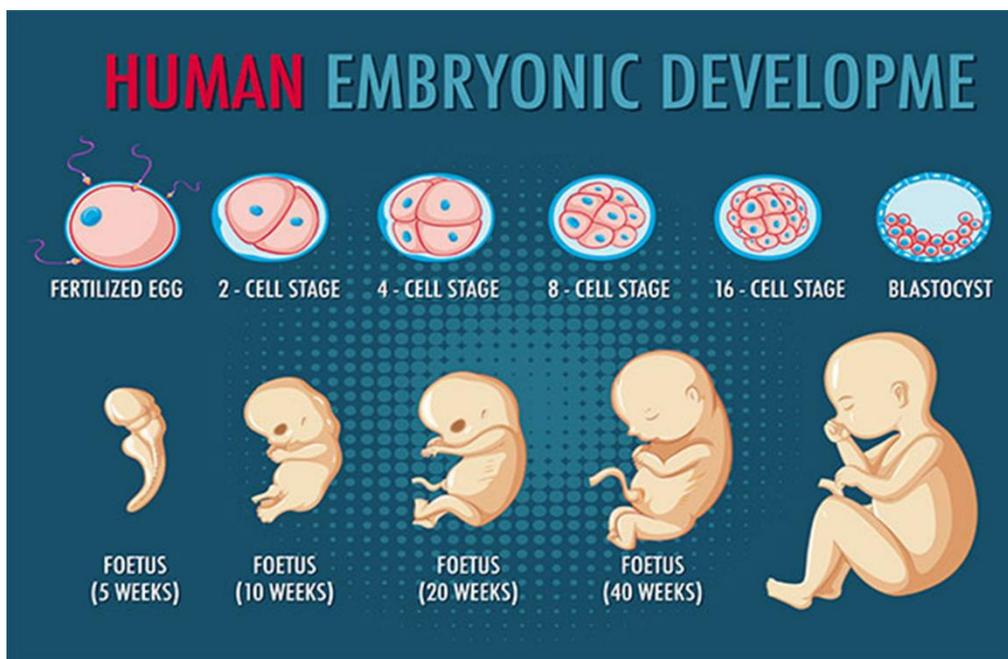


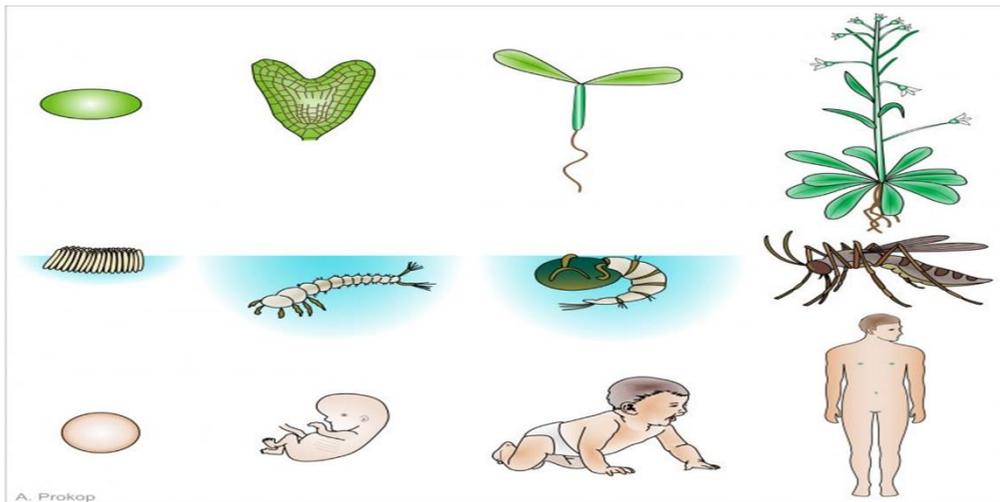
Introduction

1. Definition of Embryology: Embryology is the study of development of an embryo from the stage of ovum fertilization through to the fetal stage. It includes the main developmental changes occurring before birth, and is divided into 2 periods:

- **Embryonic period:** Begins at fertilization and ends with the end of the 8th week. (called an embryo)
- **Fetal period:** Begins at the beginning of the 9th week and ends at birth. (called a fetus)



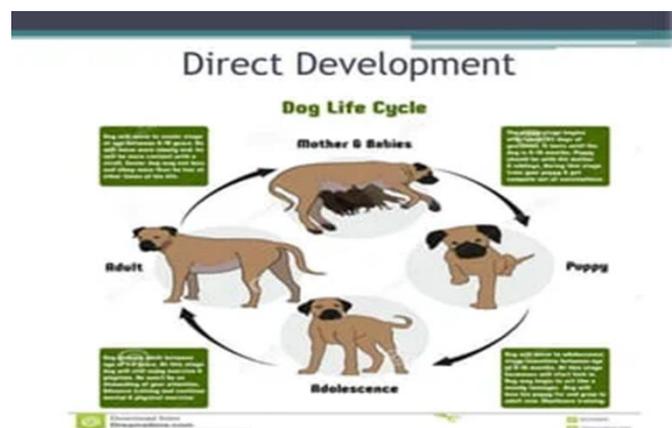
2. Definition of development in biology refers to the series of changes an organism undergoes from fertilization to adulthood, and it can happen in different ways depending on the species. Here are the main types of development in the context of animals, plants, and other organisms:



a) Direct Development

In species with direct development, the offspring looks similar to the adult form right from the start, but smaller. There are no distinct larval or juvenile stages.

Example: Humans, most mammals, and birds undergo direct development. The baby or juvenile organism develops inside the parent (in mammals, typically inside the womb) and is born as a miniature version of the adult.



b) Indirect Development

Description: In species with indirect development, the organism undergoes multiple stages, including a larval or immature stage, before reaching adulthood. The larval stage may look very different from the adult.

Example: Frogs (which start as tadpoles), insects (which may go through egg, larva, pupa, and adult stages), and amphibians.

Metamorphosis: A key feature of indirect development, where the organism undergoes a radical transformation from one developmental stage to another.

Embryonic development takes place in several stages in all metazoans:

- Fertilization
- Segmentation
- Gastrulation
- Neurulation
- Organogenesis.

3. Reproduction is the biological process by which living organisms produce offspring, ensuring the continuation of their species. It can occur through sexual reproduction, where genetic material from two parents combines to create offspring, or asexual reproduction, where a single organism produces offspring genetically identical to itself.

1. Sexual Reproduction

Sexual reproduction new organisms are produced from the fusion of a male sex cell with a female sex cell. This fusion of gametes is called fertilization. Sex cells are also known as gametes. Male gametes are made by male reproductive structures. Female gametes are made by female reproductive structures. It includes processes such as:

- **Internal Fertilization:** Fertilization occurs inside the female's body (e.g., mammals, birds, reptiles).
- **External Fertilization:** Fertilization happens outside the female's body, typically in water (e.g., fish, amphibians).

-In this form of reproduction, both sexes can:

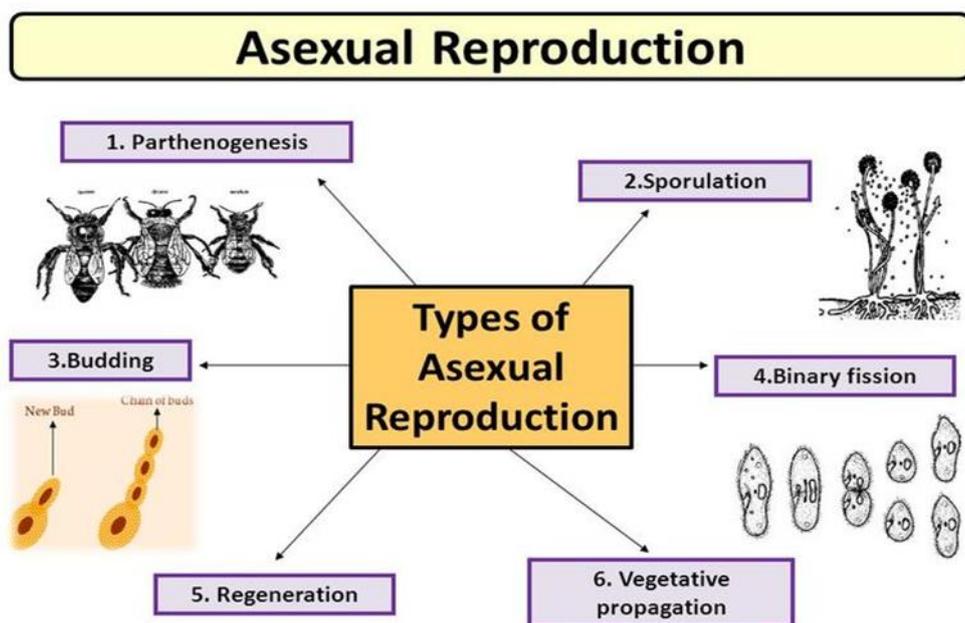
-Be carried by the same individual: this is called bisexual and is a **hermaphroditic species**, e.g. the snail.

-or be completely separate: the individuals are unisexual and the species is said to be **gonochoric**, e.g. humans.

-There are three types of animals: **oviparous**, **viviparous** and **ovoviviparous**.

Viviparous	Oviparous	Ovoviviparous
Baby animals are born alive. Almost every mammal species reproduces exclusively via live birth.	Eggs are placed outside the mother's body, and the mother's body is only responsible for a small amount of embryonic development. Oviparous organisms include both birds and reptiles.	The eggs develop inside the mother's body, where the yolk and other fluids feed them until the young are born. Ovoviviparity can be found in certain species of sharks and snakes.

2. Asexual reproduction is a type of reproduction where an organism produces offspring without the involvement of another organism or the fusion of gametes (sperm and egg). The offspring are genetically identical to the parent, meaning they are clones, unless mutations occur.

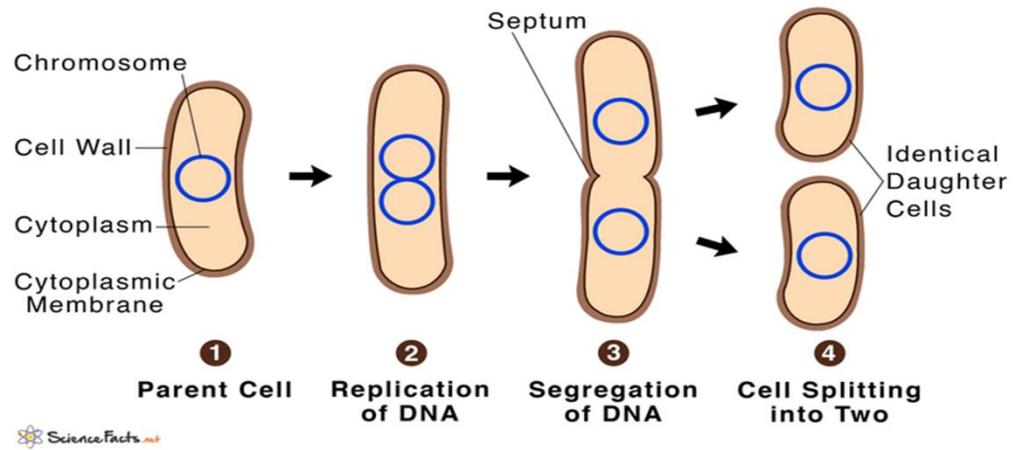


Here are the main types of asexual reproduction:

1. Binary Fission

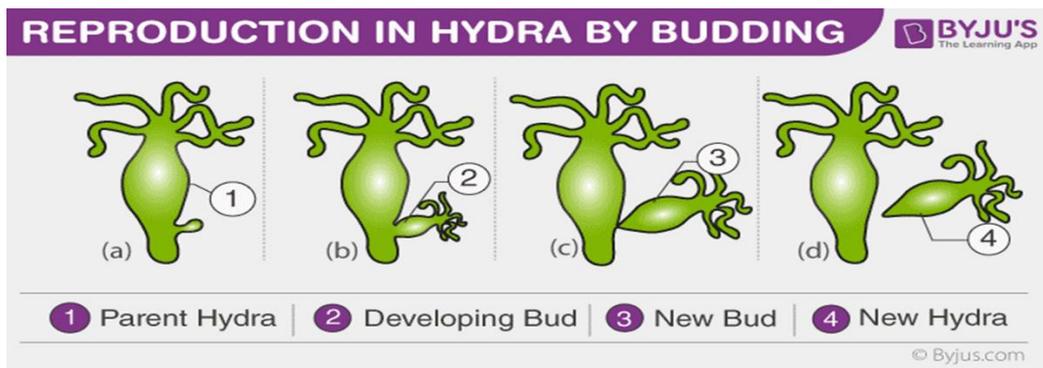
- **Process:** A single organism splits into two equal parts, each of which becomes a new individual.
- **Example:** Common in bacteria and some protozoa, such as *Amoeba* and *Paramecium*.

Binary Fission



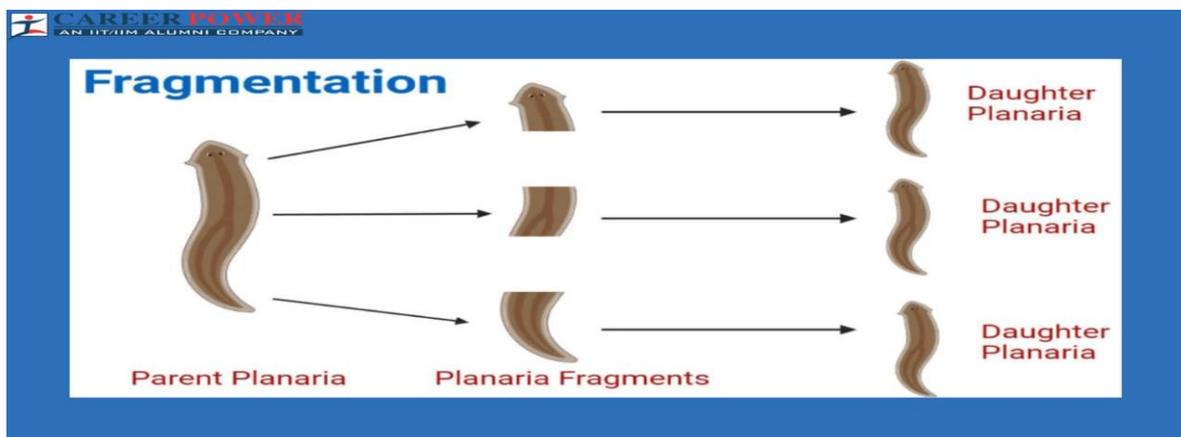
2. Budding

- **Process:** A new organism grows out from the body of the parent and eventually detaches to live independently.
- **Example:** Seen in organisms like **hydra** and **yeast**.



3. Fragmentation

- **Process:** The parent organism breaks into pieces, and each piece can grow into a new individual.
- **Example:** Seen in certain **starfish**, **worms**, and **planaria** (a type of flatworm).



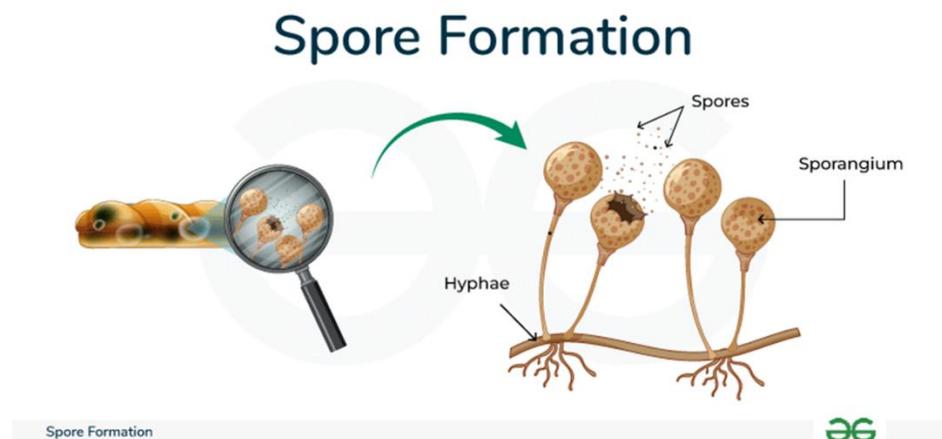
4. Vegetative Propagation

- **Process:** New plants grow from parts of the parent plant, such as roots, stems, or leaves.
- **Example:** Common in plants like **strawberries** (through runners), **potatoes** (through tubers), and **succulents** (through leaf cuttings).



5. Spore Formation

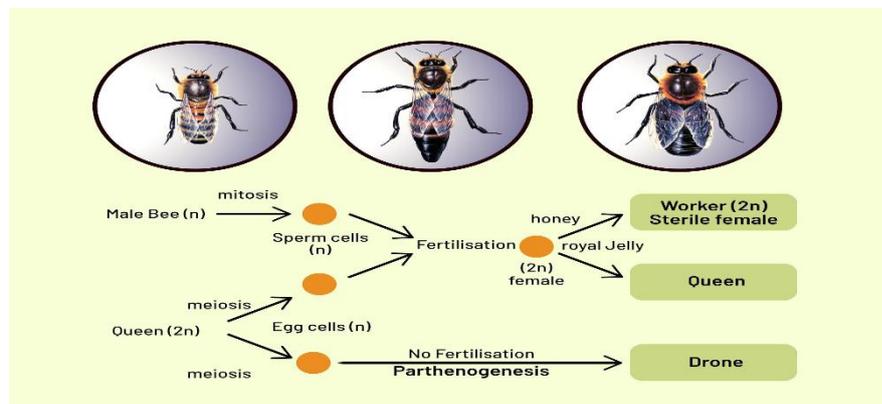
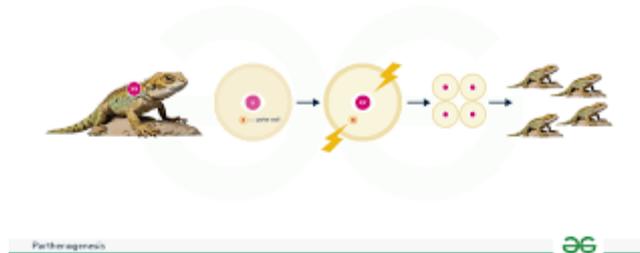
- **Process:** An organism produces spores, which are reproductive cells capable of growing into a new individual.
- **Example:** Found in fungi (e.g., **mushrooms**), **mosses**, and certain **ferns**.



6.Parthenogenesis is a form of asexual reproduction where offspring are produced without fertilization by a male. In this process, the female's egg cell develops into a new organism without the need for sperm. This can happen in various species, such as certain insects, reptiles, amphibians, and even some plants.

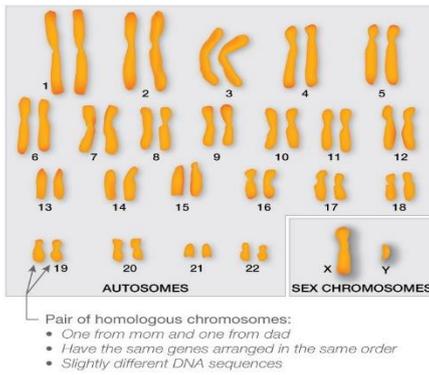
In some cases, parthenogenesis can occur naturally, while in others, it may be induced under specific conditions. There are different types of parthenogenesis, like:

1. **Obligate parthenogenesis:** where females only reproduce this way, and no males are involved at all.
2. **Facultative parthenogenesis:** where females can reproduce sexually when males are present but may also reproduce asexually when males are absent.



3. Common terms:

- **Oocyte;** the immature ovum, female germ cell.
- **Ovum;** the mature female germ cell.
- **Zygote;** the fertilized ovum.
- **Sperm;** the mature male germ cell.
- **Cell division;** one cell divides into two cells; there are two types of cell division:
 - **A-Mitotic:** the cell produces 2 cells each contains 44 autosomes and 2 sex chromosomes
 - **B- Meiotic:** (reduction) it occurs in the primitive germ cells in the testes or the ovaries, it produces 2 cells each contains 22 autosomes and one sex chromosomes.



Diploid (2n) vs. Haploid (n) Cells

Body cells are diploid (2n).	Gametes (sex cells) are haploid (n).
<ul style="list-style-type: none"> • Body Cells • Contain 2 copies of each chromosome • Total = 46 chromosomes (44 autosomes & 2 sex) • Reproduce through mitosis 	<ul style="list-style-type: none"> • Sex Cells • Contain 1 copy of each chromosome • Total = 23 chromosomes (22 autosomes & 1 sex) • Reproduce through meiosis

- **Cranial;** the top of the embryo or the head.
- **Cephalic;** superior or the head.
- **Caudal;** inferior or the tail end.
- **Dorsal;** back of the embryo.
- **Ventral;** anterior or the belly side.
- **Medial;** near to the midline.
- **Lateral;** flank side.
- **Longitudinal;** median or sagittal. (cuts it to left & right)
- **Coronal;** frontal.
- **Transverse;** horizontal. (Cuts it to superior & inferior) .