



# NEET - UG

NATIONAL TESTING AGENCY

## **Botany**

**Volume - 2**



# CONTENTS

1. Reproduction in Organisms	1
2. Sexual Reproduction in Flowering Plants:	18
3. Principle of Inheritance and Variation	42
4. Molecular Basis of Inheritance	85
5. Strategies for Enhancement in Food Production	122
6. Microbes in Human Life	135
7. Organism and Population	150
8. Biodiversity and Conservation	189
9. Environmental Issues	206
10. Environment Issues	226

# REPRODUCTION IN ORGANISMS

## **Panchanan Maheshwari:**

1. Father of Indian plant embryology.
2. First book of NCERT was published (in 1964) under the guidance of P. Maheshwari.
3. Fellowship - # Royal society of London.  
# Indian National Science Academy
4. Book:- An introduction to the embryology of Angiosperm.

## **# Organism:**

- \* It is the living unit of nature, which has following character.

Individual/Organism	Population Character
Birth	Birth rate
Death	Death Rate
Sex	Sex ratio
Age	Age ratio/Pyramid

## **Lifespan:**

- \* It is the time interval b/w birth and natural death of an organism.
- \* Life span period varies from few minutes to several years.
- \* Life span never depend on body size or body complexity of organisms.

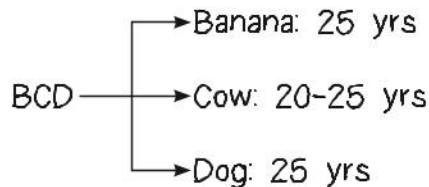
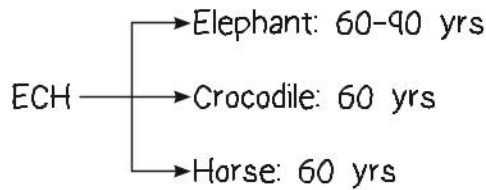
**Eg. –** Body size of crow and parrot are almost similar but lifespan of

1. Crow: 15 Yrs
2. Parrot: 140 yrs.

**Eg.-** Body size of Mango and Peepal tree are almost same but lifespan of

1. Mango: 200 yrs
2. Peepal: 2300 yrs

### More Examples:



### Reproduction:

- \* It is the biological process in which parents are involved and produce fertile offspring's, similar to itself.
- \* Requirement of reproduction:  
To ensure the continuity of species.

### Factors affecting Reproduction:

- \* External/ Environmental/ habitat factors.
- \* Internal factors/ internal physiology.

### Basic Characteristics/Property/Features of Reproduction:

#### Cell Division:

##### Mitosis

# Equational division

- \* Duplication of cell components.
- \* Increase the reproduction unit.

##### Meiosis

# Reductional division

# Responsible for creating variations (evolution)

## Types of Reproduction:

Asexual	Characters	Sexual
Single	No of Parents	Double
+/✓	Gamete formation	✓
×	Fertilization/syngamy	✓
Clone 100% Similar to parent (morpho. Of genetically)	Product	offsprings
Fast	Speed	Slow
+/✓	special organ invl.	✓
X	Involvement in solution	✓

### Note:

- \* Asexual reproduction, generally present in monera, Protista , Plant and Animals.(Simple body organisation)
- \* Animal and plant (higher) generally exhibit sexual reproduction.

## Asexual Reproduction:

### 1. Fission:

- \* It is the type of Amitosis cell division.
  - # Spindle fibre formation - Absent
  - # Direct karyokinesis - Present
- \* Types of Binary Fission :
  - ↓ Basis – division Plane

#### **Simple Binary Fission:**

- \* Cell divide from anyplane/not any fixed plane.
- Eg. Amoeba.

#### **Longitudinal Fission:**

Eg: Euglena

#### **Transverse Binary Fission:**

Eg. Paramecium, Diatoms, Bacteria.

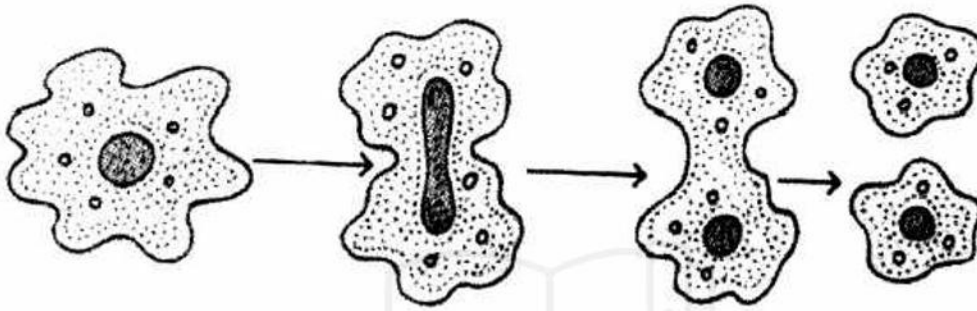
## 2. Multiple Fission:

# Plasmodium - In favorable conditions

# Amoeba divide by multiple fission.

# Amoeba in Adverse condition.

Amoeba:



## Encystment:

\* Formation of cysts (3 layers).

### Note:

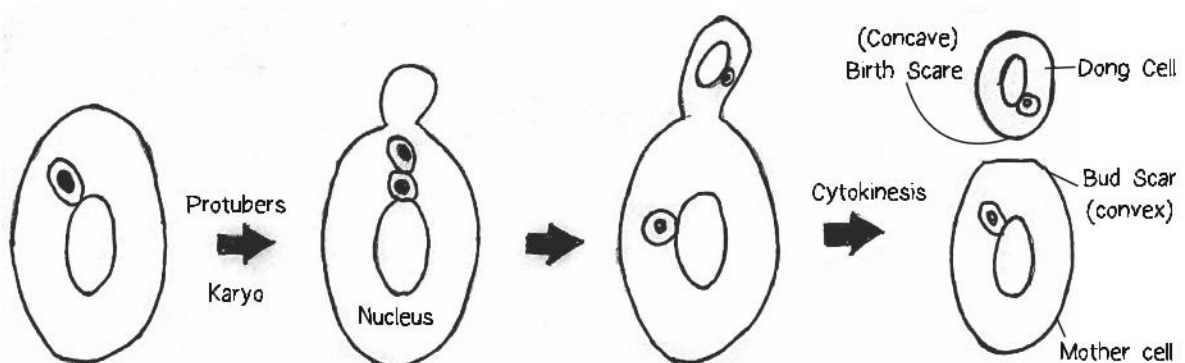
- \* Amitosis division present in bacteria (due to presence of direct karyokinesis).
- \* Mitosis division present in Amoeba and yeast (due to in-direct karyokinesis)

## 2. Budding:

- \* Unequal cytokinesis present in budding process.
- \* Existence of mother cell after the budding process.
- \* Protuberance (outgrowth) present in budding.

### Types:

- \* External Budding: Yeast, hydra
- \* Internal Budding: Porifera (Gemmules)



### 3. Spore- Formation:

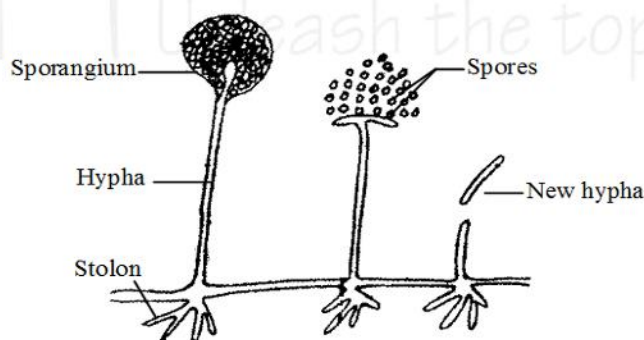
- \* Spore is a special structure present in fungi and Algae for reproduction.

#### Types of Spore:

Meiospore	Mitospore
* Formed by Meiosis Eg. Ex Ascospore and Basidiospore	* Formed by mitosis Eg: Zoospore, conidia, sporangiospore

#### Zoospore:

- \* Mostly present in algae. (because of motility) and oomycets.
- \* Motile structure → flagella +ve
- \* No. of Flagella = (1) or (2)
- \* Heterokont condition present.
- \* Formed in favorable condition (thin-walled)
- \* Zoospore formed in zoosporangia.
- \* Shape:
  - Pyriform
  - Kidney Shaped



Spore Formation in a Fungus (Rhizopus)

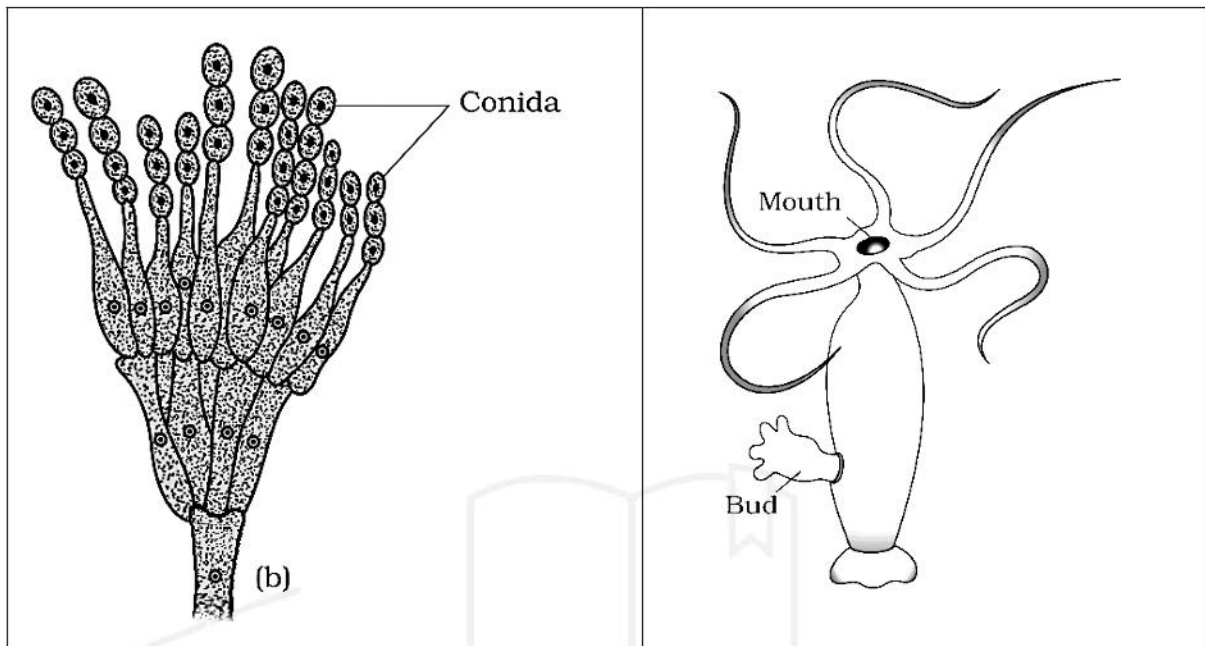
#### Conidia:

- \* Non motile structure.



- \* Flagella (Absent)
- \* Formed in favorable condition. (Thin wall present)
- \* Exogenous origin.

- \* Conidiophore - Hyphae at which conidia is formed.
- \* Ultimate branch at which Conidia is formed is medulla.



#### 4. Fragmentation:

Eg. Fungi, Algae (Spirogyra and Ulothrix), Protonema in Bryophytes.

↓  
Green creeping, Branched, Multicellular

**Note:** Spirullina unicellular green Algae.

#### 5. Vegetative Reproduction:

- \* Any somatic part of plant involved in reproduction and form a new progeny.
- \* Vegetative propagules : Part of Plant which is involved in vegetative Reproduction

**Types:**

##### 1. Natural Vegetative Reproduction:

##### A. By Root:

Tap Root	Adventitious Root
i. Dalbergia	i. Dahalia
ii. Popules	ii. Asparagus



## B. By Leaf:

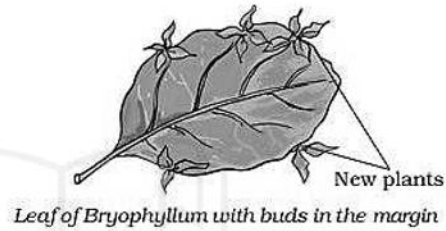
### Marginal Leaf Bud:

- eg: → Bryophyllum  
→ Bigoniya  
→ Kalanchoe



### Leaf Tip Bud:

- eg: Adiantum  
(walking fern)



## C. By Stem:

### 1. Underground stem:

- \* It is the prennating or Protective structure.

#### a. Rhizome:

- Eg: Dryopteris  
Ginger  
Turmeric  
Banana

- \* Branching
- \* Horizontal growth (Present)
- \* W.r.t. earth surface.
- \* Adventitious root. (Present)

#### b. Corm:

- Eg: Zaminkand (amorphophinres)  
Colocasia [vjch]  
Coccus [dslj]  
Colchicum  
Gladiolus

- \* Branching x
- \* Vertical growth

- \* Adventitious root (Present)

**c. Bulb:**

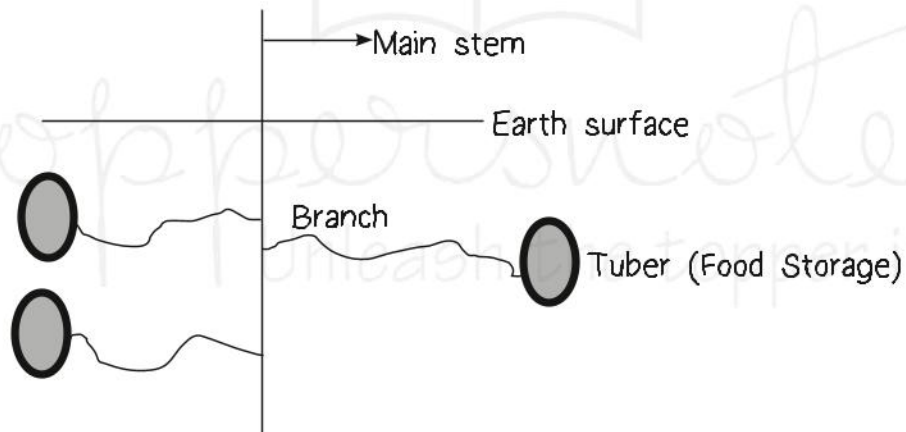
Eg: Onion, Garlic

- \* Disc shaped stem present.
- \* Adventitious root (Present)
- \* Edible part → FLESHY leaf.
- \* Dry leaf present in Bulb  
(Tunica)

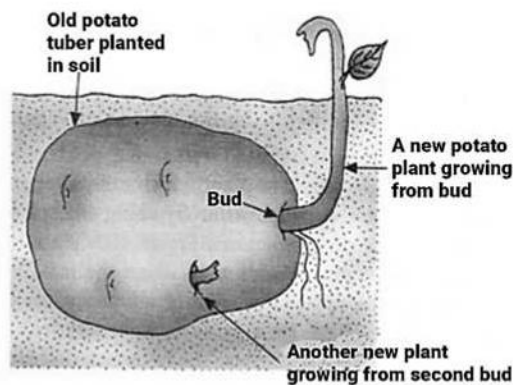
**Function of FLESHY LEAF:**

- \* Food storage
- \* Protection

**d. Tuber:**



eg: Potato



## 2. Sub-aerial Stem:

- \* It is responsible for increasing the distribution of plant in new habitat (niche)

### a. Runner:

- \* Long internode present
- \* Single OR few leaf present at node.

eg: Grasses



Runner

### b. Sucker:

- \* Underground branch of stem initially moves parallel to earth surface then upwards.
- \* Ca P Banana
- \* Chrysanthemum
- \* Pineapple



Sucker

### c. Stolon:

- \* Upper branch of stem initially move parallel to earth surface vertically downwards.
- \* J A M
- \* Jasmine
- \* Mint



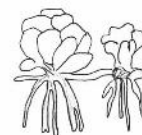
Stolon

### d. Offset:

Eg: Pistia, Eichhornia ( water Hyacinth)

Group/Tuft of leaves and root present at node.

Short internode present.



Offset

### Note:

- \* "TERROR OF BENGAL" : Eichhornia .
- \* Bengal Famine : Helminthosporium oryzae
- \* Eichhornia reduces dissolved oxygen (DO) level in water body (due to over growth)

- \* Entry of Eichornia into India due to shape of leaf and flower.
- \* Grow in standing OR stagnant water.

### 3. Bulbils:

It is the fleshy bud which is responsible for reproduction process.

- \* Gloriosa
- \* Oxalis
- \* Lily
- \* Dioscorea
- \* Pineapple
- \* Agave OR century Plant.

(modified florel bud convert to bulbils)

### 2. Artificial Vegetative Reproduction:

- \* Favorable Season: Rainy season, Spring season
- \* Pre requisites of artificial vegetative Reproduction:
- \* Presence of Bud.
- \* Formation of adventitious root.

#### Types:

##### Cutting Method:

- \* Cutting and Rooting Process Present.
- \* Auxin hormone (IAA, IBA, NAA) used for formation of adventitious root.  
eg: China rose, Rose, sensevieria, citrus, Blackberry, Raspberry.

##### Layering Method:

- \* Rooting and cutting Mechanism present.  
MECHANISM—
- \* The lower flexible branch of plant defoliated and pegged down into earth surface.
- \* Adventitious root formed due to the action of Auxin.

#### a. Tip Layering:

Ex: Blackberry and Raspberry.

**b. Tranche Layering:**

Ex: Walnut and Mulberry (शहदू)

**c. Goote or Air Layering:**

This method is generally used for tropical and subtropical tree and shrubs.

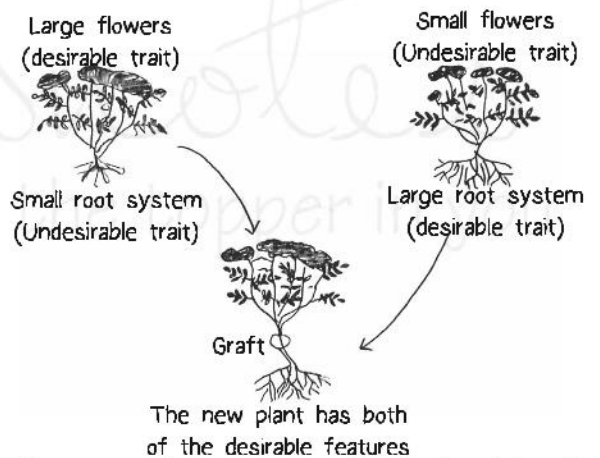
**Process:**

- \* Ring Bank removed from Tree branch.
- \* Medium applied at cut part of branched. Medium formed by following contents:
  - 1 part low-dung
  - 1 part moss
  - 2 part clay particles
- \* Auxin applied for formation of adventitious root.

eg:           Go                   Pa                   L                                   → Litchi  
              Goote               Pomegranate

**3. Grafting Mechanism:**

- \* It is the Mechanism to form a composite plant by using two different plants.
- \* Pre-requisite : cambium OR Vascular Tissue presence.



**Ques:** Calculate the no. of chromosomes in PEN (Primary endosperm nuc.), Antipodal cell, Integuments, synergid cell if 10 chromosomes present in leaf cell of composite plant?

**Soln.:**  
 $2n = 10$   
 PEN = 15  
 Antipodal = 5  
 Integument = 10  
 Synergic = 5

Characters	Annual	Biennial	Perennial
LIFE-SPAN	Single Season	Two season	> Two Season
EXAMPLES	Wheat, Rice, Maize	Raddish	Mango, Banana

<b>FLOWERING OR FRUIT FORMATION</b>	Monocarpic	Monocarpic	Polycarpic Plant (Most perennial)
	(All annual)	(All annual)	Bamboo, Strobilanthus Kunthiana are monocarpic perennial plants

- \* In Perennial Plant "Recovery stage" Present in b/w two successive flowering period. (not Juvenile stage)

## Life Stage:

### 1. Juvenile stage:

- \* Organism achieve the reproduction ability by growth and maturation in Juvenile stage .

### 2. Reproductive stage:

- \* Organism reproduce and from offspring which is similar to itself.

### 3. Senescent/Ageing/Post Reproductive Stage:

- \* Functional and structural deterioration of and organism.
- \* Senescent leads to death of an organism.

## Note:

1. All the three stages are clearly observed in annual and Biennial Plants.
2. Due to the interactions of Hormonal and Environmental change organism can shift from one stage to another stage.

PRE – FERTILISATION	FERTILISATION		POST-FARTILISATION
1. Gamete Formation	Most critical/vital went/stage of sexual reproduction		Formation of Zygote
By Mitosis Eg. Algal Bryophyta	External Fertilization ↓ Algal ↓ Location: In water	Internal Fertilization eg. Spirogyra Location: Bryophyta In Pteridopyta Archegonia Gymnosperm Angiosperm	Always $2n$ ↓ Growth Embryo formation eg. Bry, Pteri, Gymn, Anigo Algal – Embryo formation x ii) seed formation Gymno, Angio iii) Fruit formation –
2. Gamete Transfer – a) By $H_2O$ – Algal, Bryophyta, Pteridophyta Angiosperm, Gymnosperm carries of males gamete Pollen – grain Male gamete reached to ovule with the help of pollen Tube.	Location: In embryo sac. Exofertilisation/cross fertilization Endofertilisation/self fertilization		Only in Angiosperm. Zygote – vital link b/w two generations. * In some Algal and Fungi zygote becomes Thick walled in adverse condition.

## SOME TERMINOLOGY:

### 1. Monoecious Plant:

- \* Both Male and Female flower present in a similar Plant.
- \* Monoecious Plant = Bisexual Plant = Homothallic Plant
- Ex. (NCERT) Coconut, Cucurbits.

### 2. Dioeciously Plant:

- \* Both male and female flower present present at different plant.
- \* Dioecious Plant = Unisexual Plant = Heterothallic Date – Palm, Papaya
- Ex: Date – palm, Papaya

### 3. Isogamies Condition:

- \* Male and Female gametes are morphologically similar but not physiologically.
- Ex: Spirogyra, Chlamydomonas – Rhizopus (FUNGI)

### 4. Heterogamous Condition:

- \* Both Male and female gametes are Morphologically and Physiologically different.
- Ex: \* Fucus, Volvox, Red Algal.
- \* All Bryophyta, Pteridophyta, Gymnosperm and Angiosperms.

## Marchantia:

- \* Marchantia is dioecious Bryophyta

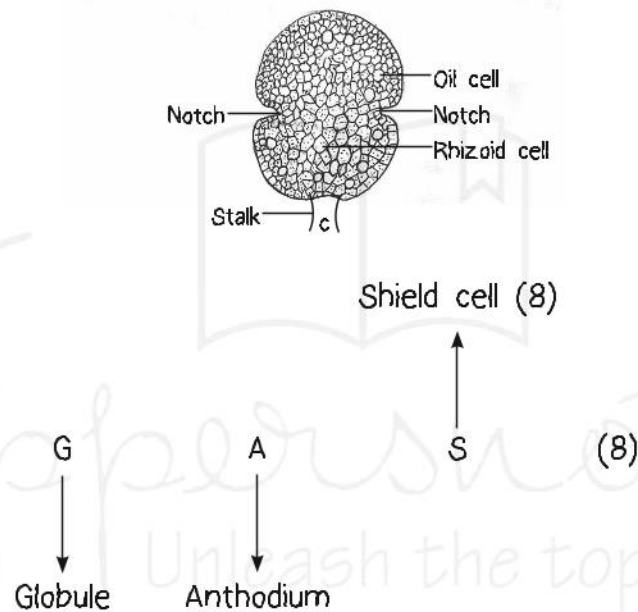


Fig: *Marchantia* spp. (A) Male plant, (B) Female plant.



**Chara:**

- \* Example of Monoecious Green Algal.
- \* Sex Organ Multinuclear and Jacketed.



Protandrous Condition present in chara.

**Unicellular Organisms are Immortal:**

- \* Plant Issued culture /Micro propagation is a type of artificial vegetative reproduction.

SOME IMPORTANT DIAGRAMS:

