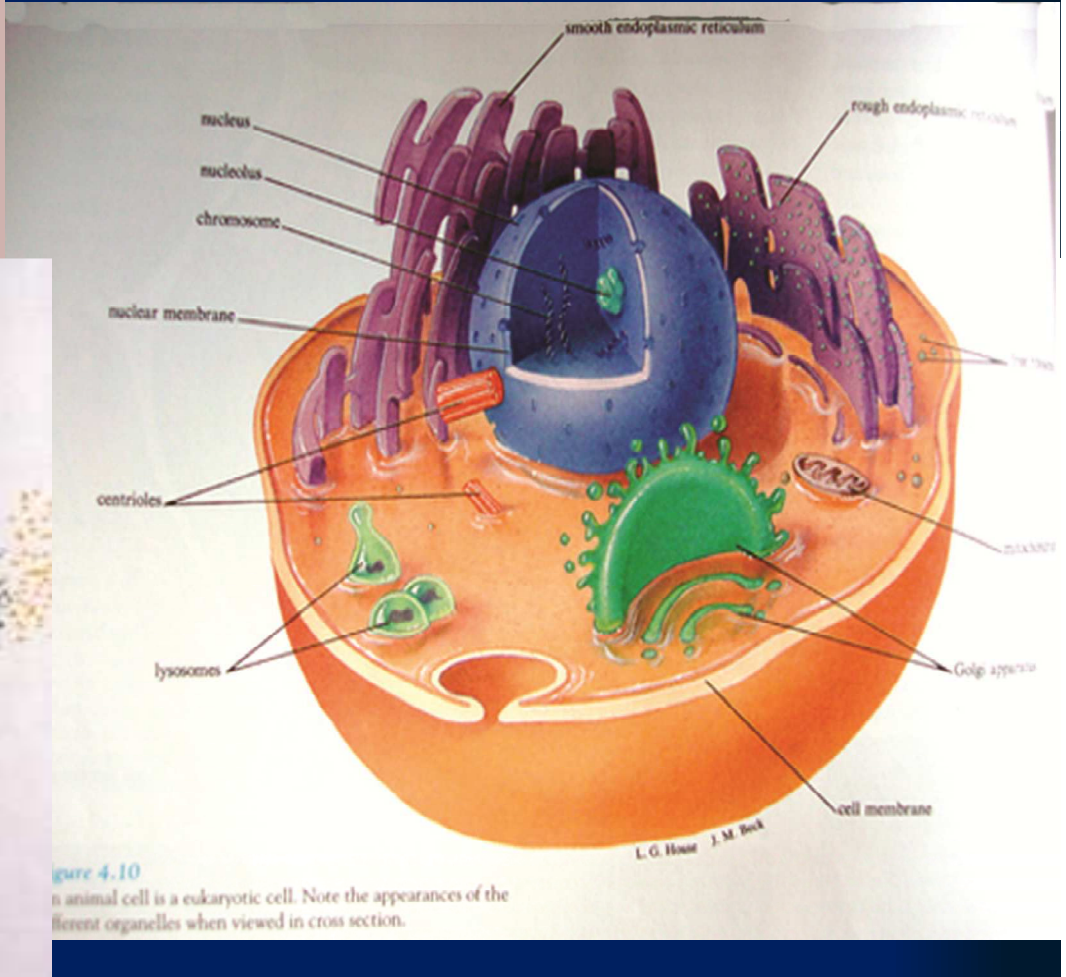
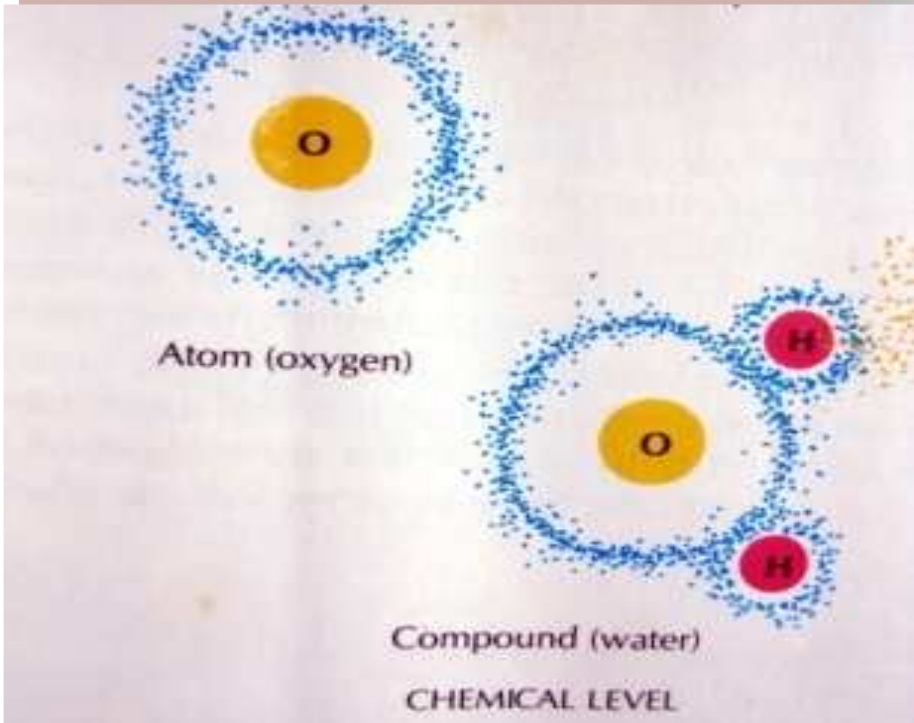
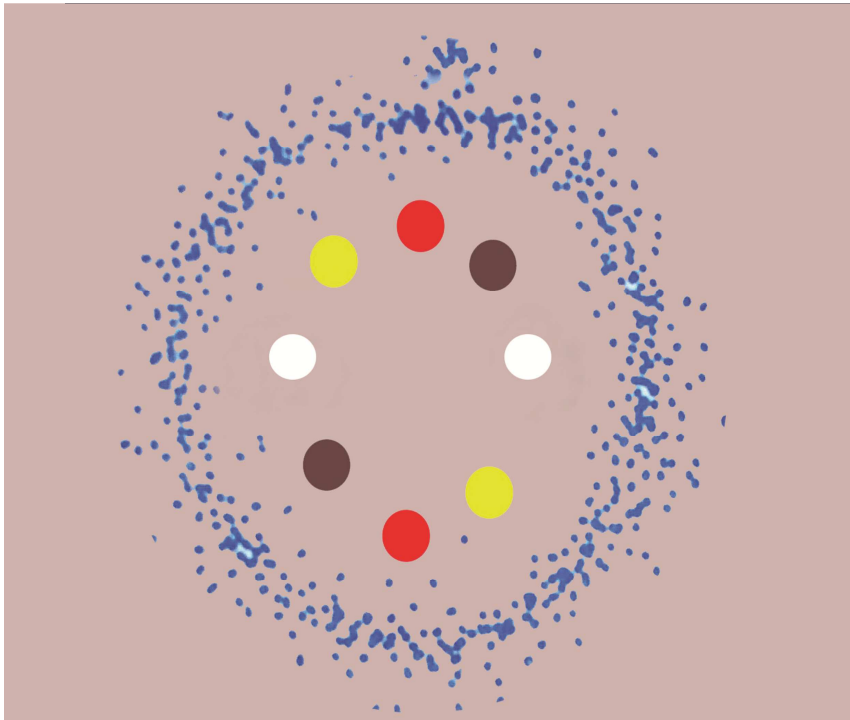


Conclusion

- The paper represents a new look and concept of a cell in modern perspectives for the young generation.

Suggestion

- As the year is the new year of peace, justice and prosperity for our country, we should (must).
- : Start Ahead and Stay Ahead of M.T.M.
- : organize S.I.Gs (small interest groups) of competent professionals to provide a Text Book of M.T.M in international language.
- : organize a working body of experienced practitioners to provide a guide line for Uniform Terminology in M.T.M based on the statement, Ancient Knowledge (Wisdom) relevant to Today's Health Care System.



Ref;

1. The essence of Buddha Abhidhama – Dr. Mehm Tin Mon
2. Gray's Anatomy
3. Human Anatomy and Physiology
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5. A New Look into Applied Anatomy for Myanmar Traditional Physicians-Prof; Dr. U Meik
7. A New Look and Concept of Integrated Basic Pathology for Traditional Physicians- Prof;Dr. U Meik
8. Wikipedia-8.8.2011
9. -Life

Person of the Year

