

Lesson 10: Monday, April 6, 2020. Biology MHS

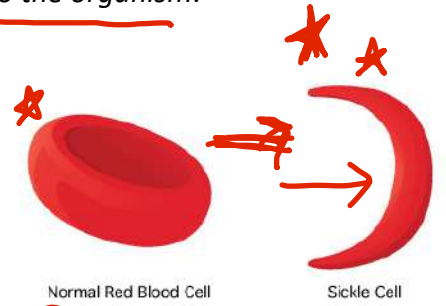
AIM: What causes mutations? Are mutations harmful?

✓ As we learned last lesson, some **mutations** (*changes in the DNA sequence*) do not affect the final protein. This means that some mutations go completely unnoticed and have no effect on the organism. But, some mutations do affect the amino acid sequence, and thereby the shape of the protein and its function.

- ✓ In very rare cases, the new protein might result in a new trait that actually gives the organism an advantage! But, this is something that we will learn about during **evolution**.
- In most cases, any change to a necessary protein is likely to be harmful to the organism.

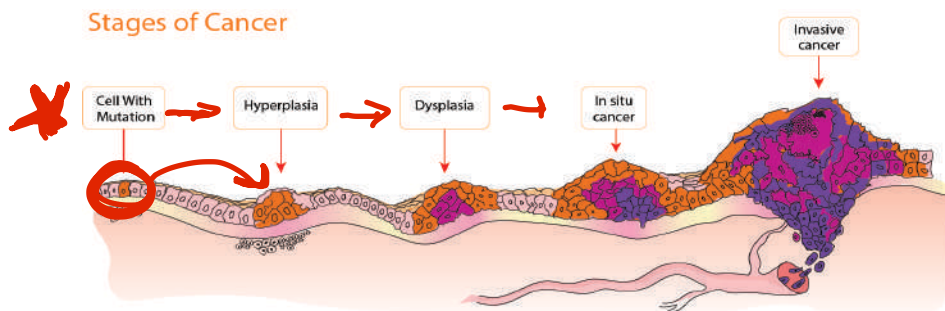
★ Example of a harmful gene mutation: Sickle Cell Disease

- Sickle Cell Disease is a **genetic disorder** that can be inherited. People with sickle cell disease have a **mutation** in the gene that codes for hemoglobin. **Hemoglobin** is a protein found in red blood cells that helps to transport oxygen. Did you know that this mutation results from just a SINGLE base change in the gene, but that this change affects the entire shape of the protein?? The change in the hemoglobin actually affects the entire shape of the red blood cell, as you can see in the picture. The "sickle cells" are not able to transport oxygen very well, and this affects the health of the individual.



★ Example of a harmful gene mutation: Cancer

- Gene mutations in a cell can result in uncontrolled cell division, called **cancer**. This can occur at any random point in any person's life. A random mutation can occur in any cell performing cell division (mitosis). If the mutation occurs in a gene that regulates cell division, the cell may start to divide uncontrollably. The genes that control cell division are genes that produce "GO" and "STOP" signals, telling cells right time to divide (i.e., growth & repair). If these STOP and GO signals are mutated, a cell may start to divide uncontrollably. Each time the cell divides, it passes on the mutation and creates more cancerous cells. Cancer cells serve no purpose and steal oxygen and nutrients from healthy cells.
- You can see from the diagram below that cancer starts with a single mutation in a cell. The mutated cells are often described as "abnormal cells."



★ What causes mutations??

- Once again, mutations are copying errors that occur during DNA replication. Mutations are like "cellular typos."
- Mutations are **COMPLETELY RANDOM EVENTS** - they can happen at any time to any cell that is dividing.
- While a mutation **CANNOT** be predicted or pre-determined, there are some factors that can increase your chances of mutation.

★ RISK FACTORS FOR MUTATIONS:

- ★ Exposure to harmful radiation - this includes UV radiation from the sun and X-rays
- ★ Exposure to harmful chemicals - you often hear on the news about chemicals that have been linked to cancer. For example - harmful chemicals in tobacco products have been linked to lung cancer.
- Exposure to risk factors does NOT "guarantee" mutation - it only increases the likelihood.