# REPRODUCTION IN ORGANISMS

**R**eproduction is one of the most important characteristics of living beings. It is the process by which different species maintain their continuity and identity. Animals reproduce in a surprising variety of ways, some relatively simple, others extremely complex. Basically, reproduction is categorized as asexual or sexual on the basis of, whether it involves genetic recombination or not. Single-celled organisms, reproduce by the most basic of all the reproductive processes i.e. cell fission. Reproduction, which requires separate male and female parents, is called “sexual” reproduction.

## The Life Span

Every organism lives for a certain period of time. The life span is the period from birth to the natural death of an organism. It roughly tells us, how long a particular species of an organism, can live.

As life span is an average value, you will always have some exceptions i.e. a few members of a species exceeding their life span. This is called as maximum life span.

The life span of some organisms might seem very short while of others are reasonably long, when compared to organisms of different species.

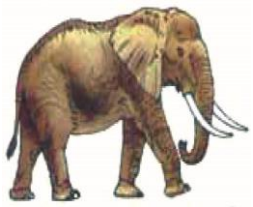
The life spans are not necessarily correlated with the body size of organisms e.g. the body sizes of crow and parrot are not very different yet there is a great difference between their life span.

The genetic makeup, metabolic rate, body size, age at sexual maturity and several other factors like habitat, quality of food, competitions, environmental conditions etc., collectively determine, the life span of an organism.

## The Reproduction

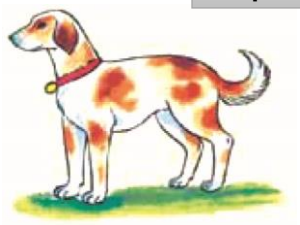
Inspite of variations in the life span of organisms, death is certain except single celled organisms (e.g. *Amoeba*), Let us think, how organisms of different species are successfully continuing their existence, over thousands of years, although their life spans are limited and death is certain? Definitely, there is involved, a process which results in their successors, at some stage, during their life span, before they die. Of course, this process is reproduction.

Reproduction is concerned with the continuity of life on earth. It may be defined as the biological process, through which, an organism gives rise to the offspring, with or without any variation in their genetic makeup. The newly produced offspring grow, mature and again produce offspring and so on. Thus, reproduction maintains the continuity of species throughout generations.



Elephant ( 75 Years)

Rose ( 10 Years)



Dog (15-16 Years)

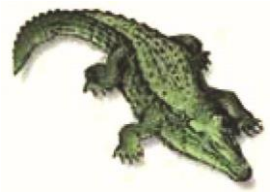
Butterfly (1 – 2 Weeks)

Crow (15Years)

Banana Tree (25 Years)

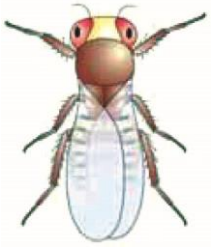
Cow (26 Years)

Parrot (140 Years)



Crocodile (60 Years)

Horse (50 Years)



Fruit fly (1 MONTH)

Rice Plant ( 4 Month)

Tortoise (300–500 Years)

Banyan Tree (300-500 Years)

Approximate life span of some organisms

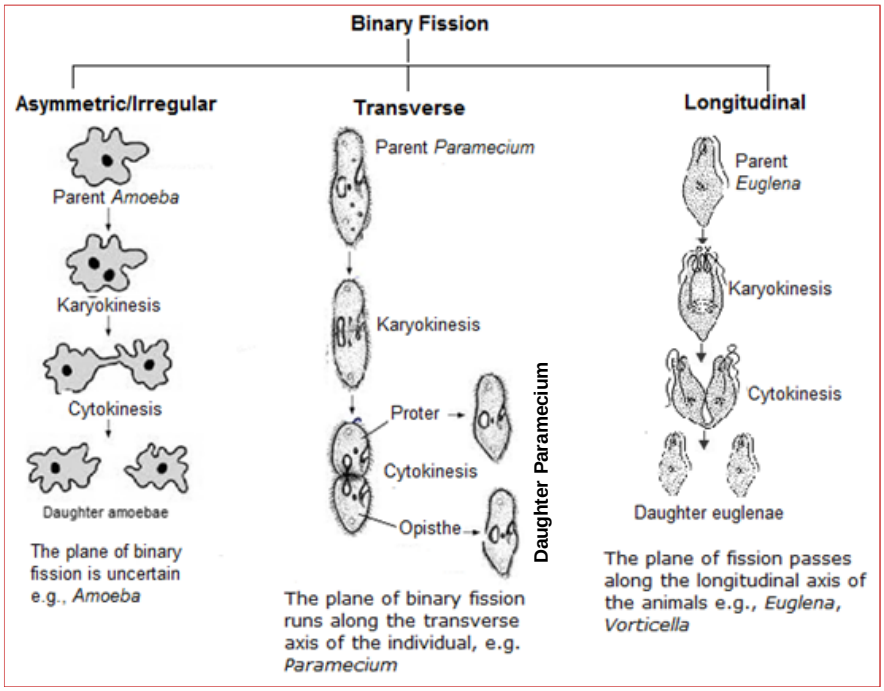
## Two types of reproductions: Asexual and Sexual

In the biological world, it may not be surprising to you, that different organisms have evolved different strategies for reproduction. Of course, it is due to the occurrence of variations in structure, physiology and habitat of organisms. In broad sense, there are two basic types of reproduction: asexual and sexual.

Asexual reproduction does not involve gamete formation and fusion. It is rapid, uniparental and less energy consuming, as there is no search, either for mate or for fertilization. On the other hand, sexual reproduction is slow, biparental and more energy consuming, as it involves search for mate as well as for gametes for the formation of zygote. But, sometimes, it is uniparental, as in the case of bisexual or hermaphrodite animals (e.g. *Taenia*).

### A. Asexual Reproduction

Asexual mode of reproduction (also called **agamogenesis** or **agamogeny**) involves the formation of new individuals, directly from the parent body or its parts, without involving the formation and fusion of gametes. Asexual reproduction occurs in unicellular as well as multicellular animals and plants of lower body organisation. The young ones, resulting from asexual reproduction are morphologically and genetically identical to their parents as well as to each other. Such a population of morphologically and genetically identical individuals is known as clone. Each member of a clone is termed as ramet. The members of a clone can however, differ morphologically due to the impact of environmental conditions.




#### 1. Fission

In this mode of asexual reproduction, the body of parent individual, divides into two or more, similar and equal sized daughter individuals. Single celled organisms (e.g. protists and monerans) reproduce by this mode of asexual reproduction. Fission may be binary fission or multiple fission.

**a. Binary fission**

in this type of fission, the parent individual divides into two equal halves, each of which becomes an independent daughter individual. In yeast, however, binary fission is unequal. The binary fission involves all the steps of mitosis e. g. karyokinesis and cytokinesis. Depending upon the plane of division, it may be irregular or asymmetric, transverse and longitudinal.

**b. Multiple fission:** In this type of fission, nucleus divides several times, by mitosis to produce many nuclei, without involving cytokinesis. Subsequently, each nucleus gathers, a small amount of cytoplasm around it and the parent individual splits into many small daughter cells (e.g. *Amoeba*, *Plasmodium*, *Monocystis*). In due course of time, each of these daughter cells, starts a free life and transforms into an adult individual.

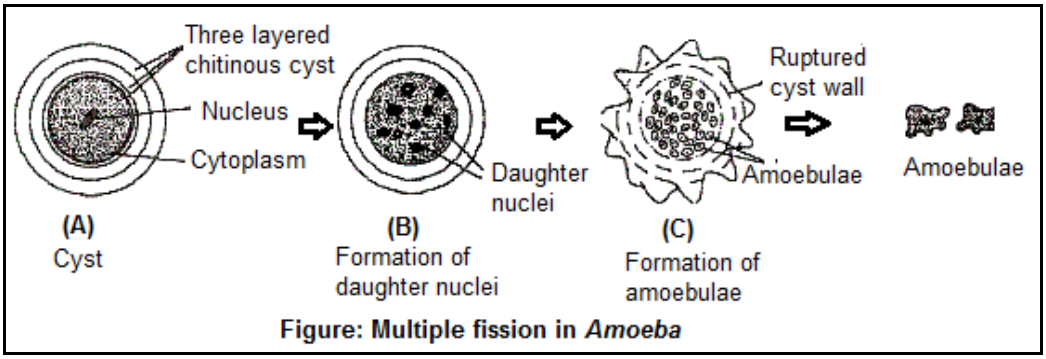



**Figure: Multiple fission in *Amoeba***

## Encystation

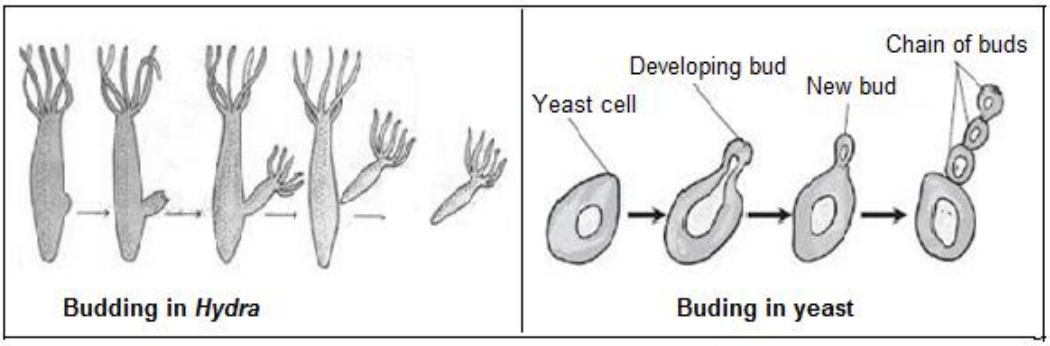
During adverse environmental conditions, *Amoeba* withdraws its pseudopodia and secretes a three layered, hard, chitinous, covering or cyst wall around itself. This phenomenon is termed as encystation. During favourable conditions, the encysted *Amoeba* divides by multiple fission and produces many minute amoebae or pseudopodiospores; the cyst wall bursts out and the spores are liberated in the surrounding medium to grow up into many amoebae. This phenomenon is known as sporulation. Protists like sporozoans (e.g. *Monocystis*, *Plasmodium*) typically exhibit sporulation in their life cycles.

## 2. Plasmotomy

It is the division of a multinucleate protozoan into multinucleate daughter individuals by cytoplasmic division but without nuclear division e. g. *Opalina*

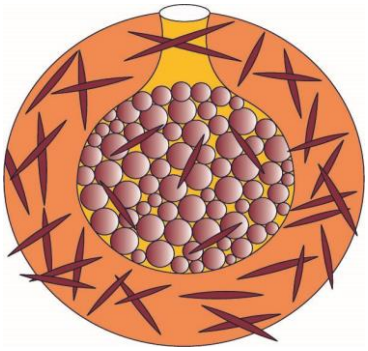
## 3. Budding

This mode of asexual reproduction is exhibited by some multicellular organisms of simple organisation e.g. *Hydra* and some single celled eukaryotic forms e.g. yeast. In budding, initially, a small **external** outgrowth appears over the parent's body, which later develops into a miniature individual. It, then separates, from the parent's body, to lead an independent life. Sometimes, the buds do not detach from the parent individual and form a colony e.g.*Obelia*




## 4. Gemmulation

In most of, the fresh water sponges (e.g. *Spongilla*) and some marine sponges (e.g. *Sycon*), the parent individual produces a specialised mass of cells enclosed in a common opaque envelope to form **gemmule.** On germination, each gemmule gives rise to a daughter individual. The **archaeocytes,** present in the gemmule, divide and transform into various types of cells. Gemmules are thought to be **internal bud.**



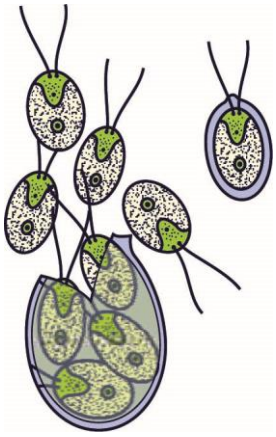
Structure of a gemmule

### 5. Fragmentation

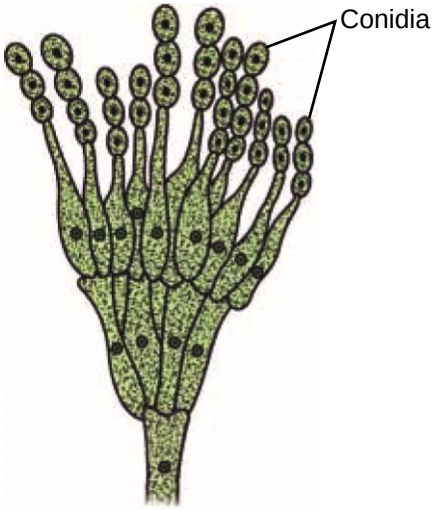
In this mode of asexual reproduction, the parent's body, breaks into distinct pieces, each of which can develop into an independent daughter individual (e.g. *Hydra*, some marine worms, starfishes amongst animals and bryophytes in plants).

### 6. Zoospores and conidia

**The m**embers of kingdom fungi, reproduce asexually by conidia, sporangiospores and zoospores. However, simple plants like algae, most commonly reproduce by zoospores.



Zoospores of Chlamydomonas




Conidia of Penicillium

**Resonate the Concept**

- The advantages of this kind of asexual reproduction, which can occur either naturally or artificially, stem from the fact that it can occur more rapidly than seed propagation and can allow a genetically superior plant to produce unlimited copies of itself without variations. Hence, vegetative reproduction is important in plant breeding in maintaining desirable traits of a hybrid throughout generations without introduction of genetic variation.

## Vegetative reproduction in plants

In vegetative reproduction, new plant arises from the vegetative part (e.g. stem, root and leaf etc.) of the parent plant. It is a form of asexual reproduction, as it doesn't involve genetic recombination and hence variations in the progeny. The new plants resulting from vegetative reproduction represent a clone.

**Methods of vegetative reproduction in plants**

**a.** **Underground stem :** Axillary buds(in the axils of leaves on stem nodes) give rise to new plants e.g. **tuber** (e.g.potato), **rhizome** (e.g.banana, turmeric, ginger, fern), **corm** (e. g. *Crocus*, *Colocasia*, *Amorphophallus*), **bulb** (onion, garlic).

**b.** **Sub-aerial stem :** Shoot apex and stem nodes give rise to new buds. These buds detach from the parent plant and produce new plants e.g. **runner** (grass), **stolon** (strawberry), **sucker** (e.g. *Chrysanthemum,* rose, mint), **offset** (e.g. *Eicchornia*).

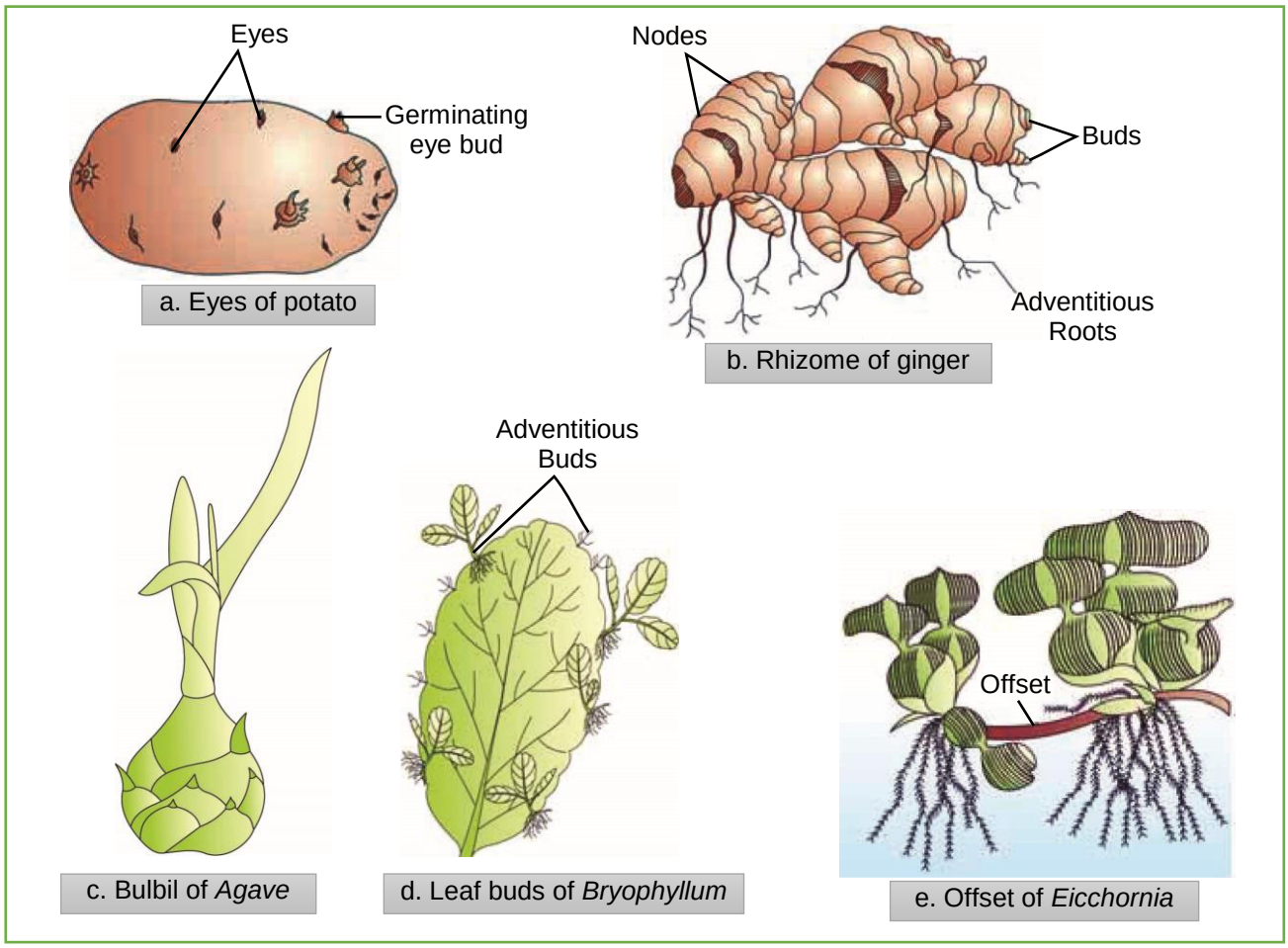
**Resonate the Concept**

- *Eicchornia* is commonly called as water hyacinth or **terror of Bengal**. It is native of America and introduced in India due to its beautiful leaves and flowers (ornamental features). After introduction, it became a serious problem of stagnant fresh water bodies (e.g., pond, lake etc.). It propagates rapidly and heavily drains water and dissolved oxygen from water bodies leading the death of aquatic animals.

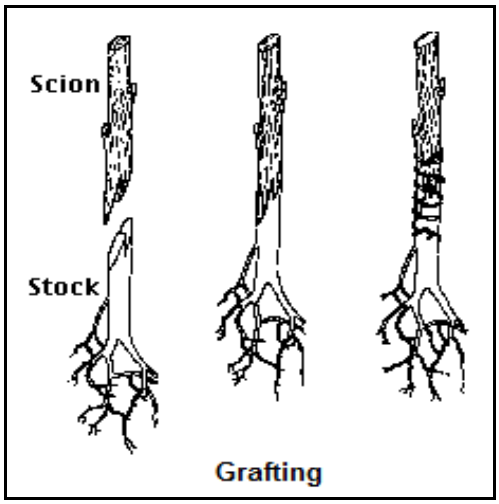
**c.** **Leaves :** Adventitious buds develop into the notches of leaf margins and give rise to new plans e.g. *Bryophyllum*, *Adiantum* (walking fern), *Begonia* etc.

**d.** **Roots :** In some fleshy and tap roots, adventitious buds develop and give rise to new plants e.g.guava, *Dalbergia* (shisham), sweet potato, dahlia, *Asparagus*.

**e.** **Bulbils :** These arise on fleshy axillary bud and behave asperennating bodies during unfavourable conditions. In suitable environmental conditions they detach from the parent plant and give rise to new plants e.g.*Agave***,** *Aloe*, *Oxalis*, *Dioscorea*.




**f. Grafting :** It is an artificial form of vegetative propagation, in which, parts of two young plants are joined together, first by artificial means and then by tissue regeneration. Typically, a twig or bud is cut from one plant and joined to a rooted plant of a related species or variety. The twig or bud is called the **scion**, and the plant onto which it is grafted (and that provides the roots) is called the **stock**. The scion eventually develops into an entire shoot system. It often allows horticulturalists to combine the best features of the two different plants into one plant. It can only be performed in dicotyledonous plants.



## Test your Resonance with concept

**1.** Gemmules are special reproductive structure for asexual reproduction present in
(1) *Chlamydomonas* (2) *Penicillium*
(3) *Hydra* (4) Sponge

**2.** Development of female gamete (ovum) to form an organism without fertilization is called as
(1) Gametogenesis (2) Implantation
(3) Parthenogenesis (4) None of these

**3.** Natural parthenogenesis is found in
(1) house fly (2) honey bees
(3) *Drosophila* (4) All of these

**4.** Binary fission is a form of
(1) Sexual reproduction (2) Asexual reproduction
(3) Both of these (4) Vegetative propagation

**5.** Organism which can show both binary fission and multiple fission is
(1) *Euglena* (2) *Paramecium*
(3) *Amoeba* (4) *Planaria*

**6.** The term blastogenesis is used for the
(1) Formation of blastula (2) Formation of blastocoel
(3) Formation of blastomeres (4) Formation of organism by Asexual reproduction

**7.** Identify the correct statement.
(1) *Amoeba* is an immortal organism
(2) Sporulation is only found is fungi
(3) Encystment is the mode of reproduction in *Planaria*
(4) Human is a seasonal breeder

**8.** Complete parthenogenesis is found in
(1) Honey bee (2) House fly
(3) *Lacertillia* (4) All of the above

**9.** The structure for asexual reproduction in a sponge is
(1) Gemmule (2) Bud
(3) conidia (4) Zoospore

**10.** Natural parthenogensis occurs in
(1) Aphids (2) *Apis indica*
(3) *Lacerta saxicola* (4) All of these

### Answers

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | (4) | **2.** | (3) | **3.** | (2) | **4.** | (2) | **5.** | (3) |
| **6.** | (4) | **7.** | (1) | **8.** | (3) | **9.** | (1) | **10.** | (4) |

## B. Sexual Reproduction

It involves production of offspring by the formation and fusion of specialised male and female cells i.e. the gametes. Gametes serve as a link between two the parents and their progeny. They fuse to form the zygote, which finally develops into a new organism.

Sexual reproduction was an early evolutionary achievement for multicellular organisms. Some lower animals and plants reproduce both, asexually and sexually. However, majority of multicellular animals reproduce sexually.

Inspite of differences in external morphology and internal structure of organisms, they possess nearly same reproductive patterns. The life cycle of all organisms consists of three distinct stages: juvenile phase (for animals) or vegetative phase (for plants), reproductive phase and post reproductive or senescence phase. These stages are however, more distinct and clear in annuals and biennials rather than perennials.

An organism must pass through the juvenile or vegetative phase to reproduce sexually. It is of variable duration in different organisms e.g.rice and wheat start flowering after 3- 4 months of vegetative growth;marigold takes about 55-60 days to start flowering, Coconut and areca nut start producing flowers only when they reach an age of 6-8 years and mango takes 4-5 years of vegetative growth to flower.

Some higher plants, after a period of vegetative growth, start flowering irrespective of the season. But some plants, flower only in a particular season of the year. We often see seasonal availability of some fruits e.g. mango, apple, jack fruit, orange etc. Based on the duration required for the plants to produce flowers, they have been classified into **annuals**, **biennials** and **perennials**. Annuals complete their vegetative growth and flowering in one season and then they die. Biennials have vegetative growth in one season and flowering in the next season. But perennials live for many years and flower seasonally.

Most plants exhibit multiple reproductive cycles in their life. They are called **iteroparous** or **polycarpic** e.g. mango, guava, banyan etc. **Semelparous** or **monocarpic** plants on other hand, show only a single reproductive episode before death e.g bamboo (exhibits flowering only once after 50-100 years), *Strobilanthus kunthiana* (flowers after 12 years).

Most of the animals reproduce sexually only during favourable conditions e. g. birds do not lay eggs throughout the year. Thus, the reproduction in birds and other animals like frogs and lizards is a seasonal phenomenon. In contrast, continuous breeders like man, can reproduce throughout the year.

Animals which reproduce more than once show many cycles within a single life time. An animal reaches maturity and then goes through cycles of producing and releasing gametes. There are species of animals which reproduce only once and then die e.g. drones of honey bee.

### Resonate the Concept

- Higher animals and plants predominantly adapted sexual mode of reproduction rather than asexual one. It was probably due to increased security with evolution of internal fertilization viviparity; reduced cost of reproduction by lowered number of progeny production and genetic variations in the progenies which enabled them to survive better in changing environmental conditions.
- Variations in the period of vegetative growth to enter into the sexual phase in different plants are due to requirement of varied **photoinductive cycles**.
- Vegetative period in plants prolongs upto appearance of first sign of flowering. Thus the **inter-flowering period** in plants that reproduce several times in their life cycle is considered as mature.

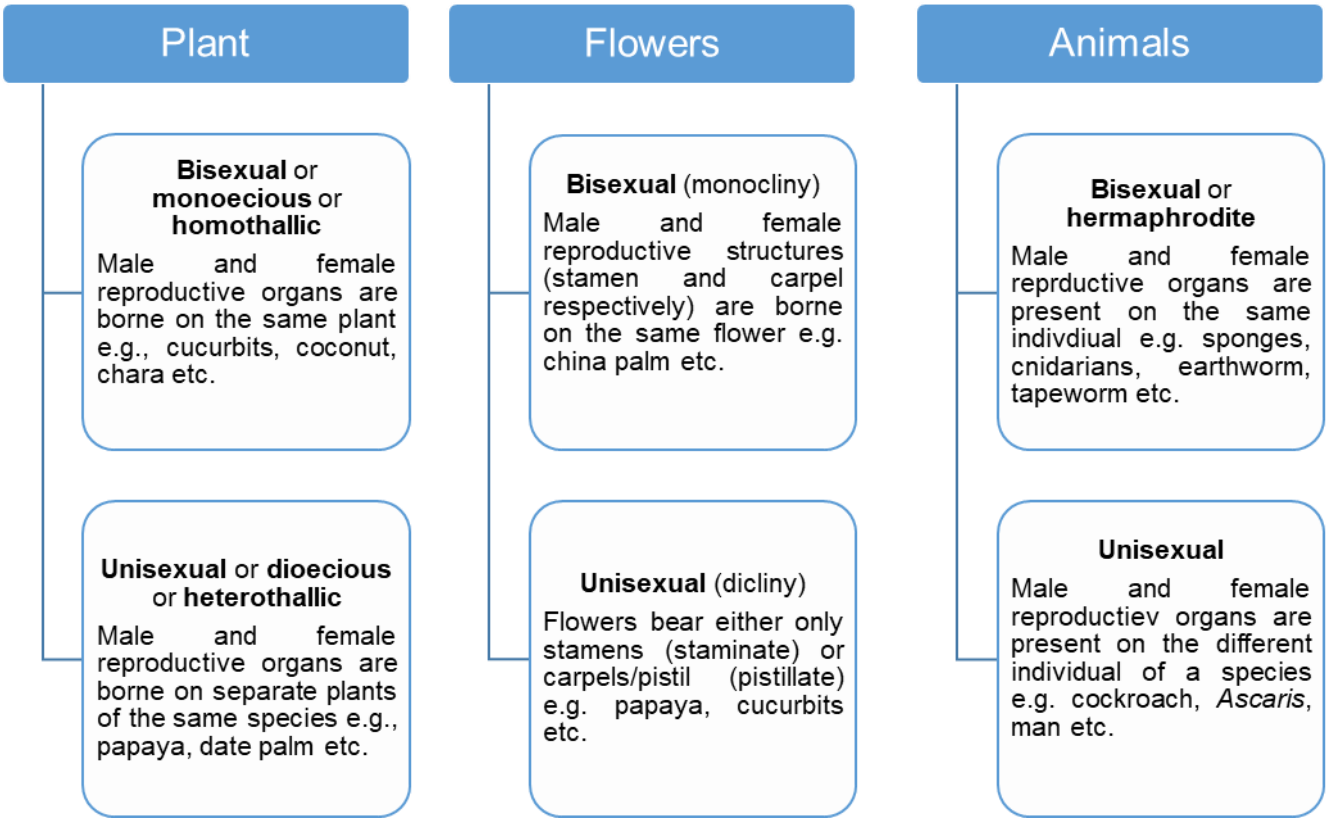
There is an internal system to control the reproduction in animals. It is neuro-endocrine system. The hormones stimulate follicular development and ovulation (release of egg) and also prepare the uterus for pregnancy in human females. The female sexual cycle, called the **menstrual cycle** is carried on throughout the year with single ovulation in a month unless the woman becomes pregnant. In mammals such as sheep, cow, rat and dog which reproduce seasonally, cyclical changes during reproduction are referred to as the **oestrus cycle.**

**Resonate the Concept**

- An organism has a limited amount of available energy and must distribute it among various functions i.e. **trade-off** or **adjustment** of available energy between fecundity, growth and survivorship in its life history. These trade-offs come into play in the evolution of iteroparity and semelparity in organisms. This is why semelparity is exhibited by boom of flowering and production of more offspring in their single fatal reproductive episode **(big-bang reproduction)** than do closely related iteroparous species in any one of their reproductive cycles.
- Reproductive maturity in human beings is characterized by appearance of beard and moustache, development of musculature, enlargement of penis, low pitched voice, narrowing of hip in males while the development of breasts, initiation of menstruation, widening of hip and high pitched voice in females.

In mammals, the reproductive phase comes to an end as the organism grows old. This is accompanied by the decrease in the metabolic efficiency and ultimately the death.Both in plants and animals, hormones are responsible for the transition between three phases.

## Sexuality in organisms



## Resonate the Concept

- Most of the unisexual animals show **sexual dimorphism** e.g. *Ascaris*, cockroach etc. However, star fish is unisexual but do not show sexual dimorphism.
- It is interesting that most hermaphrodites do not exhibit self-fertilization, e.g. in earthworms, two animals copulate and each inseminates the other. Usually, it is due to **protandry** or **protogyny**.
- Tapeworm (*Taenia solium*) is a bisexual animal and exhibits self fertilization.

**Events in sexual reproduction**

The entire sexual reproduction in organisms has following events:

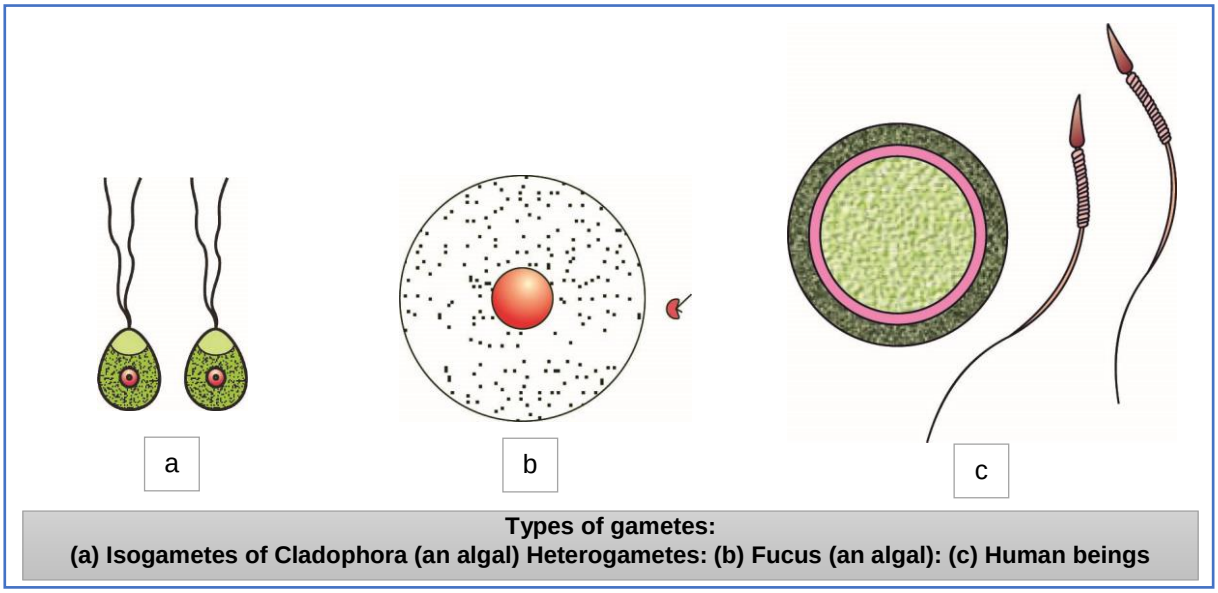
1. Pre-fertilization events
2. Syngamy or fertilization
3. Post-fertilization events

**1. Pre-fertilization Events**

Pre-fertilization events include two processes: formation of gametes(gametogenesis) and transfer of gametes.

**i. Gametogenesis**

The phenomenon of formation of gametes is known as gametogenesis. The gametes are of two types :male and female. They are always haploid. When the two gametes are morphologically identical and it is not possible to differentiate between them into male and female gametes, they are called as **isogametes** or **homogametes** e.g. some algae (e.g. *Ulothrix*, *Cladophora*). **The heterogametes** are morphologically dissimilar and can easily be differentiated from each other.The majority of higher organisms are heterogametic. In plants, the male and female gametes are called as **antherozoids** (e.g. *Fucus*, bryophytes) or male gametic nuclei (carried by male gametophyte formed due to the germination of **microspore** or pollen grain e.g. mango, *Hibiscus*) and **egg** respectively. In animals, the male gametes are called as **sperms** and female gametes as **ovum** (e.g. Man). In comparison to male gametes, female gametes are always produced in greater number.




**Types of gametes:**
**(a) Isogametes of Cladophora (an algal) Heterogametes: (b) Fucus (an algal): (c) Human beings**

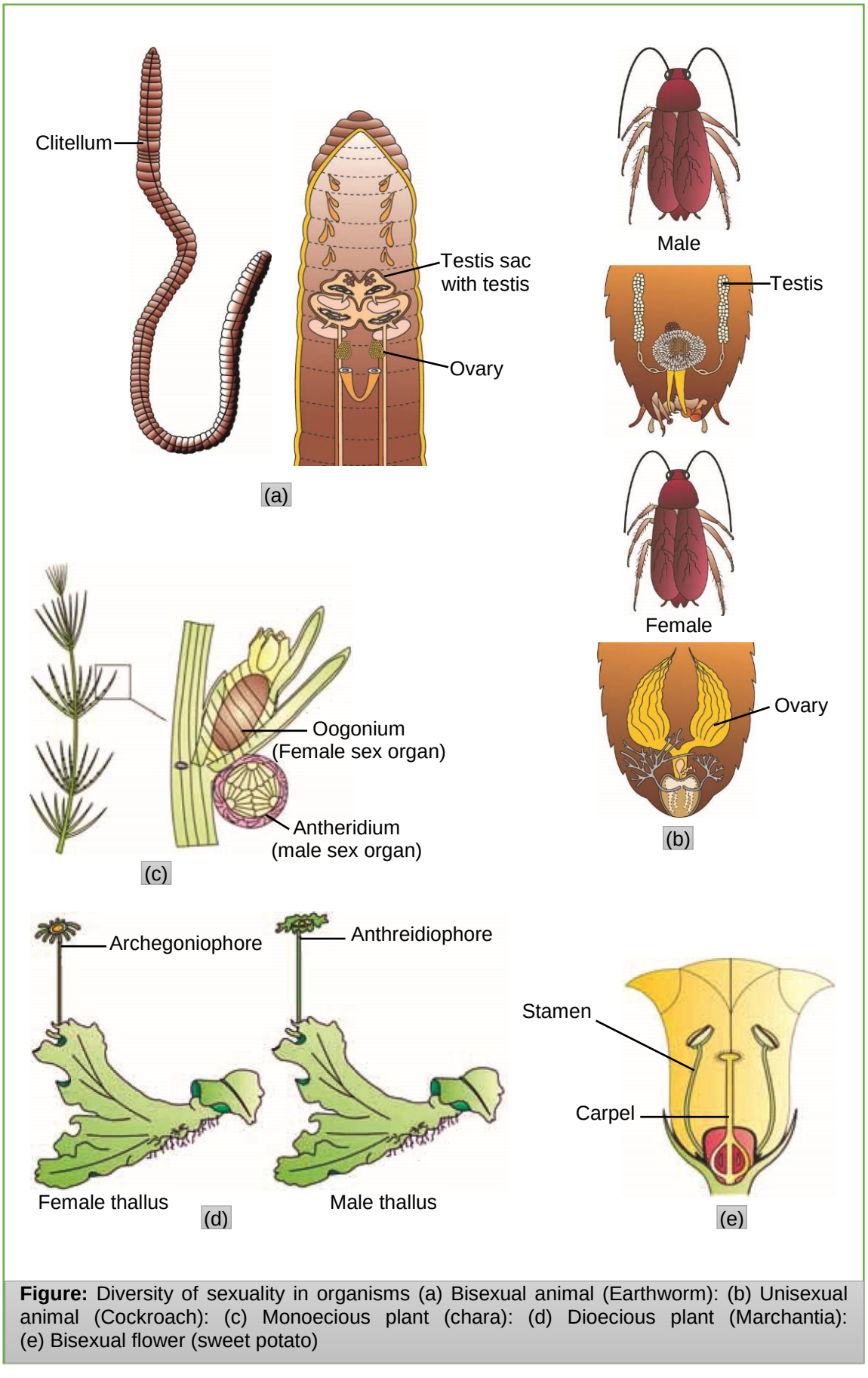



**Figure:** Diversity of sexuality in organisms (a) Bisexual animal (Earthworm): (b) Unisexual animal (Cockroach): (c) Monoecious plant (chara): (d) Dioecious plant (Marchantia): (e) Bisexual flower (sweet potato)

**Cell division during gametogenesis**

**Table: Chromosome number in Meiocytes (diploid, 2n) and Gametes (haploid, n) of some Organisms. Fill in the Blank Spaces**

| Name of organism | Chromosome number in meiocyte (2n) | Chromosome number in gamete (n) |
|---|---|---|
| Human beings | 46 | 23 |
| House fly | 12 | **6** |
| Rat | **42** | 21 |
| Dog | 78 | 39 |
| Cat | **38** | 19 |
| Fruit fly | 8 | 4 |
| Ophioglossum (a fern) | **1260 (highest in plants)** | 630 |
| Apple | 34 | 17 |
| Rice | 24 | 12 |
| Maize | 20 | 10 |
| Potato | 48 | 24 |
| Butter fly | 380 | 190 |
| Onion | 32 | 16 |

Gametes are always haploid though the parent body may be haploid or diploid. The monerans, several algae, fungi and bryophytes have haploid plant body while pteridophytes, gymnosperms, angiosperms and most of the animals including human beings are diploid organisms. In diploid organisms, haploid gametes are produced via meiosis in **meiocytes** (gamete mother cells). In haploid organisms, the gametogenesis involves mitosis. Thus, gametogenesis via meiosis is characteristics of diploid organisms only.

**ii. Gamete transfer**

After the formation of gametes, it is essential that male and female gametes are brought together in physical contact. The most primitive mechanisms for copatible gametes to come together are chemical cues. In a majority of organisms, male gamete is motile and the female gamete is stationary. Whether fertilization is external or internal, there is always a need of the medium, through which male gametes move and reach to the female gamete/s,e.g. water serves as a medium to move the male gametes in algae, bryophytes and most of the pteridophytes.

Being motile, the male gamete has to move and to reach the female one after crossing several physical barriers. This is why male gametes are produced in much greater number than that of female gametes.

**Resonate the Concept**

- Meiosis is an essential feature of sexual reproduction. It results in the formation of gametes, each with half the number of chromosomes of the parent cell (meiocyte).
- If meiosis does not occur, fusion of gametes will result in doubling of the chromosome number in the sexually produced progenies. This would result doubling of chromosomes in the individuals of successive generations.
- Sexual reproduction results genetic variations as well as maintains chromosome numbers in the progenies.

In seed plants, the transfer of gametes takes place by **pollination**. It is the transfer of pollen grains from anthers to the stigma/s of the same flower (**self pollination**) or different flower borne at the same or different plant/s of a species (**cross pollination**). The pollen grains (carriers of male gametes) reach the stigma, germinate and discharge the male gametes in the ovule (carrier of egg) through the pollen tube. This leads to fertilization.

Animals have evolved different strategies for the transfer of gametes,e.g. many animals secrete sex pheromones to attract their partners. Some insects like the silkworm and moth produce pheromones and attract males to mate and release the gametes. Several marine invertebrates, release their gametes into water, thus there is no need for the parents to make direct physical contact. In others, male releases sperms into the reproductive tract of the female during the mating. The semen of the and secretions of the female reproductive tract provide a medium for sperms to move and fertilize the ovum.

| Comparison chart for self and cross pollination | |
|---|---|
| **Self pollination** | **Cross pollination** |
| Pollens shed directly onto the stigma. | Takes place by wind, insects, water or animals. |
| It results in more uniform progeny. | It results in variation in the species, as genetic information of different plants are combined. |
| It does not need to spend energy for attracting pollinators. | It relies on the existence of pollinators that travel from plant to plant. |
| It involves autogamy or geitonogamy. | It involves allogamy. |
| Seen in peanut, orchids, pea, sunflower, wheat, barley, oat, rice, romato and potato. | Seen in pumpkin, tulip, grasses, dandelion and maple. |

**2. Syngamy and Fertilization**

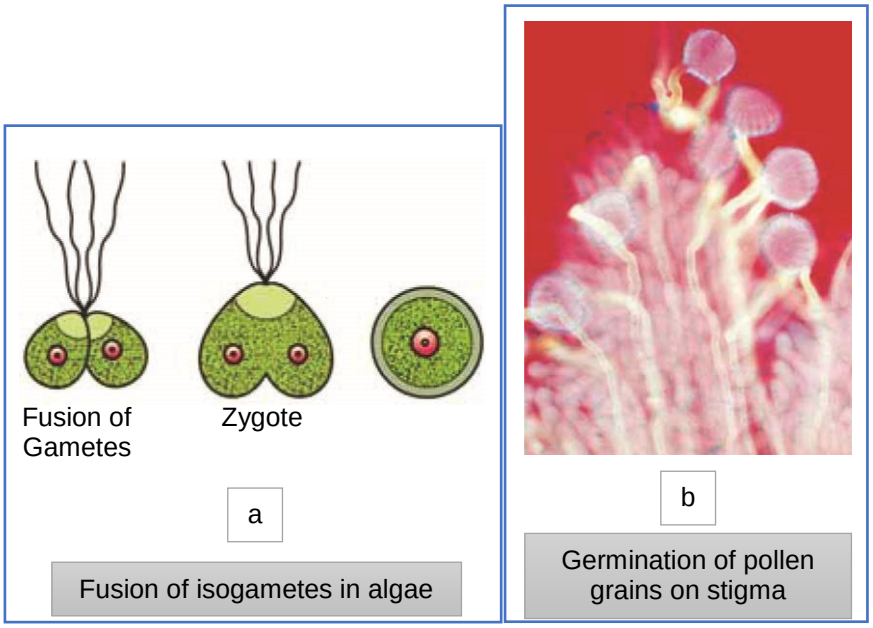
The most important step in the process of sexual reproduction is the fusion of male and female gametes. Although, the terms **syngamy**and **fertilization** are used synonymously but the actual act of fusion of gametes is syngamy whereas ferilization includes all the events that ultimately lead to syngamy. The result of syngamy and fertilization is the formation of a diploid zygote (a cell containing a set of chromosomes from each parent).

In most of the cases, external fertilization usually does not involve mating. The gametes are released in the surrounding medium where fertilization takes place. It essentially requires **watery medium**. Frogs have **external fertilization**, yet a form of mating takes place. Even fishes, which cannot easily hold on to one another, may have courtship leading to pairing of male and female, before eggs are laid and fertilized.

**Internal fertilization** requires direct contact between the two sexes. In most birds, the openings of the reproductive systems are simply brought together, through which sperms are transferred. This is a brief encounter, typically for a very few seconds. Snails, insects and mammals have developed special copulatory organ for the delivery of sperms. In higher animals sperms are motile and reach the ovum by swimming into the fluid of semen and the secretions of female's reproductive tract. In contrast, the male gametes are delivered near the eggs through pollen tube in seed plants.

**Resonate the Concept**

- Some animals (e.g. ants, bees, wasps) show an unusual type of sex differentiation. The males are haploid and produce haploid sperms by mitosis. The females are diploid and produce haploid eggs by meiosis. If an egg is fertilized, it develops into female while unfertilized eggs develop into males.
- The phenomenon of production of two types of eggs (haploid and diploid) is called, **haplodiploidy** or **arrhenotoky**.




### 3. Post-fertilization events

As mentioned above, in all sexually, reproducing organisms, the fusion of male and female gametes results in the formation of a zygote. In organisms with external fertilization, zygote is formed outside the body, usually in water as in frogs and bony fishes etc. In organisms exhibiting internal fertilization, zygote develops inside the body of the organism. The post fertilization events include:

**Embryogenesis**

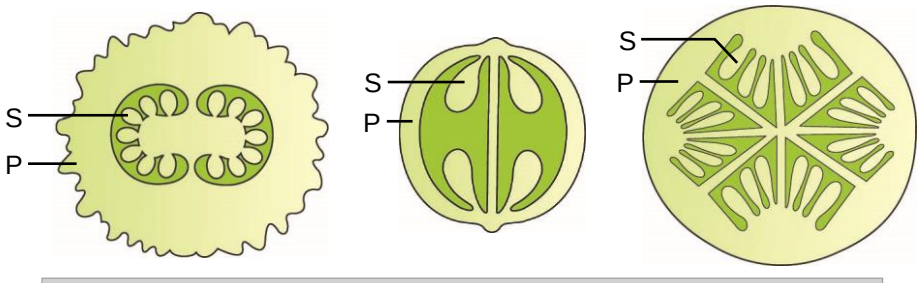
The development of an embryo from the diploid zygote is known as embryogenesis. It is a complex process which involves **cell division** and **cell differentiation**. These events proceed according to the genetic information contained in the zygote and ultimately lead to the formation of mature animals. How amazing that from one fertilized zygote, different cells as that of liver, muscle, nerve and skin are produced. These cells differ from one another in that they synthesise different enzymes and structural proteins. The developing embryo grows in size, at the expense of food derived from outside. The mammalian embryo is nourished by the placenta.

Depending upon the development of the zygote inside or outside the body of the female parent, organisms have been classified into oviparous or viviparous. Oviparous organisms lay eggs (e.g. some species of sharks, skates, bony fishes, frogs, lizards, birds), the yolk in the egg supplies food to the embryo.

In some oviparous organisms (e.g. reptiles and birds), the fertilized eggs are covered by hard calcareous shell or in some cases with a leathery coat. Such eggs are laid in a safe environment, where they are incubated for a certain period of time after which young ones hatch out. In viviparous organisms, on the other hand, development of fertilized egg into embryo takes place within the uterus of the female parent and the offspring is born as a juveniles. The embryos in viviparous organisms receive nourishment from the mother's blood through placenta.

Many species of sharks are Ovoviviparous. In such organisms, the eggs are incubated within a modified portion of the oviduct called uterus and the young ones are born after hatching. During the development, they depend on stored yolk for their nourishment.

In the flowering plants, the zygote is formed inside the ovule. After fertilisation, the sepals, petals and stamens of the flower wither and fall off. The pistil however, remains attached to the plant. The zygote develops into the embryo and the ovules develops into the seed. The **ovary** develops into the **fruit** with a thick wall called **pericarp** that is protective in function. After dispersal, seeds germinate under favourable conditions to produce new plants.




**A few kinds of fruits showing seed (S) and protective pericarp**

## Resonate the Concept

- Development adult from unfertilized of haploid egg is called **parthenogenesis**. However, the failure of syngamy or fertilization does not always involves parthenogenesis.
- In some plants the sepals remain attached even after the formation of fruits e.g. brinjal, *Capsicum* etc.

## Test your Resonance with concept

**1.** Haploid number of chromosomes is found in
(1) *Amoeba* (2) Bacteria (3) Gamete (4) Zygote

**2.** Which of the following is immortal?
(1) Plasma cell (2) Germ cell (3) Brain cell (4) Kidney cell

**3.** Sequential and regular conversion of zygote into an animal is known as-
(1) Embryogenesis (2) Blastogenesis (3) Morphogenesis (4) None of the above

**4.** If female reproductive organs mature before male reproductive organs in a bisexual organism, this phenomenon is known as
(1) Protandry (2) Protogyny (3) Parthenogenesis (4) None of the above

**5.** Development of female gamete (ovum) to form an organism without fertilization is called as
(1) Gametogenesis (2) Implantation (3) Parthenogenesis (4) None of these

**6.** Which of the following is not a bisexual animal?
(1) Leech (2) Cockroach (3) Earthworm (4) Tapeworm

**7.** Estrous cycle is characteristic of
(1) Mammals (2) Human females
(3) Mammalian females (4) Mammalian females other than those of primates

**8.** The gametogenesis in animals occurs in
(1) Ovaries (2) Testes (3) Gonads (4) Oviducts

### Answers

**1.** (3) **2.** (2) **3.** (1) **4.** (2) **5.** (3)
**6.** (2) **7.** (4) **8.** (3)