G9UA Biological Diversity

**Topic 1: Biological Diversity and Survival**

* Variation is the difference or variety between living things. The larger the variation, the larger the diversity. (Ecosystems with a large biological diversity have many kinds of organisms). Variation helps species of organisms to excel in their environment.
  + Variations happen between species, as different species have different adaptations (a fish breathes underwater, turtles hold their breath.)
    - Structural Adaptations: body parts adapted to a job/environment.
    - Behavior Adaptations: behaviors adapted to a job/environment.
      * Adaptations are useful in helping an organism manage their niche.
  + Variations happen between members of the same species (one person is taller than another person).
* Large biological diversity (lots of variation) offers more possible resources for humans (like kinds of medicines found in plants).
* A species is a group of organisms that are similar and can’t reproduce (or don’t naturally reproduce) with other kinds of organisms. There can be a large amount of variation between different species.
  + Different species have special names --- See the Linnean Binomial naming system for more information on species names.
* The **diversity index** is as measurement of biodiversity. The larger the diversity index, the larger the number of species of organisms there are in a location.

**Topic 2 Habitat and Lifestyle**

* Niche is the role an organism plays in a specific habitat. If a habitat changes then the niche changes, if the job (or role) of the organism changes then the niche changes.
  + A Spruce tree and a Pine tree in the same forest can share the same niche, since they both do the same job in the same ecosystem.
  + A spruce tree and a bear in the same forest don’t share the same niche, since they do different jobs in the forest.
  + A spruce tree and a pine tree in different forests don’t share the same niche, since they don’t exist in the same environment.
* Competition between organisms occurs when two organisms share the same niche. The spruce tree and pine tree will compete for sunlight and water in the forest.
* Competition often occurs within a species, since the organisms will do the same job in the same environment.
  + The better adapted organisms succeed in competition and their traits will be passed onto the next generation.
* Broad Niche: in Canada, the ecosystems of the North are very large, and resources are spread out. Many organisms, like wolves travel over large areas competing for resources (generalists), so there is less diversity in a broad niche.
* Narrow Niche: when the ecosystem is stable (temperature and food supplies don’t change much, like in the tropics), organisms become specialists and are very adapted to do one job. The trouble with a narrow niche is that small changes to the environment makes some species unsuccessful.
* Symbiotic relationships: close relationships in nature between different species.
  + Mutualism: both species benefit from the relationship
  + Commensalism: one species benefits from the relationship, the other species is not affected by the relationship.
  + Parasitism: the parasite benefits from the relationship, but he host is harmed by the relationship.

**Topic 3: Passing it on**

\*\*\*\* remember that greater diversity results in greater chances of survival and it makes the species better able to adapt to changes in its habitat.

Heritable traits: are traits (or characteristics) that are passed on to the offspring from the parent organism(s).

Reproductive strategies: there are two basic ways to reproduce:

**sexually** (requiring a male and female parent that contribute half their DNA to the child)

**asexually** (only requires one parent, and creates an exact copy of the parent).

**Asexual reproduction**: creates exact copies of one parent, this does not allow much opportunity for variation or diversity (organisms that can only asexually reproduce aren’t as likely to survive changes to their habitat).

Kinds of Asexual Reproduction:

* **Binary Fission**: single celled organisms can split directly in half (binary means 2 and fission means splitting: literally one cell splits into two cells)
* **Asexual spores**: some multi-cellular organisms can create a single cell (called a zoospore) which can develop into a new multi-cellular organism.
* **Meristems** in plants (growing cell regions) can be removed at certain times in plants to clone the plant (a plant cutting).
  + Plants can reproduce asexually with **tubers** (potatoes are tubers), **Runners** (from roots, like a spider plant),
* **Budding**: some animals (sponges/jellyfish) can bud, which is a new organism develops on the parent and separates when it is a complete new organism.

**Sexual Reproduction**: uses DNA from both parents, and allows for a lot of diversity, since the offspring has a mix of both parent’s traits. Sexual reproduction makes it more likely that a species of organism is going to survive changes to their habitat.

Kinds of Sexual Reproduction:

* Bacterial conjugation: is the sharing of DNA between bacteria, this isn’t really reproduction, but does increase the diversity of the bacteria. Bacteria will reproduce asexually after conjugation.
* Plant sexual reproduction: (see pages 33-34 for a full explanation).
  + Plants generally can gymnospores (ferns) that reproduce sexually using spores
  + Other plants are angiosperms (flowering plants). Flowering plants can have many different looking flowers. They all have female reproductive parts, like the pistil (containing and egg) and male parts like the stamen (contains the sperm).
    - * Note the attached description of flower sex.
* Animal Sexual Reproduction: sexual gametes (the general name for male and female

reproductive cells, like eggs and sperm).

* + - Fertilization happens when the male and female gametes (contain half their parent’s DNA) meet up at the same time. This makes a zygote.
    - Gametes die quickly (they dry out really quickly), so moist warm environments are best for fertilization.
    - Fertilization can occur in the female (internal—like in mammals) or in the environment (external—like in frogs) depending on the species.
    - Zygotes, if protected can grow into many cells called an embryo.

Plant Reproduction: Hardware and step by step guide to making embryos

1. The male reproductive organ is the stamen, which is made out of a filament (looks like a hair) and the anther (at the end of the filament), which carries the pollen. Pollen is the male gamete (male reproductive cell) is taken from the anther by the wind or carried by an organism (like bee).
2. The pollen attaches to the stigma (sticky end) of the pistil (female reproductive organ). This is called pollination. A pollen tube forms in Style of the pistil and carries the pollen to the ovule (which holds the ovary of the plant—the ovary holds the female gamete—the egg)
3. When the pollen reaches the ovary, it fertilizes the egg, creating a zygote.
4. The zygote will grow into a seed, which contains an embryo (small plant) and cotyledon (food source for the embryo). The seed is protected by the seed coat.

Animal Sexual Reproduction: Hardware and step by step guide to making embryos.

1. The male gamete (sperm) is donated to either the female (internal fertilization- the sperm must be able to move), or the sperm is deposited on the eggs in the environment (frogs fertilizing eggs on the bottom of their pond).
2. The female gamete (egg) meets the male gamete (sperm) and they combine to create one new cell called the zygote. The zygote splits into two cells (doubles), then doubles repeatedly creating an embryo.

**Topic 5: DNA : The Secret of Life**

* **Nucleus –** the control center of the cell that contains genetic materials. The nucleus contains the chromosomes.
* **Chromosomes –** composed of strands of DNA. Humans have 46 chromosomes – found in 23 pairs – with one copy of each chromosome coming from each parent.
* **DNA – Deoxyribonucleic Acid –** is the molecule that contains the genetic material. This genetic material has the ability to reproduce itself, move from parent to offspring, and explains the variation within species. The DNA molecule has the shape of a spiral ladder.
* **Nucleotides –** Make up the sides of the ladder of the DNA molecule. Each nucleotide contains a phosphate, a sugar, and one of 4 different nitrogen bases. The nucleotides occur in pairs and each pair forms one rung of the spiral ladder of the DNA molecule.
* **Nitrogen Bases –** There are 4 possible nitrogen bases of a nucleotide. They are Adenine, Thymine, Cytosine, and Guanine. They always occur in pairs. **A always bonds with T, and C always bonds with G**. These nitrogen bases pair up because the shapes of the bases fit together.
* The sequence of bases, or letters in DNA forms a code. This code is the blueprint that controls production of proteins in cells. A section of the DNA molecule that codes for a specific protein is called a **gene**.
* Cell replacement: Normal cells (**Somatic Cells**) have 23 pairs of chromosomes. They are replaced over time, by splitting in half (copying DNA). Replacing somatic cells is done by the process of **Mitosis.**
* Sex Cells or **Gametes** (sperm and egg) only have one copy of each chromosome (23 in total). Gametes are made by the process of **Meiosis**.
* Sexual reproduction in humans has 223 possible gene combinations (8 400 000).
* Large variation in traits makes it possible for a population of organisms to survive times of change and competition.
* **Genetic Engineering**: taking DNA from one cell and putting it into a different somatic cell. The technology to genetically engineer organisms is called **biotechnology**. Medicine uses genetic engineering to make valuable proteins, like insulin.
* The food industry is affected by biotechnology:
  + Aquaculture: growing crops in the ocean, uses genetic engineering to make the fish disease resistant and grow faster.
  + Genetic engineering can lead to more monoculture, since the desired DNA trait added to the organism is meant to stay in the organism, the opportunity for variation is decreased by limited reproduction.