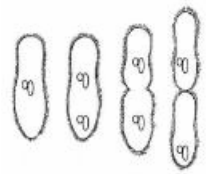
SEXUAL,
ASEXUAL,
what's the difference?

Core Concepts

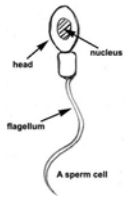
- Both sexual and asexual reproduction occur in the animal kingdom
- Diverse mechanisms of asexual reproduction enable animals to produce identical offspring rapidly
- Reproductive cycles vary extensively among animals

Asexual and Sexual Reproduction

- **Asexual Reproduction**
  - Creation of individuals whose genes come from **one parent** (no fusion of egg and sperm)
  - **Mitotic** cell division
  - Occurs mainly in organisms with a simple structure



- **Sexual Reproduction**
  - Fusion of haploid **gametes** to form a diploid **zygote**
  - Increases **genetic variation** - ability among offspring to generate unique combinations of genes from two parents



Reproductive Cycles and Patterns

- Periodic nature related to seasons
- Allows conservation of resources and energy
- Controlled by hormones and environmental cues

CESIUM BIO GROUP 1

- In some cases, animals may **alternate** between 2 modes
    - Asexual reproduction occurs in favorable conditions while sexual reproduction occurs in stressful situations
    - Factors affecting mode of reproduction
        - Environmental conditions (lunar cycles, rainfall, seasons, etc)
        - Availability of a mate
        - Hormonal signals
        - Availability of energy source
    - In *Daphnia* – each female can produce eggs of two types depending on conditions. One type is fertilized while the other develops through **parthenogenesis**.
        - Some vertebrates undergo parthenogenesis- females produce offspring from unfertilized eggs (e.g. fishes, amphibians, etc.)
        - chromosomes are **doubled** after meiosis to create diploid zygote
    - **Hermaphrodite** – individual having both male and female reproductive systems. Commonly observed in sessile or burrowing animals (e.g. tapeworms)
    - Each individual encountered is a potential mate resulting in twice as much offspring

Mechanisms of Asexual Reproduction

- **Fission**
    - A unicellular organism divides into two or more cells of the same size. The result is a living cell produced by division into two equal or near-equal parts.
- **Budding**
    - The formation of a new organism by the protrusion of part of another organism. This may be found in animals such as hydras, other cnidarians and tunicates

- **Release of gemmules**
    - Reproductive buds produced by asexual reproduction in freshwater and ocean sponges
- **Fragmentation**
    - Body breaks into pieces which develop into adults
    - Accomplished through **regeneration** (regrowth of lost body parts)
- **Polyembryony**
    - The only form of asexual reproduction in vertebrates. An embryo is divided in several identical embryos that have independent development (identical twins)

Advantages of Asexual Reproduction

- Offspring without mates
- Numerous offspring in short amount of time
- Advantageous in stable, favorable environments (perpetuates successful genotypes precisely)

Disadvantages of Asexual Reproduction

- No gene mixing
- No increase in genetic diversity. Thus, when environmental conditions are no longer favorable for that genotype the entire species is wiped out

Mechanisms of Sexual Reproduction

- **Fertilization**
    - **Factors affecting fertilization**
        - Specific mating behaviors
        - Courtship triggers the mutual release of gametes
        - Selective choice of mates and increased success rate of fertilization
        - Environmental cues also trigger gamete release
        - Pheromones are chemicals that influence the behavior of other organisms. These function as mate attractants

- **Internal and external fertilization** depend on mechanisms ensuring that mature sperm encounter fertile eggs of the same species

    - **External Fertilization**
        - Eggs are **released** into the environment
        - The male send out sperm to the environment to fertilize the egg
        - Usually happens in moist habitats to prevent desiccation
    - **Internal Fertilization**
        - The sperm fertilizes the egg inside the reproductive tract of the female
        - **Characteristics of Internal Fertilization**
            - Produces fewer zygotes but compensated by greater protection
                - Resistant eggshells (Amniotic Ca & Protein shells)
                - Development within reproductive tract
                - Parental care
            - Eutherian mammals complete fetal development outside the uterus via the placenta (eg. Kangaroo)
            - *Belostoma* produce few offspring but the parents increase chance of survival.

Advantages of Sexual Reproduction

- Greatly increases **genetic variety/diversity** within a population which leads to increase in genotype diversity subsequently leading to increase in **phenotype diversity** which is ideal for reproductive success and for lowering the chance of extinction of the entire species by natural selection

Disadvantages of Sexual Reproduction

- Takes more time than asexual reproduction
- Uses up more energy
- Finding a mate is necessary in most cases

Some sexual reproductive systems/activities

- Distinct gonads for specific gamete transport, such as complex system of **tubes and glands** (eg. parasitic flatworms)
- **Spermatheca** - female sperm storage sac (eg. insects)
- **Flatworms** - "penis fencing" (hermaphroditic)
- **Annelids** - most annelids are hermaphrodites, exhibit hermaphroditism
- Some organisms exhibit sequential hermaphroditism, which is changing sex within ones lifetime, which can be either **protogynous** (female first, i.e. Caribbean bluehead wrasse, kind of fish) or **protandrous** (male first, some oysters)
- Some reptiles like the *Cnemidophorus* reproduce asexually by parthenogenesis, others sexually by internal fertilization in the female, release eggs with hard external covering (shell)
- Frogs & most amphibians undergo external fertilization
- Most nonmammalian vertebrates have a single opening for the digestive, excretory and reproductive systems called the cloaca