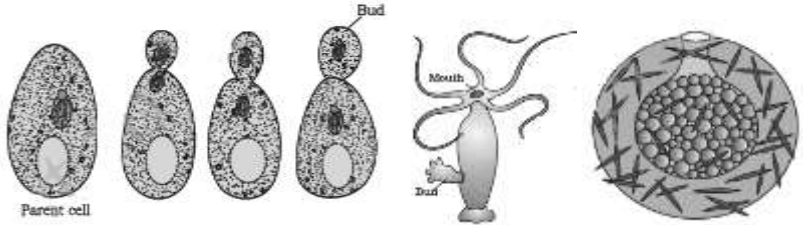
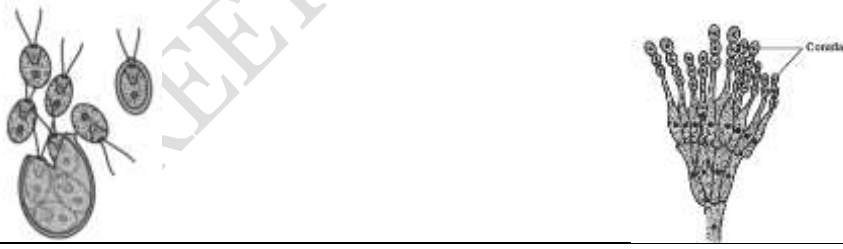


CHAPTER 1
REPRODUCTION IN ORGANISMS

Definitions:

Reproduction	a biological process in which an organism gives rise to young ones similar to itself.
clone	The term clone is used to describe such morphologically and genetically similar individuals formed in asexual reproduction.
Fission	parent body divides into two or more parts and each of which develop into a new individuals. (WHERE CELL DIVISION IS A MODE OF REPRODUCTION)
Binary Fission	The type of fission in which parent body divides into two individuals. Example: protozoa (e.g., Amoeba, Paramecium)
Multiple Fission	The type of fission in which parent body divides into more than two daughter organisms Example: paramecium, amoeba, plasmodium
Budding	one or two small outgrowth develops on the part of parent body called bud which after some growth may separates from the parent body and develops into new individual example: sponges (gemmules), hydra and corals, yeast 
Regeneration	The reformation of lost parts of the body is called as Regeneration. Example: star fish, a lizard can regenerate its tail, hydra
Fragmentation	Parent body splits off into many pieces and each grow into new complete individuals is called fragmentation. Example: It is common in sponges, algae, bryophyte
Sporulation	The process of formation of unicellular spores is called Sporulation Example Sporulation occurs in bacteria, protozoan, algae, fungi, mosses and fern as well as plants. <ul style="list-style-type: none"> The most commonly produced asexual spores are: Zoospores in algae (motile structures) conidia in Penicillium (nonmotile structures) 
meiospores	Spores produced by meiosis.
Meiocytes	cells that undergoes meiosis called meiocytes Number of chromosomes in gametes will be half of meiocytes.
Vegetative Propagation	Process of development of a new plant develops from a vegetative part (root, stem, leaf etc.) of the plant.
vegetative propagules	The units of vegetative propagation such as stem, leaves roots or buds
Parthenogenesis	without fertilization egg develops into new individual Parthenogenesis is common in some insects like honey-bees, wasps, ants, rotifers (aquatic microscopic invertebrates belongs to pseudocoelomata), birds (turkey), reptiles (whiptail lizards, comodo dragon) and some species of fishes (some species of shark) and amphibians (salamanders).
life span	The period from birth to the natural death of an organism.
Embryogenesis	The process of development of embryo from the zygote.
Syngamy	Fusion of gametes

Importance of Reproduction:

1. Maintain the continuity of the species
2. Genetic variation is created

Types of Reproduction

1. Asexual Reproduction

- a. Fission
 - b. Budding
 - c. Regeneration
 - d. Spore formation
 - e. Fragmentation
 - f. Vegetative Propagation
2. Sexual Reproduction

Difference b/w asexual and sexual reproduction:

Asexual Reproduction	Sexual Reproduction
Fusion of gametes does not take place	Involve formation and fusion of male and female gametes
Requires only a single parental organism	Two parents (opposite sex) are involve
offspring produced are exact copies of their parents (CLONES)	Variety of organisms are produced

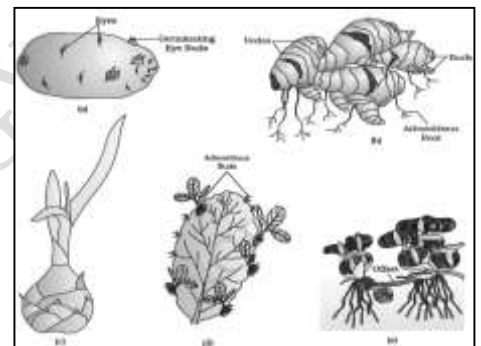
Why do we say there is no natural death in single-celled organisms?

(There is no natural death of unicellular organisms. When they reproduce through fission, cytoplasm and germplasm divides into two daughter cells through mitosis.)

Vegetative Propagules:

- runner (grass)
- rhizome (banana and Ginger)
- sucker (mint)
- tuber (plants emerging from the buds (called eyes) of the potato tuber)
- offset ('water hyacinth')
- bulb (onion, garlic) are all capable of giving rise to new offspring
- **Adventitious buds**

Adventitious buds arise from the notches present at margins of leaves of Bryophyllum helps in vegetative propagation of plant. This ability is fully exploited by gardeners and farmers for commercial propagation of such plants.



The 'terror of Bengal':

- The 'terror of Bengal' is the aquatic plant 'water hyacinth'
- It is one of the most invasive weeds found growing in standing water.
- This plant was introduced in India because of its beautiful flowers and shape of leaves
- It can propagate vegetatively (by offset) at a phenomenal rate and spread all over the water body in a short period of time
- It is very difficult to get rid of them.
- It depletes oxygen from the water body and results into fish mortality.

Is vegetative reproduction also a type of asexual reproduction? (Yes, single parental and produce clones)

Is the term clone applicable to the offspring formed by vegetative reproduction? (Yes, genetically and morphologically identical progeny)

Significance of Asexual Reproduction-

1. Fast mode of multiplication
2. Useful in seedless plants
3. Identical copies or clones are formed

It is interesting to note that asexual reproduction is the common method of reproduction in organisms that have a relatively simple organisation, like algae and fungi and that they shift to sexual method of reproduction just before the onset of adverse conditions.

Q. Why is sexual reproduction favoured under unfavourable conditions?

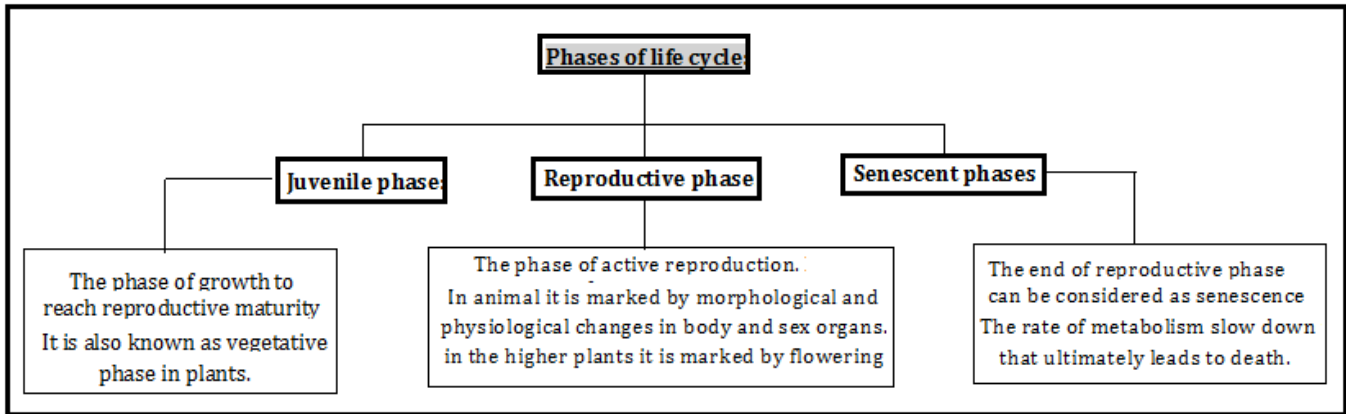
ANS. Through sexual reproduction variety of organisms are produced and the diversity of characteristics (genetic variation) increases the chances of survival of a species in an unfavourable environment.

Significance of Sexual Reproduction:

1. avoid genetic monotony
2. maintains the chromosome number in a species

3. Varieties of organisms are produced.
4. increases the chances of survival in an unfavourable environment
5. Foundation of evolutionary changes.

Phases of life cycle:



- **Regulation of the reproductive processes and the associated behavioural expressions:**
 - Reproductive processes and the associated behavioural expressions are regulated by:
 - Hormones
 - Environmental factors
- **The annual and biennial Plants, show clear cut vegetative, reproductive and senescent phases.**
- **In the perennial species it is very difficult to clearly define these phases.**
- **A few plants exhibit unusual flowering phenomenon; some of them such as bamboo species flower only once in their life time, generally after 50-100 years, produce large number of fruits and die.**
- **Strobilanthus kunthiana (neelakuranji), flowers once in 12 years. Last flowering was in 2006, 2018 and next expected in 2030.**

Oestrus cycle	Menstrual cycle
eggs are produced only in favourable season	eggs are produced throughout the year
cyclical changes in the ovaries and accessory ducts as well as hormones occur only during favourable seasons	cyclical changes in the ovaries and accessory ducts as well as hormones occur throughout the reproductive phase
Animals with Oestrus cycle called seasonal breeders	Animals with Menstrual cycle called continuous breeders
Menstrual flow absent	Menstrual flow present
non-primate mammals like cows, sheep, rats, deers, dogs, tiger, etc.,	in primates (monkeys, apes, and humans)

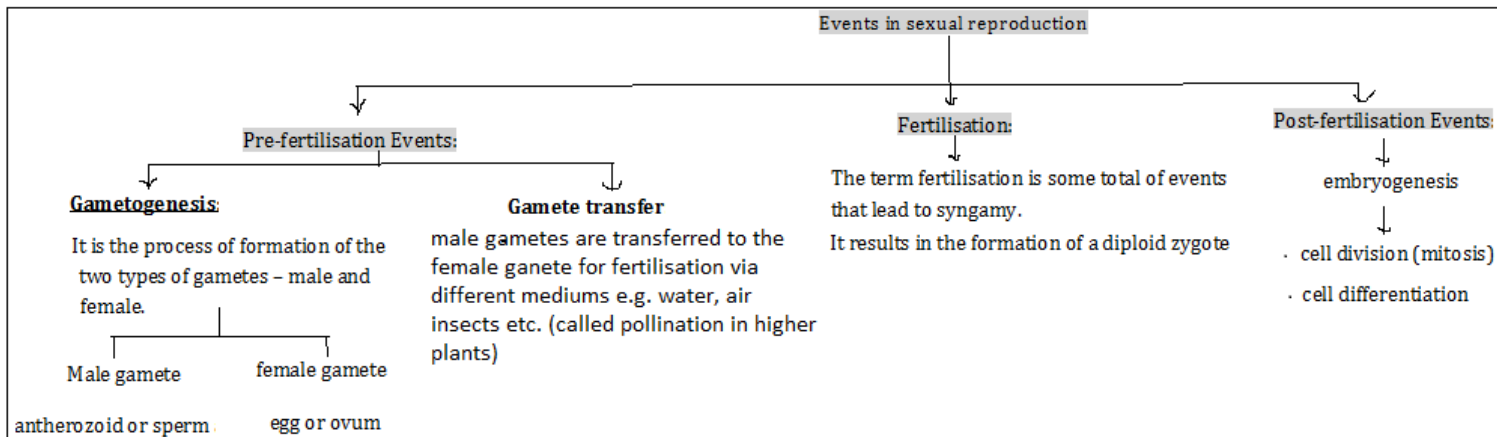
Seasonal breeders	Continuous breeders
lay eggs only seasonally	they lay eggs all through the year
reproductively active only during favourable season	reproductively active throughout the year in their reproductive phase
Menstrual flow absent	Menstrual flow present
frogs and lizards, birds, non-primate mammals like cows, sheep, rats, deers, dogs, tiger, etc.,	in primates (monkeys, apes, and humans)

Q. Egg laying by birds in poultry farms throughout the year is a commercial exploitation for human welfare. Justify the statement.

ANS. Birds living in nature lay eggs only seasonally. However, birds in captivity (as in poultry farms) can be made artificially to lay eggs throughout the year by hormonal application, but laying eggs is not related to natural reproduction so it is a commercial exploitation for human welfare.

Factors responsible for transitions between the phases of life span:

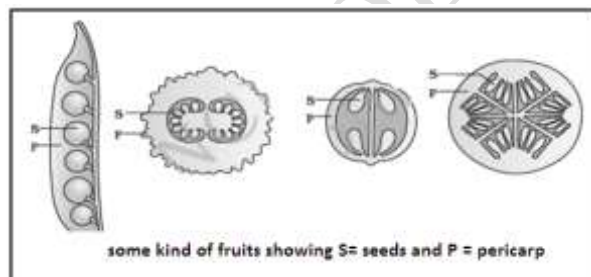
In both plants and animals, hormones are responsible for the transitions between the three phases.



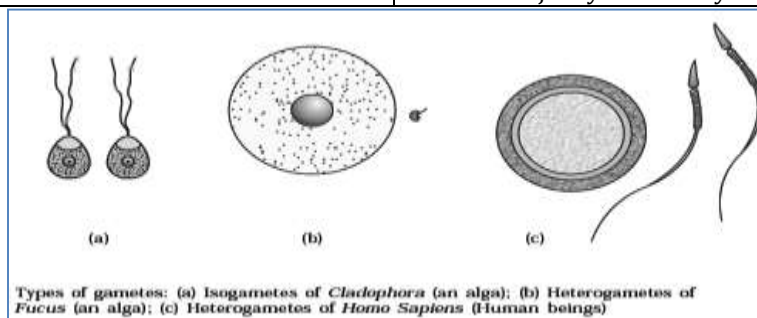
- To compensate loss of male gametes during transport, the number of male gametes produced is several thousand times the number of female gametes produced.
- Syngamy may occur either externally, outside the body of organisms (external fertilization) or internally, inside the body (internal fertilization).
- Zygote is the vital link that ensures continuity of species between organisms of one generation and the next.

Post-fertilisation changes in plants:

- In 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 remains attached to the plant.
- The zygote develops into the embryo and the ovules develop into the seed.
- The ovary develops into the fruit which develops a thick wall called pericarp that is protective in function.
- After dispersal, seeds germinate under favourable conditions to produce new plants



Homogametes	Heterogametes
1. gametes are similar in appearance called isogametes	1. the gametes produced are of two morphologically distinct types, antherozoid or sperm and egg or ovum
2. Present In some algae	2. in a majority of sexually reproducing organisms



Gametogenesis	Embryogenesis
1. The process of formation of the two types of gametes	1. the process of development of embryo
2. Pre-fertilisation Event	2. Post-fertilisation Event
3. Involve meiosis	3. Involve mitosis
4. Single cell structure is formed	4. Multicellular structure is formed

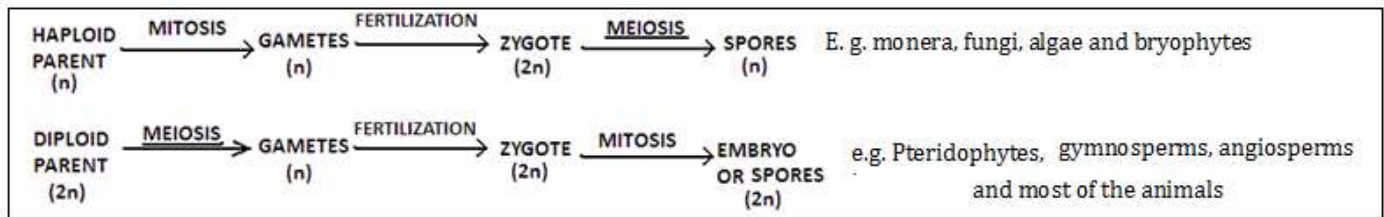
Homothallic/monoecious/bisexual	Heterothallic/dioecious/ unisexual
1. have both male and female reproductive structures in the same organism	1. have both male and female reproductive structures in the different organisms

2. May self or cross pollinated/fertilized	2. Only cross pollinated/fertilized
cucurbits and coconuts	papaya and date palm
Earthworms, sponge, tapeworm and leech	Cockroach, human

staminate	Pistillate
1. Sexually these are male flower	1. Sexually these are female flower
2. bearing stamens	2. bearing pistils
3. Produce male gametes or pollen grains	3. Produce female gametes

- **Bisexual animals that possess both male and female reproductive organs are hermaphrodites.**
- **In some organisms like rotifers, honeybees and even some lizards and birds (turkey), the female gamete undergoes development to form new organisms without fertilisation. This phenomenon is called parthenogenesis.**

Cell division during gamete formation: Gametes are haploid.



zoospore	Zygote
1. Haploid	1. Diploid
2. Motile	2. Non-motile
3. Asexual structure	3. Sexual structure
Self-fertilisation /pollination	cross- fertilisation /pollination
1. Gametes produced in same individual are fused to form zygote	1. Gametes produced in different individuals are fused to form zygote
2. May present in bisexual organisms and flowers	2. May present in bisexual or unisexual organisms and flowers
3. relatively easy	3. Not easy
4. anthers and stigma are located close to each other no pollinating agent is required	4. a specialised event called pollination facilitates transfer of pollen grains to the stigma
5. Success rate high	5. Success rate low
Peas Tape worm (monoecious)	Maize Earthworm (monoecious), cockroach (dioecious)

external fertilisation	Internal fertilisation
1. syngamy occurs in the external medium (water), i.e., outside the body of the organism	1. syngamy occurs inside the body of the organism
2. zygote is formed in the external medium	2. zygote is formed inside the body of the organism
3. offspring are extremely vulnerable to predators	3. offspring are rarely vulnerable to predators
4. Success rate low	4. Success rate high
5. large number of offspring are produced	5. relatively less number of offspring are produced
6. large number of female gametes are produced	6. a significant reduction in the number of eggs produced
7. In most aquatic organisms, such as a majority of algae and fishes as well as amphibians	7. In many terrestrial organisms, belonging to fungi, higher animals such as reptiles, birds, mammals and in a majority of plants (bryophytes, pteridophytes, gymnosperms and angiosperms)

Disadvantage of external fertilisation:

- The less chances of syngamy
- Large number of gametes are produced to enhance the chances of syngamy
- Offspring are extremely vulnerable to predators threatening their survival up to adulthood.

oviparous	viviparous
development of the zygote take place outside the body	development of the zygote take place inside the female body
lay fertilised/unfertilised eggs	they give birth to young ones
Oviparous animals produce large number of eggs.	Viviparous animals produce small number of eggs.
eggs are always protected by tough water proof shells	Eggs required no shells because they are well protected

	inside the female body.
The egg of oviparous animals are large size, contain enough store nutrients and yolk for embryo.	Eggs of viviparous animals are small in size contain very small amount of yolk
Fishes, amphibian(lay unfertilised eggs) reptiles and birds (lay fertilized eggs)	Mammals except prototheria
<u>Disadvantage</u> : chances of survival of young ones is lesser in oviparous organisms	<u>Advantage</u> : Because of proper embryonic care and protection, the chances of survival of young one is greater in viviparous organisms.

PREETIBIOLOGY