

REPRODUCTION IN ANIMALS

Reproduction is the biological process by which living organisms produce new individuals of their own kind.

Purpose of Reproduction

- It ensures the **continuity of life** on Earth.
- Without reproduction, a species would become **extinct**.

Types of Reproduction

There are **two main types**: 1.Asexual Reproduction 2. Sexual Reproduction

Asexual Reproduction

Asexual reproduction is a type of reproduction in which **only one parent** is involved and **no fusion of male and female gametes (sperm and egg)** takes place.

The offspring produced are **identical copies (clones)** of the parent.

Why is it called *Uniparental Reproduction*?

- The word “**uni**” means **one**, and “**parental**” means **related to parent**.

It is called uniparental reproduction because only one parent is needed for the process, unlike sexual reproduction which requires two parents (male and female). In asexual reproduction, there is no fusion of male and female gametes; all genetic material comes exclusively from a single organism, making the process uniparental in nature.

Asexual (Uniparental) Reproduction

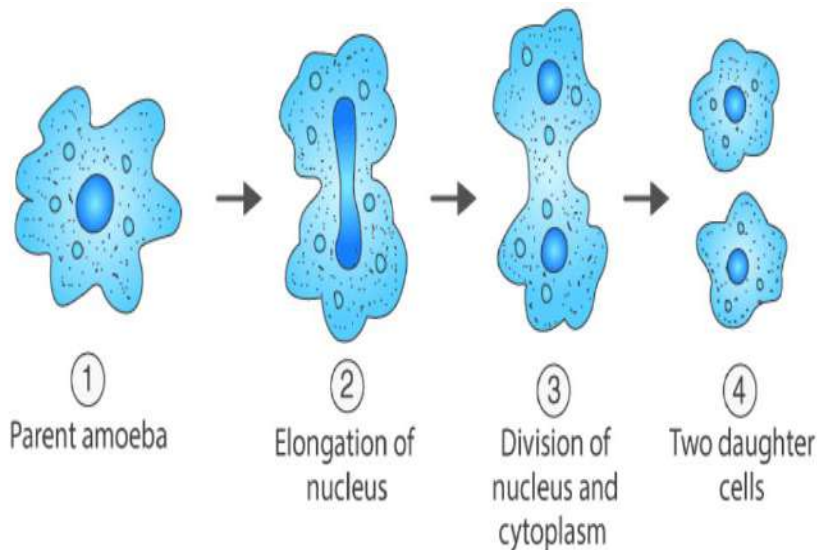
Aspect	Advantages	Disadvantages
1. Number of Parents	Only one parent is needed — simple process.	No genetic mixing — all offspring are identical to parent.
2. Speed	Faster reproduction — can produce many offspring quickly.	Rapid multiplication can lead to overcrowding or competition for resources.
3. Energy Requirement	Less energy required — no need to find a mate or perform mating behavior.	No variation — harmful traits may continue in all offspring.
4. Suitability	Best suited for stable environments where adaptation is not required.	If environment changes, identical offspring may not survive easily .
5. Example Organisms	Amoeba (binary fission), Hydra (budding), Yeast (budding).	—

Types of Asexual Reproduction

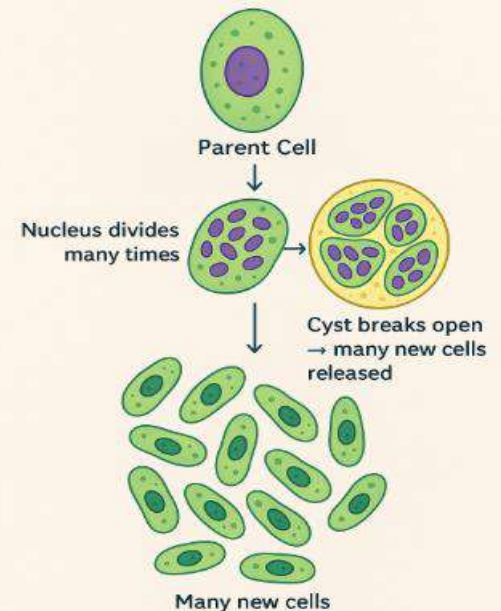
1.Binary Fission

- In binary fission, a single parent cell divides into two identical daughter cells.
- Common in Amoeba and bacteria.
- Steps: The nucleus replicates and the cytoplasm divides equally to form two new cells.
- Each daughter cell gets a copy of genetic material and grows into an adult.

BINARY FISSION IN AMOEBA



MULTIPLE FISSION IN PLASMODIUM



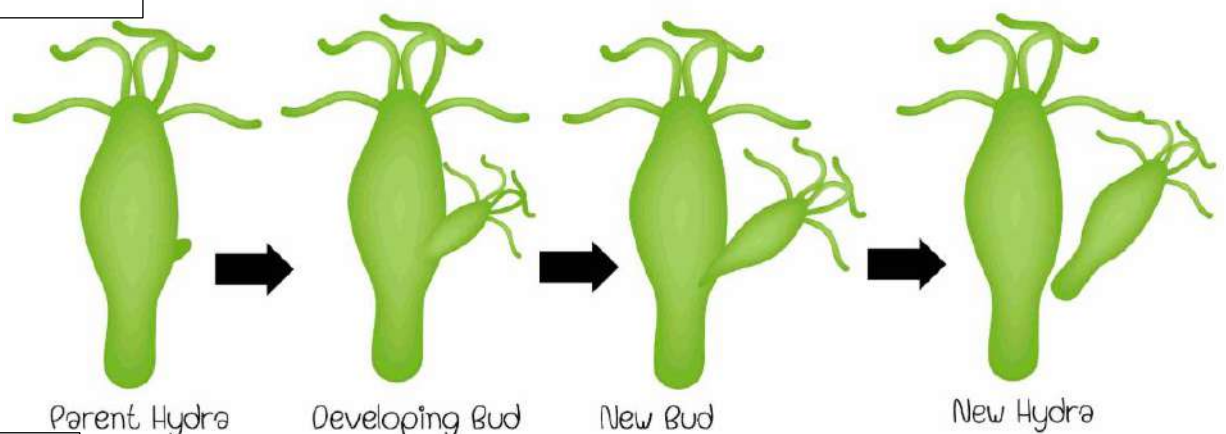
2. Multiple Fission

- In multiple fission, a single cell divides to form many new cells at the same time.
- Seen in organisms like Plasmodium (malarial parasite).
- The nucleus divides repeatedly to form many nuclei, each of which gets some cytoplasm and forms a daughter cell when conditions improve.

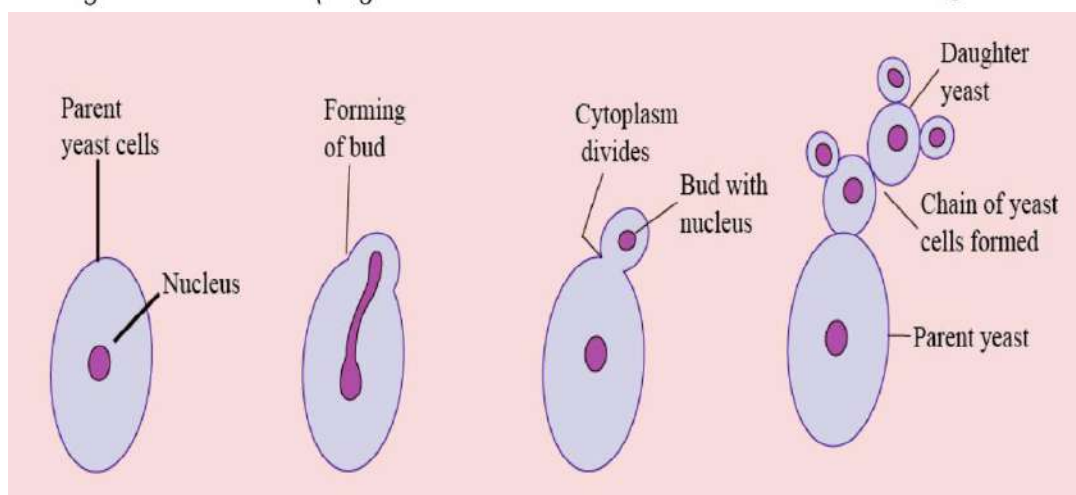
3. Budding

- In budding, a small outgrowth called a bud forms on the parent body.
- The bud develops into a new organism, which may remain attached for a while before detaching and leading an independent life.
- Common in yeast and Hydra.

BUDDING IN HYDRA

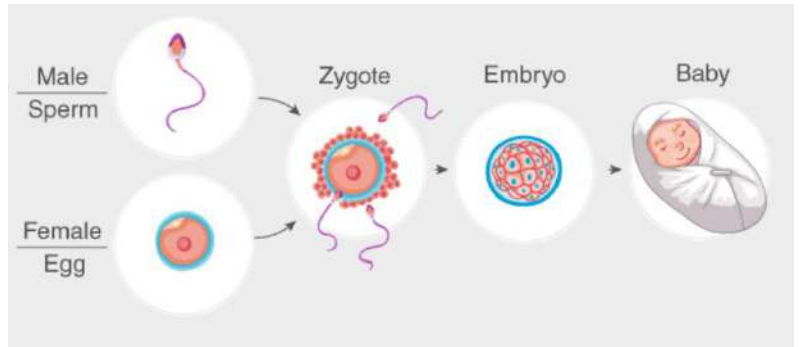


BUDDING IN YEAST



Sexual Reproduction

Sexual reproduction is a biological process in which two parent organisms, typically one male and one female, combine their genetic material through the fusion of specialized sex cells called gametes to produce offspring with genetic variation. This process is crucial for creating genetic diversity, which helps species adapt and evolve over generations.



Important Terms in Sexual Reproduction

- **Gametes:** Specialized reproductive cells that carry half the genetic material (haploid). Males produce sperm, and females produce ova (egg cells).
- **Sperms:** The male gametes, usually motile, responsible for fertilizing the female gamete.
- **Ova (Eggs):** The female gametes, typically larger and non-motile, provide the cytoplasm and most of the nutrients for the developing embryo.
- **Hermaphrodite:** An organism that produces both male and female gametes, capable of self-fertilization or mating with others (e.g., earthworms).
- **Fertilization:** The process where a sperm and an ovum fuse to form a single cell called the zygote, restoring the diploid number of chromosomes.
- **Zygote:** The fertilized egg cell formed after fertilization, which then divides and develops into a new organism.

Sexual reproduction involves several stages including gamete formation (gametogenesis), gamete transfer, fertilization, and development of the zygote into an embryo, ultimately resulting in an offspring genetically distinct from its parents

Difference Between Sexual and Asexual Reproduction

Feature	Sexual Reproduction	Asexual Reproduction
1. Number of Parents	Involves two parents — one male and one female.	Involves only one parent .
2. Gametes	Involves the formation and fusion of male and female gametes (sperm and ovum).	No gamete formation or fusion takes place.
3. Fertilisation	Fertilisation occurs (fusion of sperm and egg) to form a zygote.	No fertilisation occurs.
4. Offspring Type	Offspring show variations — they are not identical to parents.	Offspring are identical to the parent (clones).

Feature	Sexual Reproduction	Asexual Reproduction
5. Speed of Process	Slower process.	Faster process.
6. Energy Requirement	Requires more energy for gamete production and fertilisation.	Requires less energy .
7. Example Organisms	Humans, Cows, Birds, Frogs, Flowering Plants.	Amoeba, Hydra, Yeast, Spirogyra, Plasmodium

Reproductive Patterns Based on the Site of Fertilisation and Development

There are **three main patterns** based on **where fertilisation and development occur** —

- 1 External Fertilisation and External Development
- 2 Internal Fertilisation and External Development
- 3 Internal Fertilisation and Internal Development

◆ 1. External Fertilisation and External Development

Both **fertilisation** and **development** occur **outside the female's body**, usually in **water**.

- **Process:**
 - Male and female release gametes (sperm and eggs) into water.
 - Fertilisation occurs in water (outside body).
 - The fertilised egg (zygote) develops into an embryo and then into young ones **in water**.
- **Examples:**
Frog, Fish, Amphibians
- **Key Points:**
 - **Requires water** for gamete movement.
 - Many gametes are produced to ensure success.
 - **Young ones are unprotected**; many die early.

◆ 2. Internal Fertilisation and External Development

Fertilisation occurs **inside the female's body**, but **development** occurs **outside** in **eggs** laid by the female.

- **Process:**
 - Male deposits sperms inside the female body.
 - Fertilisation takes place inside the female.
 - The fertilised egg (zygote) is then **laid outside**, and development continues within the **egg shell** until hatching.
- **Examples:**
Birds, Reptiles (snakes, lizards).
- **Key Points:**
 - **Egg has hard or leathery shell** for protection.
 - Embryo gets nourishment from the **yolk** in the egg.
 - **Parents may guard eggs** until hatching.

◆ 3. Internal Fertilisation and Internal Development

Both **fertilisation** and **development** occur **inside the female's body**.

- **Process:**

- Male gamete fertilises the female gamete **inside the female body**.
- The **zygote develops into an embryo** within the mother's uterus.
- The mother **gives birth to live young ones**.
- **Examples:**
Humans, Cows, Dogs, Cats.
- **Key Points:**
 - Embryo gets **nutrition and protection** inside the mother.
 - **Chances of survival** are very high.

Male Reproductive System

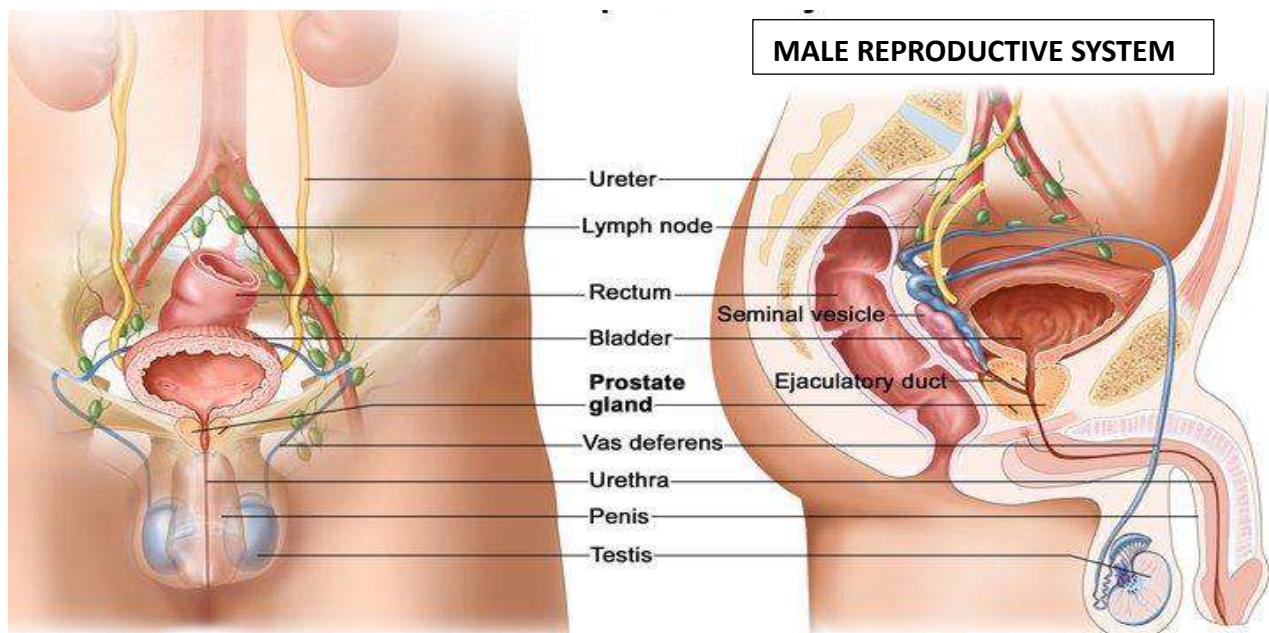
The **male reproductive system** is responsible for producing **male gametes (sperms)** and for **delivering them** into the female body during reproduction.

Main Parts and Their Functions

Part	Structure / Location	Function
1. Testes (singular: Testis)	Two oval-shaped organs located inside the scrotum.	- Produce male gametes called sperms . - Produce male sex hormone called testosterone , which controls development of male features (like deeper voice, beard, etc.).
2. Scrotum	A sac-like pouch of skin that holds the testes outside the abdominal cavity.	- Keeps the testes slightly cooler than body temperature (needed for sperm production). - Protects the testes from injury.
3. Sperm Duct (Vas Deferens)	A narrow muscular tube connecting the testes to the urethra.	- Carries sperms from testes to the urethra.
4. Urethra	A common passage running through the penis.	- Carries both urine and semen (but not at the same time) to the outside of the body.
5. Semen	A mixture of sperms and fluid secreted by accessory glands (seminal vesicles and prostate gland).	- The fluid provides nourishment and medium for sperms to swim easily.
6. Penis	A cylindrical organ through which the urethra passes.	- Used to transfer sperms (semen) into the female reproductive tract during copulation.

◆ Flow of Male Gametes (Sperms)

- Testes → Sperm Duct (Vas Deferens) → Urethra → Penis → Outside Body



Structure of a Sperm

A **sperm** is the **male gamete** (reproductive cell) produced in the **testes**.

It is a **microscopic, motile** (can move) cell, designed to **fertilise the ovum (egg)**.

Key Points

- A sperm is **haploid** (has half the number of chromosomes).
- The **nucleus of the sperm** fuses with the **nucleus of the ovum** to form a **zygote**.
- Millions of sperms are released during fertilisation, but **only one sperm** fuses with the ovum.

♦ Main Parts of a Sperm

A sperm has **three main parts**:

👉 **Head**

👉 **Middle Piece**

👉 **Tail**

1 Head

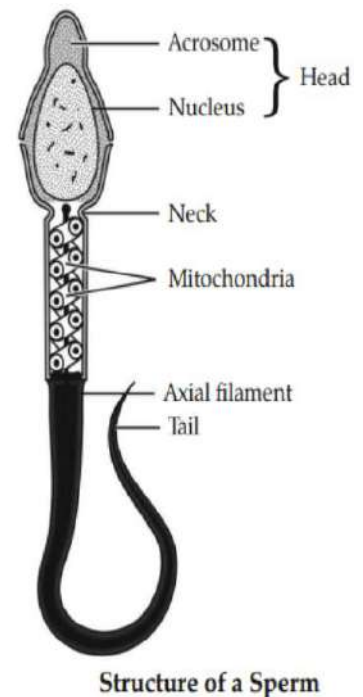
- **Structure:**
Oval or rounded in shape; forms the **front part** of the sperm.
- **Contains:**
 - **Nucleus:** holds the **father's genetic material (DNA)**.
 - **Acrosome:** a cap-like structure that contains **enzymes** to help the sperm **penetrate the egg** during fertilisation.
- **Function:**
 - The **nucleus** combines with the **nucleus of the ovum** to form the **zygote**.
 - The **acrosome** helps the sperm to **enter the egg**.

2 Middle Piece

- **Structure:**
Short, thick portion just behind the head.
- **Contains:**
 - Many **mitochondria** (the “powerhouses” of the cell).
- **Function:**
 - Provides **energy** for the sperm to move using its tail.
 - Helps the sperm **swim towards the ovum** in the female reproductive tract.

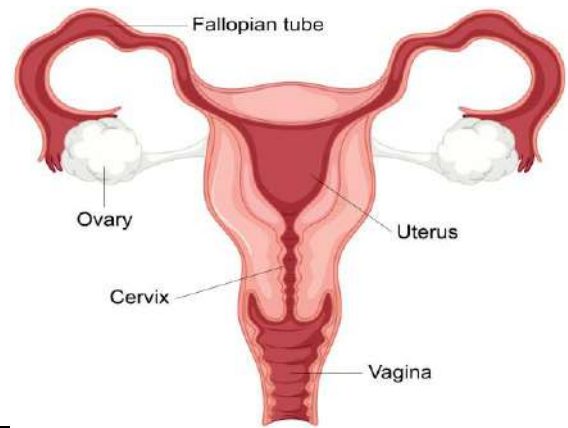
3 Tail

- **Structure:**
Long, thin, whip-like structure.
- **Function:**
 - Enables **movement** — the tail beats back and forth, propelling the sperm forward.
 - Helps the sperm **swim towards the egg** for fertilisation.



Female Reproductive System

The **female reproductive system** is responsible for producing **female gametes (ova or eggs)**, receiving the **male gametes (sperms)**, and providing a place for the **development of the baby (embryo)**.



Main Parts of the Female Reproductive System

Part	Description / Function
1. Ovaries	- Two small, oval-shaped organs present in the lower abdomen. - They produce female gametes called ova (eggs). - Also secrete female sex hormones – oestrogen and progesterone, which control the development of female body features and regulate menstrual cycle.
2. Oviducts (Fallopian Tubes)	- Two thin tubes that connect each ovary to the uterus. - The oviduct is also called the fallopian tube. - The fertilisation of sperm and ovum takes place here — inside the oviduct. - After fertilisation, the zygote is formed in the oviduct.
3. Uterus	- A hollow, pear-shaped organ where the zygote develops into an embryo and then a foetus. - The inner lining of the uterus provides nourishment and protection to the developing baby.
4. Cervix and Vagina	- Cervix: Lower part of the uterus that opens into the vagina. - Vagina: A muscular passage that receives sperms from the male during reproduction and also serves as the birth canal during delivery.

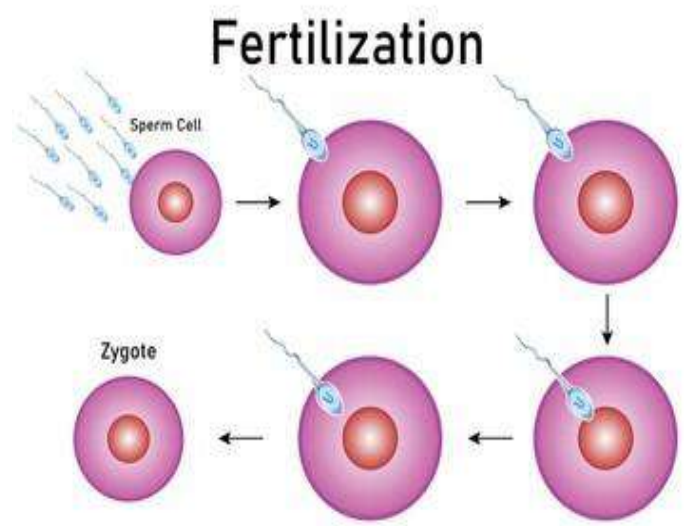
Fertilisation and Development of Embryo

◆ 1. Fertilisation — How It Takes Place

Fertilisation is the process of **fusion of the male gamete (sperm)** and **female gamete (ovum or egg)** to form a **zygote**.

💡 Key Points

- **Fertilisation** occurs in the **oviduct (fallopian tube)**.
- **Embryo development** takes place in the **uterus**.
- The embryo receives **food and oxygen** from the **mother's blood** through a structure called the **placenta**.



⚙️ Process:

1. During reproduction, **sperms from the male** are released into the **female's vagina** during mating.
2. The **sperms travel** through the **uterus** and reach the **oviduct (fallopian tube)**.
3. In the **oviduct**, **one sperm** fuses with the **ovum** (egg).
4. This **fusion of sperm and egg** is called **fertilisation**.
5. The **fertilised egg** formed is called a **zygote** — the **first cell of a new organism**.

◆ 2. Development of the Embryo

The **zygote** formed after fertilisation begins to **divide repeatedly** to form a **ball of many cells**, which is called the **embryo**.

⚙️ Steps of Development:

1. **Zygote → divides** into 2 cells, then 4, then many more.
2. The **embryo** travels down the **oviduct to the uterus**.
3. In the **uterus**, the embryo **implants (attaches)** itself to the **uterine wall**.
4. The **uterus provides nourishment** to the growing embryo through the **mother's blood**.
5. As the embryo develops further, it forms different body parts — **head, limbs, organs**, etc.
6. When the embryo becomes fully developed, it is called a **foetus**.
7. Finally, the mother gives birth to the **baby**.

Stage	What Happens
Fertilisation	Sperm + Egg → Zygote
Zygote Formation	First cell of a new organism
Embryo Development	Zygote divides and grows in uterus
Foetus Stage	Embryo develops body parts and becomes a baby

Difference Between Embryo, Foetus, and Infant

Stage	Description	Development Stage	Where It Develops	Remark
Embryo	Formed when the zygote starts dividing into many cells. It looks like a small ball of cells.	Early stage of development after fertilisation.	Inside the uterus , attached to the uterine wall.	At this stage, body parts are not yet formed , only basic cell mass is seen.
Foetus	When the embryo develops body parts such as hands, legs, head, and organs.	Later stage of development before birth.	Inside the uterus (protected by the mother).	Body is recognisable as a baby , though not yet born.
Infant	The young one after birth .	After birth stage of growth and development.	Outside the mother's body .	The baby that feeds on mother's milk .

Fun Facts 1: Formation of Twins

Type of Twins	How They Are Formed	No. of Sperms & Eggs	Similarity	Sex	Examples / Notes
Identical Twins (<i>Monozygotic</i>)	One fertilised egg (zygote) splits into two embryos	1 sperm + 1 egg	Exactly alike (same DNA)	Always same sex	Same facial features, height, voice, etc.
Fraternal Twins (<i>Dizygotic</i>)	Two separate eggs are fertilised by two different sperms	2 sperms + 2 eggs	Not identical (different DNA)	Can be same or different sex	Look like normal siblings

Key Points

- Identical twins share 100% of their genes.
- Fraternal twins share about 50% of their genes, just like normal brothers and sisters.
- That's why siblings (and fraternal twins) may look similar but not identical!

Fun Facts 2: How Siblings Get Common Characters

Siblings (brothers and sisters) often share similar features because they inherit traits from both parents.

How It Happens:

- Each parent contributes half of their genetic material (DNA) to the baby —
 - Father's sperm → contributes half the genes.
 - Mother's ovum (egg) → contributes the other half.
- This mix of genes gives rise to shared traits, like:
 - Same eye colour
 - Similar hair type
 - Resemblance in face or height
 - Common mannerisms or voice tone

However, because the gene combination is random, siblings also show differences in looks and personality.

How Hens Lay Eggs

In hens, **fertilisation takes place inside the female's body** when the male's sperm fuses with the female's ovum in the **oviduct**, forming a **zygote**. As the zygote moves through the oviduct, it develops into an egg. The **yolk** forms first, followed by layers of **albumen (egg white)**, and finally, a **hard shell** made of **calcite**, which is a mineral form of **calcium carbonate** that protects the egg. Once the egg is fully formed, the hen **lays the egg** through the cloaca. If the egg is fertilised, the hen sits on it to keep it **warm** — this process is called **incubation**. The **incubation period** lasts about **21 days**, during which the embryo develops inside the egg. At the end of this period, the fully developed chick **breaks the shell and comes out**, which is called **hatching**.

VIVIPAROUS AND OVIPAROUS ANIMALS

Type of Animal	Where Fertilisation Occurs	Where Development Occurs	Gives Birth / Lays Eggs	Examples
Viviparous	Inside the female body	Inside the female body	Gives birth to young ones	Humans, Cows, Dogs
Oviparous	Usually inside the female body	Outside the body (in eggs)	Lays eggs	Birds, Frogs, Snakes

DEVELOPMENT

Development is the process by which the **zygote** (the fertilised egg) **grows and changes** to form a **fully developed organism** (baby or young one).

Types of Development

There are **two main types** of development in animals:

◆ 1 Direct Development

In **direct development**, the **young one looks like the adult** soon after birth or hatching — there is **no larval stage**.

- The baby only grows in **size** and **maturity**, but its **body form remains the same**.
- **No metamorphosis** occurs.

Examples: Humans, Cow , Bird

🧠 Key Point:

Zygote → Embryo → Young one → Adult (same basic form)

◆ 2 Indirect Development

In **indirect development**, the young one is **very different from the adult**.

It passes through one or more **larval stages**, and its body form **changes completely** during growth — this process is called **metamorphosis**.

- The larva gradually transforms into the adult form.
- **Metamorphosis** involves major structural and functional changes.

Examples: Frog: Egg → Tadpole (larva) → Adult Frog

Butterfly: Egg → Caterpillar (larva) → Pupa → Adult Butterfly

🧠 Key Point:

Zygote → Larva → Pupa (sometimes) → Adult (different body form)

Difference Between Direct and Indirect Development

Feature	Direct Development	Indirect Development
1. Definition	The young one resembles the adult soon after birth or hatching.	The young one does not resemble the adult ; it passes through a larval stage before becoming an adult.
2. Change in Body Form	No major change in body form — only growth in size and maturity.	Body form changes completely through metamorphosis .
3. Larval Stage	Absent — young one develops directly into adult.	Present — larva transforms into adult.
4. Examples	Humans, Cows, Birds, Dogs	Frogs, Butterflies, Silkworms, Houseflies
5. Type of Development	Simple and gradual	Complex due to metamorphosis

What is Metamorphosis?

Metamorphosis is the **process of transformation** of an immature form of an animal (like a larva) into its **adult form**, involving **major changes in body structure and function**.

LIFE CYCLE OF A FROG

The life cycle of a frog consists of several distinct stages:

1. **Eggs:** Frogs lay eggs, called frogspawn, usually in water. The eggs are covered with a jelly-like substance for protection.
2. **Tadpole:** When the eggs hatch after about 7-10 days, tadpoles emerge. Tadpoles live in water, have tails, gills for breathing underwater, and feed on algae.
3. **Growing Tadpole:** Over weeks, tadpoles grow larger, developing hind legs first and then front legs. They begin to develop lungs for breathing air. As the tadpole undergoes metamorphosis, its tail shortens, and it starts breathing through lungs. At this stage, it can leave water and survive on land.
4. **Adult Frog:** The tail disappears completely, and the froglet matures into an adult frog. Adult frogs live on land, breathe air through lungs, and reproduce by laying eggs in water, continuing the cycle.

This complete transformation from egg to adult frog, involving aquatic and terrestrial phases, is called metamorphosis and typically takes a few months to years depending on the species.

This life cycle allows frogs to adapt to both aquatic and terrestrial environments effectively.

Difference Between Tadpole and Frog

<u>Feature</u>	<u>Tadpole</u>	<u>Adult Frog</u>
1. Stage of Life	It is the larval stage of a frog.	It is the adult stage of a frog.
2. Habitat	Lives only in water .	Lives both on land and in water (amphibian).
3. Body Shape	Has a long tail and looks like a fish .	Has no tail ; has four legs and a short body.
4. Organs for Breathing	Breathes through gills like a fish.	Breathes through lungs and skin .
5. Mode of Nutrition	Feeds on algae and plant material (herbivorous).	Eats insects and small animals (carnivorous).
6. Movement	Swims using its tail .	Moves by jumping and swimming using legs .
7. Development Type	Immature form; undergoes metamorphosis to become frog.	Fully developed form; can reproduce.

