

CELL PROCESSES STUDY GUIDE

DNA and Reproduction

All living things contain **DNA**. DNA is a chemical that contains a library of information. This information is needed to build an organism and control it. DNA is found in the nucleus of nearly every cell in your body. The DNA in every cell carries the same information. DNA has the shape of a twisted ladder...a **double helix**. The sides of the ladder are made of phosphate and sugar molecules. The steps of the ladder are made of pairs of **nitrogen bases** (thymine::adenine or cytosine::guanine)(remember AT:GC). DNA in every living thing is same, except for the pattern of bases that make up the steps of the DNA ladder.

The study of traits or characteristics passed from parent to offspring (babies) is called **heredity**. Traits or characteristics are passed from parent to offspring because DNA is transferred in the process of reproduction.

In **asexual** reproduction, all DNA comes from one parent. Offspring from asexual reproduction are exactly like the parent. One celled living things use mitosis to reproduce. Some examples of asexual reproduction are budding, regeneration, spore formation, and parthenogenesis.

Budding – offspring grow off the side of the parent

Regeneration/Fragmentation – a part broken off the parent grows into a new organism

Parthenogenesis – the development of an unfertilized egg into an individual

Because all genetic information comes from one parent in asexual reproduction, it allows for little diversity within a population, but these organisms are not faced with competition related to reproduction.

In **sexual** reproduction, half of the DNA comes from the mother, and half from the father. For this to happen, gametes (egg and sperm) must be created. Gametes (or reproductive cells) have half the normal number of chromosomes. Gametes are formed by meiosis. Gametes DO NOT have a pair of genes for each trait, only one. When gametes join together in the process of **fertilization**, the new cell again has a pair of genes for each trait, one from each parent. Offspring from sexual reproduction may look similar to one parent or the other. They may also look very different. Sexual reproduction allows for great diversity, but often creates competition for mates.

THE CELL CYCLE

The cell cycle includes three stages: **Interphase**, **Mitosis**, and **Cytokinesis**

During **interphase**, the cell grows, the DNA makes a copy of itself (replicates), and the cells gets ready to divide.

Mitosis is divided into several stages:

Prophase: the chromosomes form, with one copy of the DNA on each chromatid (arm of the chromosome)

Metaphase: The chromosomes line up in the **Middle** of the cell

Anaphase: The chromatids get pulled **Apart** and **Away** by the spindle fibers that stretch across the cell

Telophase: The chromosome halves get pulled to either side of the cell. Two nuclei are now present.

Cytokinesis: the cell pinches in half to form two new cells with a complete package of DNA.

REMEMBER: **I Paco Make A Taco Cheesy**

The result of the entire cell cycle is two new cells with the exact same DNA. The result of mitosis is the creation of two identical nuclei.

Reproduction in Flowering Plants

Flowers are the reproductive organs of many plants. The main parts of the flower are the **stamen** (male), the **pistil** (female), the **petals**, and the **sepals**. An individual flower may or may not have all of these parts.

The stamen is made of a filament and the **anther**, which sits on top of it. The anther is where pollen is produced. The **pollen** contains the male gamete.

The pistil is in the center of the flower. The pistil is made of the ovary, the style and the stigma. The **stigma** is at the top and collects pollen. The **ovary** contains eggs, the female gamete. The ovary will swell up once the eggs have been fertilized. Fertilized eggs develop into seeds. Many fruits that we eat are these swollen ovaries. These contain, feed, and protect the developing seeds.

The petals are the colorful part of the flower. Petals make the flower attractive to insects and other pollinators. The sepals are green, leaf-like petals that surround the flower before it opens.

A major part of reproduction in flowering plants is **pollination**. Pollen must get from the anther to the stigma. Insects, wind, and other animals often play a part in this. Cross-pollination happens when pollen from one plant reaches the pistil of a different plant. The other option is self-pollination.

ENERGY IN LIVING THINGS

PHOTOSYNTHESIS

Nearly all living things depend on the sun as the ultimate source of energy for living. Plants are **autotrophs** (producers), which means they make their own food, and they do this by the process of photosynthesis:



The raw materials for photosynthesis are carbon dioxide and water. CO_2 is collected by the stomata on the underside of leaves. Water moves up from the roots of the plants by the process of transpiration. The process begins as the chlorophyll and other pigments absorb sunlight, fueling the chemical reaction to create sugar such as glucose. Chlorophyll is a green pigment found in **chloroplasts**. This is where photosynthesis happens.

Think of photosynthesis as the process by which plants store energy in little packets called glucose. Not only do living things depend on the sugars produced by photosynthesis, they also need the oxygen that is created.

RESPIRATION

You and I -our dogs, cats, and other animals- are **heterotrophs** (consumers). We must depend on something else for our food. By the process of cellular respiration, we “tear open” the energy packets created by photosynthesis. Here is the equation for respiration:



Notice that it is the opposite equation of photosynthesis, but don't be misled. Don't think plants do one and we do the other. **PLANTS DO BOTH**. That is why they make the food in the first place – we get the leftovers!

The first stage of cellular respiration is the breaking down of **glucose**. This happens within the cytoplasm and releases only a tiny bit of energy. This step does NOT need oxygen. The rest of respiration happens in the **mitochondria**. With oxygen, processes in the mitochondria release a LOT of energy. While we talk of breathing as respiration, it is not the same as the process of cellular respiration.

FERMENTATION

Many things get energy by the process of **fermentation**. This happens when there is no oxygen present. Yeast that makes bread rise use alcoholic fermentation. When you exercise, your body may use the process of lactic acid fermentation if you don't get enough oxygen. Cellular respiration is much more efficient than fermentation.