

The Living World

- ✓ Life is a unique, complex organisation of molecules that express itself through chemical reactions which lead to growth, development, responsiveness, adaptation and reproduction.
eg. Trees, shrubs, Cattle, Birds, Fungi, Bacteria etc.

What is Living ?

We can explain it by 2 methods –

- (a) Technical method : It includes the comparison between living and non-living.
- (b) Philosophical thoughts :

- ✓ Characteristic features of “Living beings’ are

A. All living organisms grow

- Two main characteristics of growth are
 - i. Increase in mass
 - ii. Increase in no. of cells
- It's a irreversible process which requires ATP expenditure
- When the rate of Anabolism is more than that of catabolism → Growth takes place
- Types of Growth :-

(a) Unicellular organism – can grow by

- i. Increase in mass of cell (main mode)
- ii. by cell division (but actually its a reproduction)
eg. Amoeba, Chlamydomonas, Volvox etc.

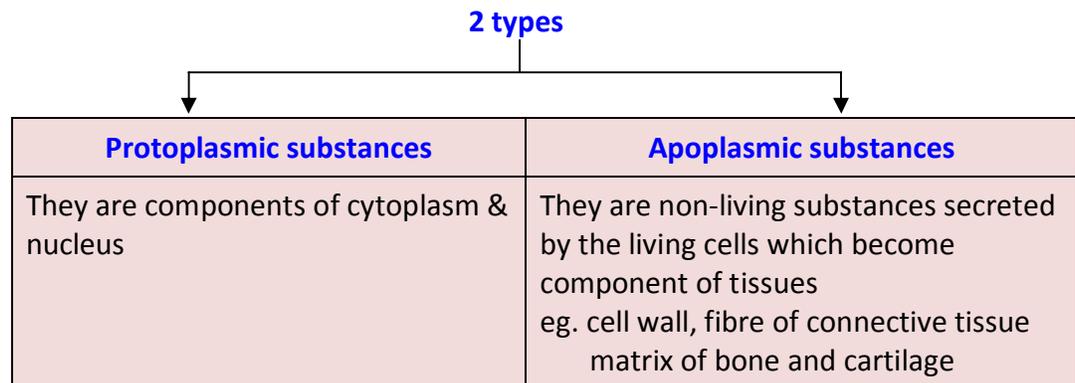
(b) Multicellular organism — can grow by

- i. Increase in mass of cell
- ii. by cell division → (main mode)
 - ◆ Plants :- growth is unlimited but localized
 - ◆ Animals :- growth is limited but unlocalized

Objection :- Dead organism does not grow but some non-living articles can grow
eg. Mountains, boulders, sand mounds etc.

Explanation :- In non-living growth takes place from outside or on the surface → Accretion
In living being growth is from inside → Intussusceptions.

In living being growth producing substances are of



Conclusion : Growth cannot be taken as defining property of living organisms.

B. Reproduction

It is the formation of new individuals of the similar kind.

For the unicellular organisms reproduction is synonymous with growth i.e., increase in cell number
e.g. Unicellular algae, Amoeba, Bacteria etc.

R Virchow - Ominis cellulae cellula (each cell arises from pre-existing cell)

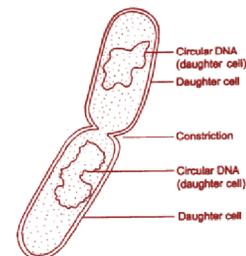
Types of Reproduction :

Vegetative Reproduction

✓ Fragmentation

- ◆ Bac. - Actinomycete
- ◆ Algae - Spirogyra, Ulothrix etc
- ◆ Fungus - hyphae
- ◆ Bryophyta - Funaria (moss)

In primary and secondary protonema

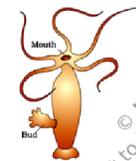
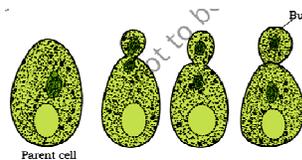


✓ Binary fission

- ◆ Bacteria
- ◆ Some protozoa

✓ Budding

- ◆ Bacteria
- ◆ Fungus - yeast - (Torulla)
- ◆ Porifera - hydra etc



✓ Regeneration

- ◆ In Planaria (flatworm)
A fragmented organism regenerates the lost part of its body and becomes a new organisms.

ASEXUAL

- ◆ Uniparental
- ◆ No gametes form
- ◆ No fertilization
- ✓ **By spores**
 - ◆ Endospores
 - ◆ Zoospores
 - ◆ Conidia / oidia
 - ◆ Chlamydo-spore
 - ◆ Aplanospore
 - ◆ Hyphospore
 - ◆ Akinetes
 - ◆ Palmella stage
 - ◆ Parthenospores

SEXUAL

- ◆ Biparental
- ◆ Gametes -2 types
- ◆ Fertilization → (2n)zygote
- ✓ **3 types**
 - ◆ Isogamous
 - ◆ Anisogamous
 - ◆ Oogamous

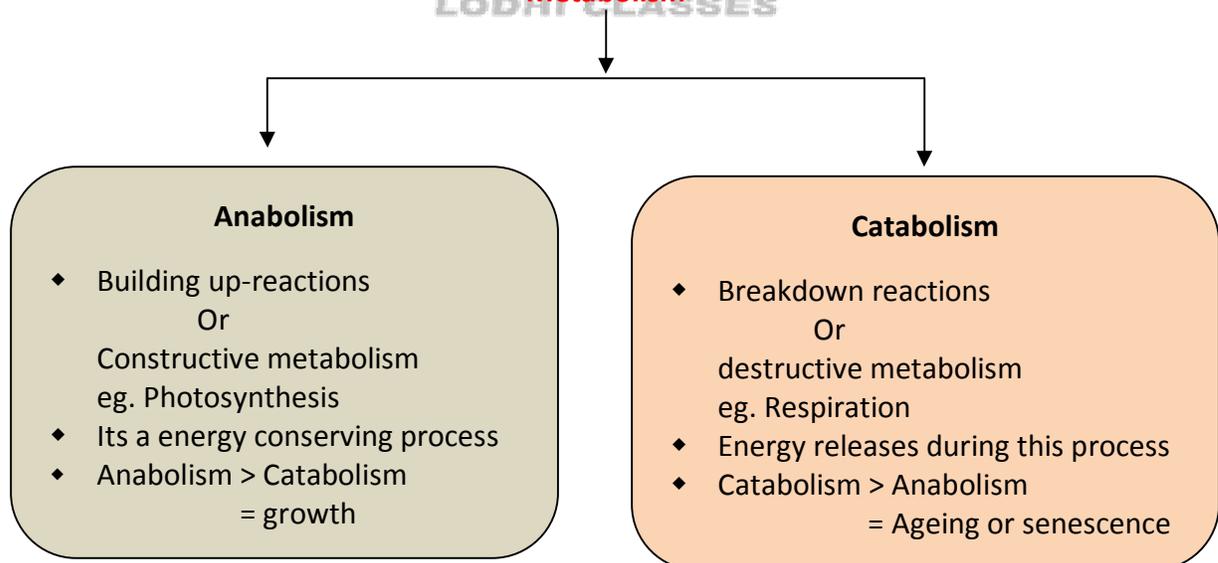
Objection : (i) No non-living object is capable of reproduction or replicating by itself
(ii) Many living organisms & cells do not reproduce .
eg. Mules, Sterile worker bees, Infertile human couples etc.

Result : Reproduction is not a defining characteristic of living organisms but no non-living object can reproduce or replicate.

C. Metabolism

All the chemical reactions occur in our body is known as Metabolism

Metabolism



Objections : Metabolic reactions can be demonstrated outside the body in cell-free system

Explanation : This types in-vitro performing metabolic-reactions are no living things but known as **living reaction** or 'Biological reaction

Result : ♦ Metabolic or physiological activities perform only by the living beings (unicellular or multicellular)
♦ **Metabolic activities** and **cellular organisation** of the body is the defining feature of life forms.

D. Consciousness

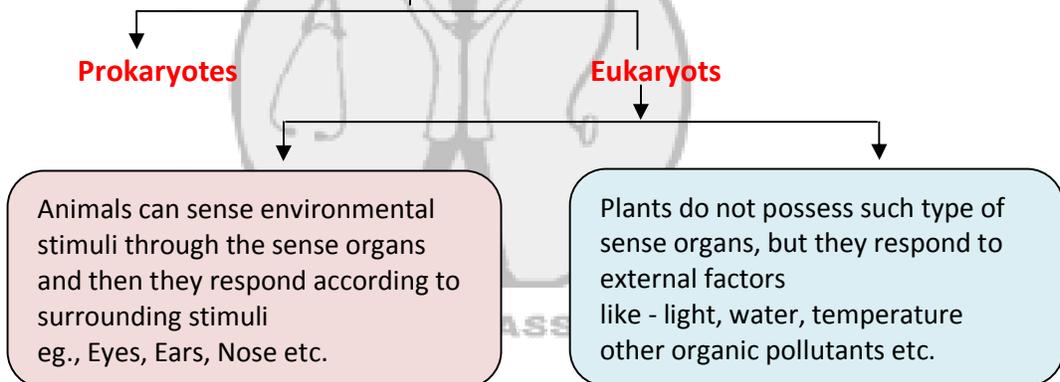
is the ability

- i. To sense their surroundings or environments &
- ii. Respond to these environmental stimuli

♦ Types of Environmental stimuli may be

- (a) Physical
- (b) Chemical
- (c) Biological

♦ All organism can sense & respond of environmental stimuli.



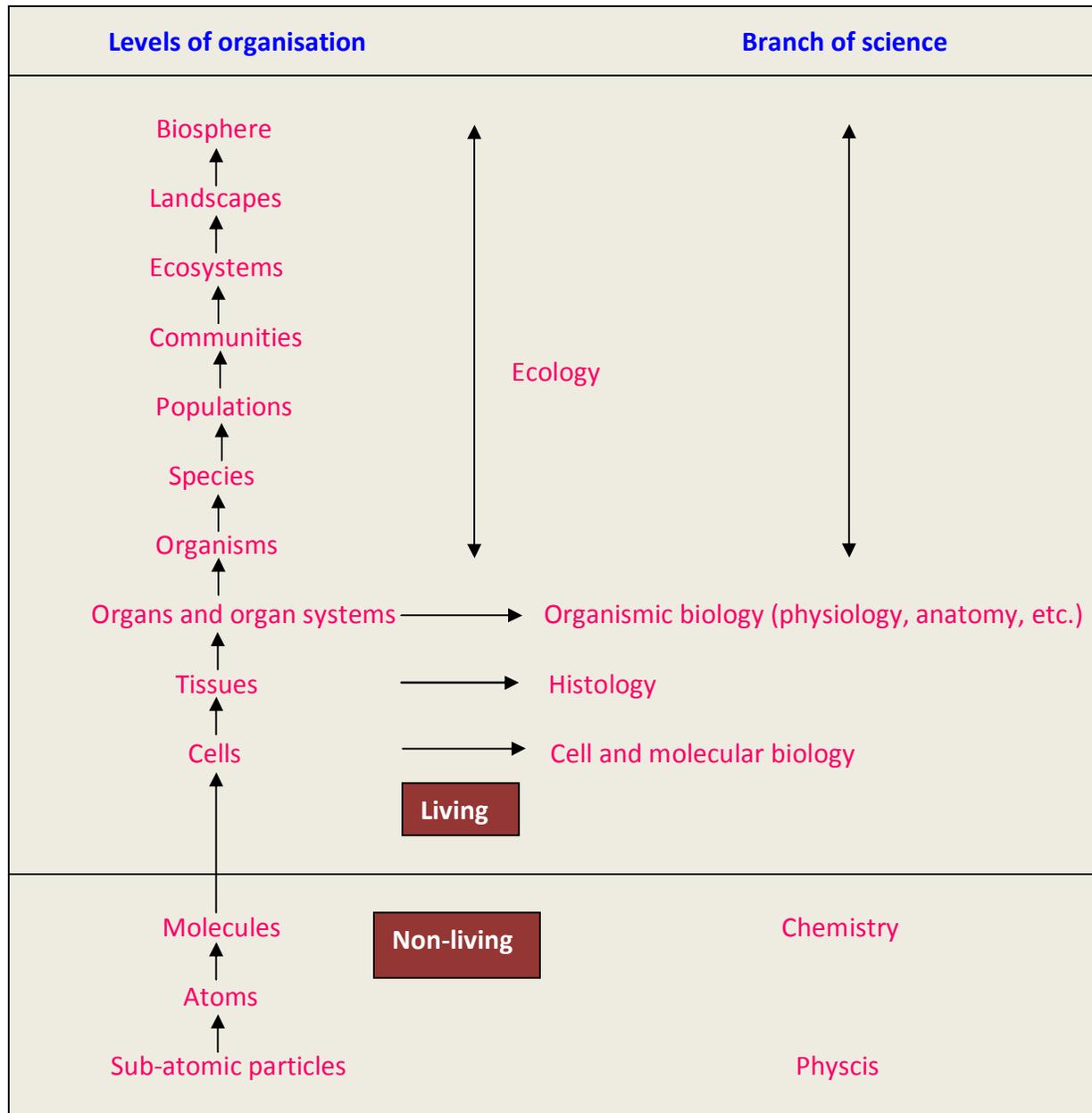
Special : ♦ Photoperiod affects reproduction in seasonal breeders, both plants and animals.

- ♦ For Human - Only human beings have an additional faculty of self consciousness (awareness of self)
Condition - For the human beings its more difficult to define the living state when a patients lying in coma (with brain-dead) with life supporting machines.
Conclusion - This type of human is not considered as a living due to lack of self consciousness.

Result : Consciousness is the defining property of living organism.

E. Organisation :

The hierarchy of biological organisation and the branches of their study



Note : Properties of a level is not present in its constituent sub. level.
In fact,

- ◆ **“Living organisms are self-replication, evolving and self-regulating interactive systems capable of responding to external stimuli”.**
- ◆ All living organisms - present, past and future, are linked to one another by the sharing of the common genetic material, but to varying degree.

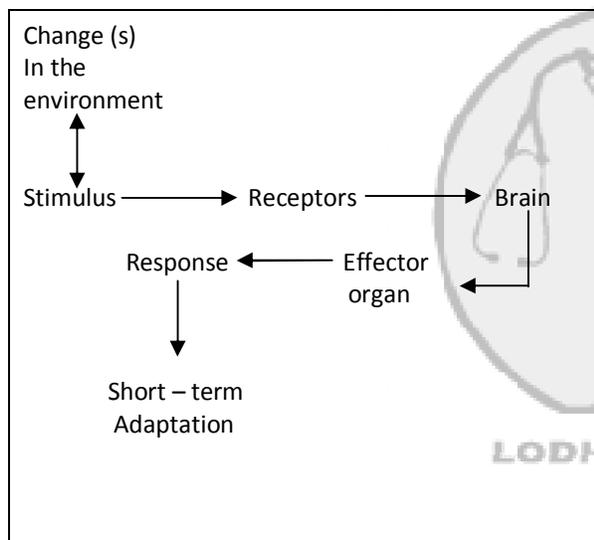
Other Living Characteristics

- F. Homeostasis** : living beings have a self regulated system to adjust and maintain the steady internal environment is known as homeostasis.
In multicellular organisms all the cells except reproductive cells contribute to the maintenance of Homeostasis
- G. Healing and Repair** : Living beings can repair and heal the broken and injured part.
- H. Adaptation** : Useful inheritable variations or changes in structural, physiological or behavioral characteristic of an organism, that enhances its chances of survival and ability to reproduce in its environment.

Adaptations are of two types-

Short-term adaptations

- ✓ These develop due to a temporary or a brief change in the environment.



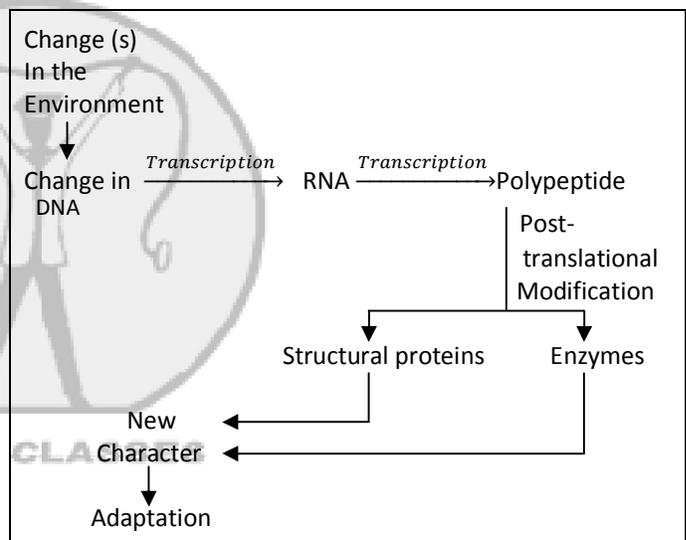
Development of short-term adaptation

Examples

1. Our skin becomes tanned (dark/black), when exposed to the sun for a long time.
2. Stem grows/bends towards light (Positive phototropism)
Roots grow downwards towards gravity (positive geotropism).
3. Hibernating animals maintain a very low rate of metabolism.

Long-term adaptation

- ✓ These are the adaptation which develop after a long period of time and result in permanent change(s)



Development of a long-term adaptation

Examples

1. Aquatic plants have aerenchyma to give buoyancy for floating.
2. Giraffe has a long neck to feed on the leaves of tall plants.
3. Kangaroo uses its tail as the fifth limb.
4. Night-blooming flowers are generally scented and white, to attract pollinators.
5. Some orchid flowers resemble the shape and colour of certain species of bees/flies; this helps in their pollination.