MODULE 5
HEREDITY

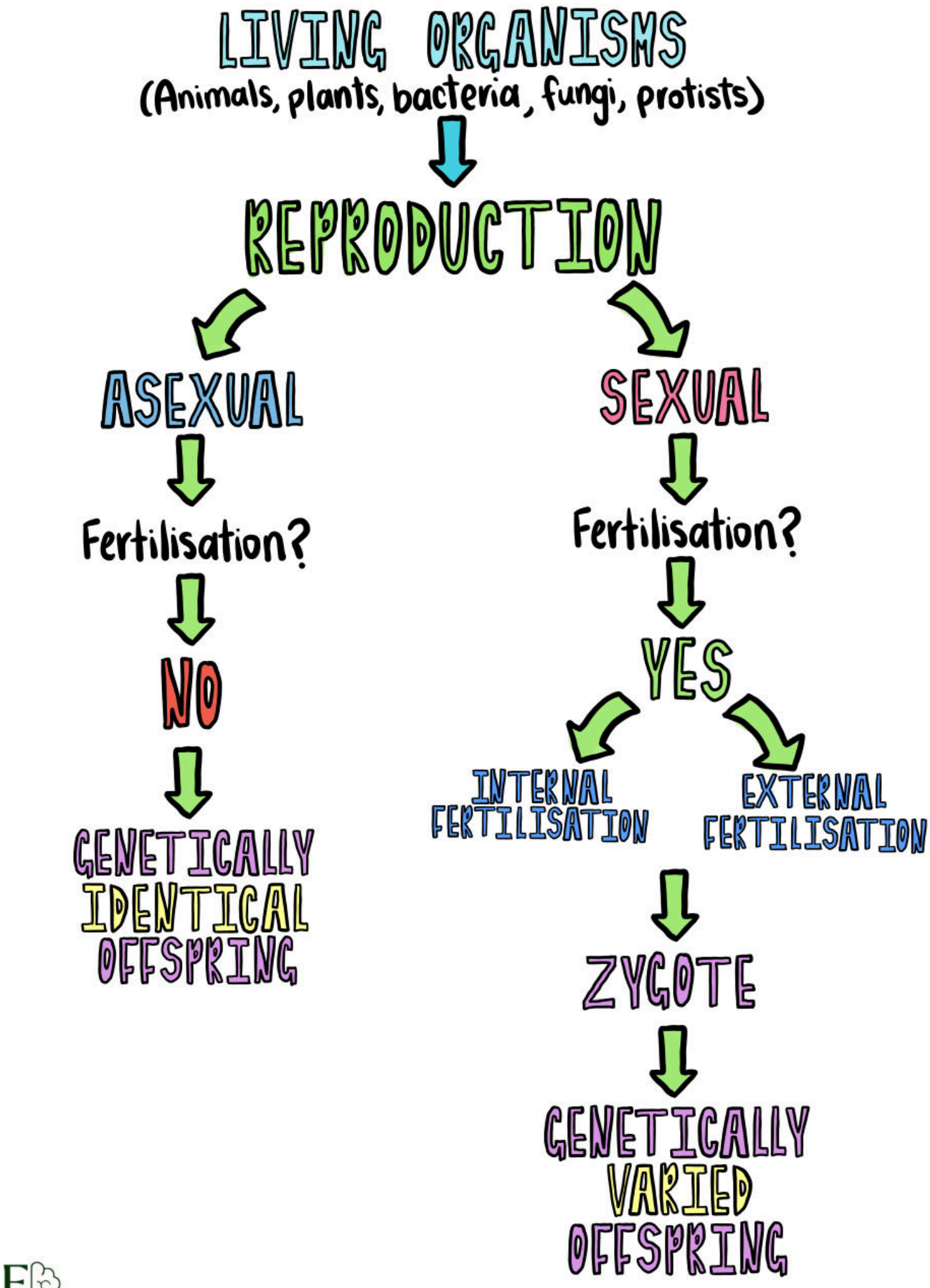
Biology

Enhance Education

REPRODUCTION

INQUIRY QUESTION: How does reproduction ensure the continuity of a species?

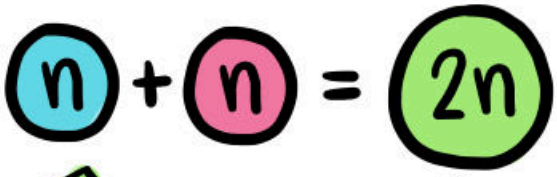
- Explain the mechanisms of reproduction that ensure the continuity of a species, by analysing sexual and asexual methods of reproduction in a variety of organisms, including but not limited to:
  - Animals: advantages of external and internal fertilisation
  - Plants: asexual and sexual reproduction
  - Fungi: Budding, spores
  - Bacteria: Binary fission
  - Protists: Binary fission, budding
- Analyse the features of fertilisation, implantation, and hormonal control of pregnancy and birth.
- Evaluate the impact of scientific knowledge on the manipulation of plant and animal reproduction in agriculture



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SEXUAL REPRODUCTION

Sexual reproduction involves the fusion of male and female gametes (fertilisation), which combine to form a zygote. This zygote carries a mix of genetic material from both parents, ensuring genetic diversity in the offspring.



PLANTS

In plants, sexual reproduction depends on pollination, where external agents such as insects, wind or animals transport pollen from one flower to another. This process allows for the genetic exchange between plants, creating new gene combinations that increase the likelihood of survival in changing environments. Seed dispersal mechanisms also contribute to the survival of the species by ensuring that seeds are spread to new, favourable environments.

CROSS POLLINATION

SELF POLLINATION

ANIMALS

In animals, sexual reproduction typically involves internal or external fertilisation. Internal fertilisation offers a protected environment for developing embryos, increasing their chances of survival, while external fertilisation often occurs in aquatic environments, requiring the production of a larger number of gametes to ensure success.

INTERNAL FERTILISATION

EXTERNAL FERTILISATION

SEXUAL REPRODUCTION IN PLANTS

LIFE CYCE OF A PLANT

POLLINATION

the transfer of pollen from the anther of one plant to the stigma of the same or another plant (self or cross pollination).

FERTILISATION

the fusion of a sperm (from the pollen grain) with the egg in the ovule.

SEED DISPERSAL

the process by which seeds are spread away from the parent plant to reduce competition and allow the plant species to colonise new areas. This can be achieved through wind, water, or animals.

GERMINATION

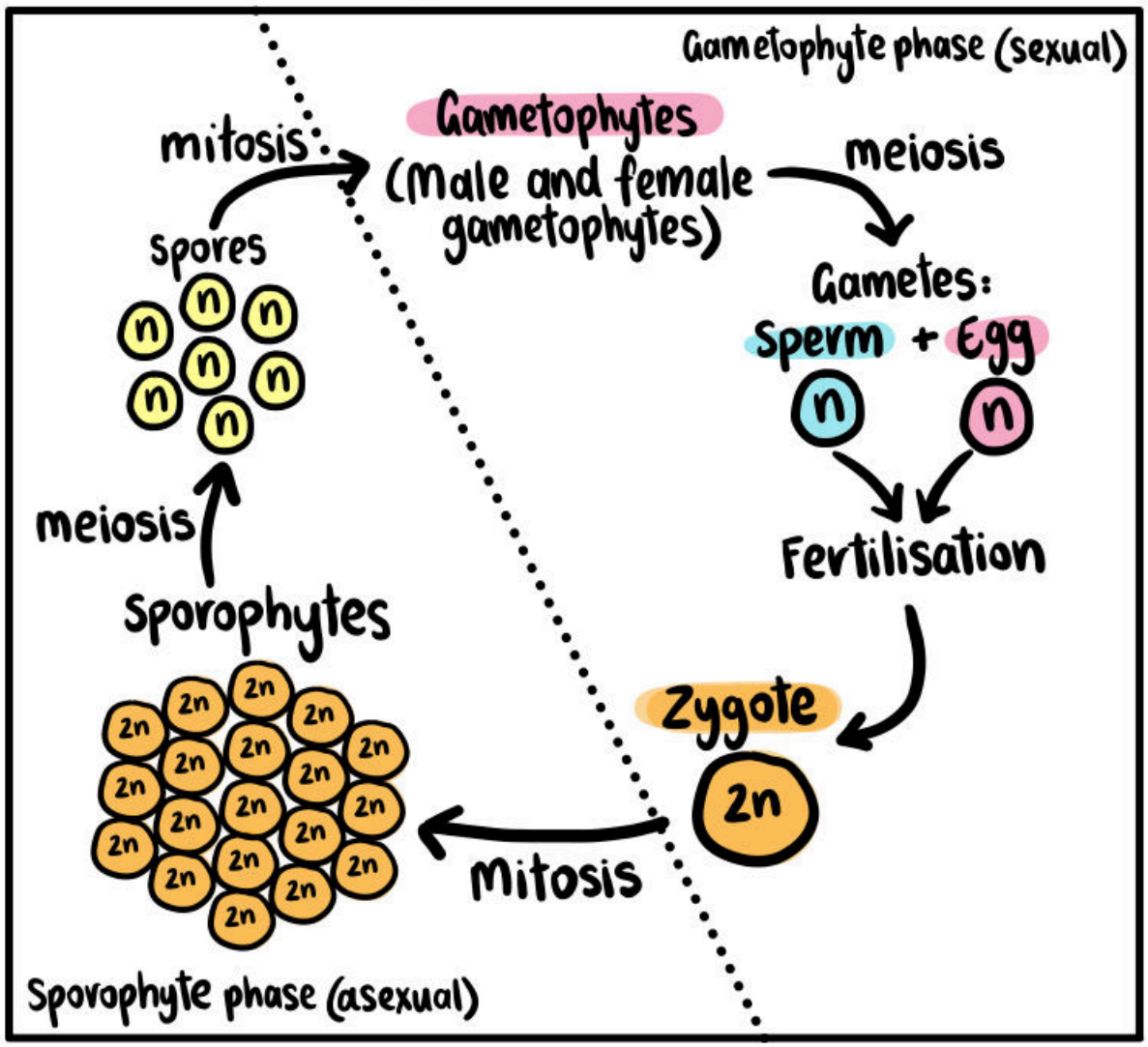
the process where a seed emerges from dormancy, begins to sprout, and develops into a seedling under favourable conditions such as water, light and temperature



GYMNOSPERMS
(non-flowering plants)

NOT CUTESY!

Gymnosperms reproduce sexually by producing seeds in cones. Male cones produce pollen, which fertilises the egg in female cones, leading to seed formation.



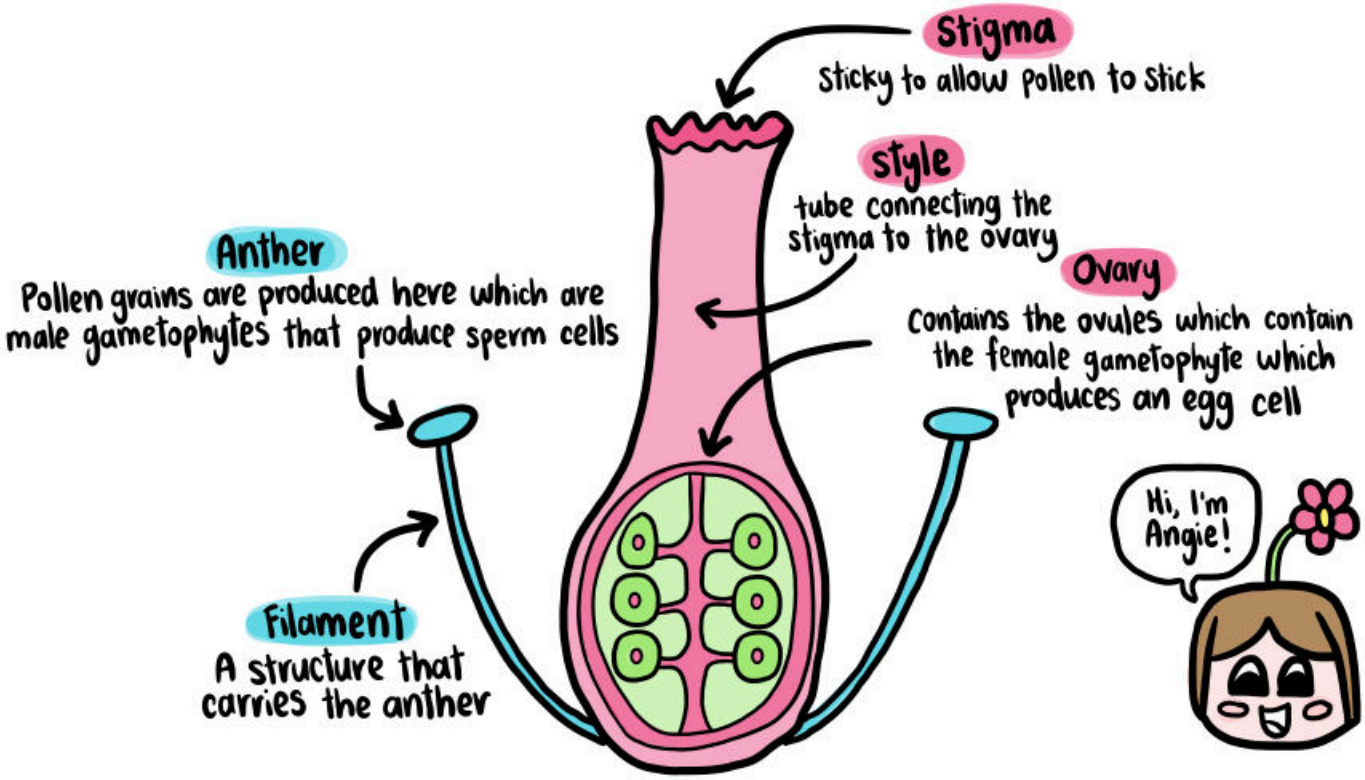
1. Gametes develop in male/female gametophytes.
2. Flagellated sperm swim in watery a environment to the female gametophyte where the egg is located.
3. Sperm nucleus fuses with the egg's nucleus (fertilisation) forming a zygote.
4. The zygote undergoes mitosis to form the sporophyte.
5. Diploid sporophyte cells undergo meiosis to produce haploid spores.
6. Spoves undergo mitosis to form the haploid multicellular gametophytes.

ANGIOSPERMS

these are more cutesy

(flowering plants)

Angiosperms reproduce sexually. Their reproductive structures are flowers, which produce pollen and ovules



1. Pollen grains (Male gametophyte) in the ANTHER undergo meiosis to produce sperm cells.
2. The female gametophyte in the ovule undergoes meiosis to produce egg cells.
3. The pollen grain is transferred via wind, water, insect or birds to the stigma on the same or a different plant (self or cross pollination).
4. A pollen tube grows through the style to the ovary which allows sperm to reach the egg cell.
5. The egg is fertilised (egg nucleus fuses with the sperm nucleus) to form a zygote
6. A seed develops around the fertilised ovule and the ovary wall thickens to form a fruit to protect the seed.
7. The seed germinates via mitosis to form the sporophyte which is the overall bodily structure of the plant.

POLLINATION

Self-pollination

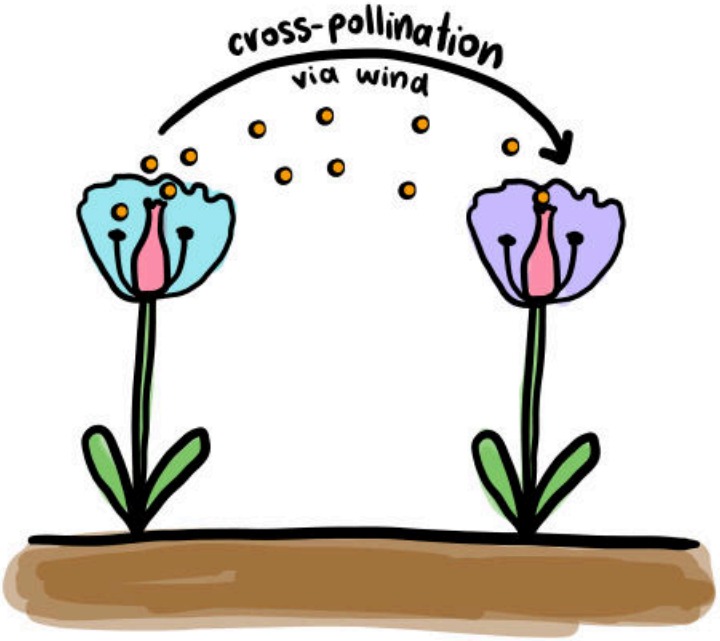
occurs when the pollen from a plant's anther is transferred to their own stigma.

ADVANTAGE:

- Guaranteed fertilisation when pollinators are scarce.
- Requires less energy investment in attracting pollinators.

DISADVANTAGE:

- Limited genetic variation since it uses the plant's own genetic material.



Cross-pollination

occurs when pollen from the anther of one flower is transferred to the stigma of a flower on a different plant of the same species.

↳ This type of pollination promotes genetic diversity, as it combines genetic material from two plants.

POLLINATION BY WIND

- Dispersing pollen in the air to reach another plant's stigma.

ADVANTAGE:

- Large amount of pollen can travel and reach vast areas

DISADVANTAGE:

- High chance of pollen not reaching and fertilising the plant.
- Favourable weather conditions are needed
- Direction of wind must be ideal

POLLINATION BY ANIMALS

- Animals such as birds, bees and butterflies transfer pollen by touching the anther of one flower and the stigma of another.

ADVANTAGE:

- Direct transfer of pollen

DISADVANTAGE:

- Time consuming
- Animals may not be present to pollinate during certain seasons.
- Pollinators must be attracted by colour, nectar and scent

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INTERNAL FERTILISATION

Internal fertilisation occurs when sperm fuses with an egg inside the female's reproductive tract.

- This method is common in terrestrial animals such as mammals, reptiles and birds.
- The internally fertilised egg may either:
  - ↳ Develop a shell and be laid in the external environment to complete its development
  - ↳ Become an embryo that is nurtured inside the female's reproductive system

ADVANTAGES

- Parental protection: The internal environment protects the gametes from dehydration and protects the fertilised eggs and developing embryo from predation or harsh environmental conditions.
  - ↳ This increases the likelihood of its survival
- Fewer eggs are required for the survival of a sufficient number of offspring
- Closer proximity of gametes increases the chance of fertilisation.

DISADVANTAGES

- Fewer offspring are produced because internal fertilisation requires more energy and care for the development of each offspring
- Copulation in animals such as birds, takes place on the ground, making the birds vulnerable to predators.
- Higher chance of transmitting diseases to parents through physical and sexual contract



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EXTERNAL FERTILISATION

External fertilisation involves the union of male and female gametes outside the body of the female parent.

- It is best suited to organisms that reproduce in an aquatic environment or a very moist environment.
  - ↳ The likelihood of a successful external fertilisation increases when reproductive cycles, mating behaviours and the release of gametes are aligned.

- Examples:

↳ **BONY FISH:**

* Female marine bony fish typically produce large quantities of eggs (ova), which are released into the water, where they are fertilised by sperm outside the female's body.
* Due to the rapid dispersal of gametes, both females and males must release their eggs and sperm almost simultaneously.
* Although thousands of eggs may be fertilised during one mating, many offspring may fall prey to microbial infections or predators, with only a small number surviving to maturity.

↳ **AMPHIBIANS:**

* During mating, the male amphibian holds onto the female positioning himself on her back.
* As the female releases her eggs into the water, the male simultaneously releases sperm, which fuses with the eggs.
* The fertilised eggs develop into tadpoles.

