

## Abiotic Factors

Cells exist within a very narrow range of environmental conditions. Sudden changes in these environmental conditions may cause great stress or even death to living organisms. **Non-living environmental conditions that affect living organisms are called abiotic factors.**

REMEMBER THIS!!!

**Abiotic factors are non-living. If even one of the abiotic factors is beyond the range that a cell can tolerate, then the cell must move to a different area, suffer, or die. Biotic factors are living or were once living.**

Let's see how the various abiotic factors affect the cells. You will need to know the following information.

### 1. pH

**pH is the measure of whether something is an acid, neutral, or a base.** In biology, we are concerned about the pH of a cell and the pH of the environment of the cell. The **pH scale ranges from 1 to 14**. The lower numbers indicate a strong acid. The higher numbers indicate a strong base. The number 7 is neutral. Numbers around 7 are almost neutral. A solution with a pH of 2 is a stronger acid than a solution with a pH of 6. A solution with a pH of 13 is a stronger base than a solution with a pH of 9.

**Most living things, including humans, live within a very narrow pH range.** Most living things need a **pH near 7, or neutral**. If a cell is placed in a strong acid or strong base environment, then the cell either has to move, suffer, or die.

***Interesting Scientific Fact:** The pH inside of a cell is very important. If a cell is unable to get rid of carbon dioxide (a waste product of respiration), the pH inside the cell begins to become more acidic. If the condition continues, the cell dies. If enough cells die, the whole organism dies.*

### 2. Temperature

**Temperature is the measure of how much heat something contains.** Temperature shows whether something is hot or cold. **Living organisms exist within a very narrow temperature range.** Some living things respond best in warm temperatures, like the Rattlesnakes of the Southwest. Other living things prefer the cooler climates of the north, like Polar Bears. **All living things have a preferred temperature range.** A Polar Bear would not survive in the heat of the Southwest. A Southwest Rattlesnake would not survive in the cold temperatures of Alaska.

**The temperature inside of a cell is very important.** If the cell is allowed to cool off too much it dies. This is what can happen when animals are exposed to cold temperatures for a long time, like falling into icy water. A cell can also die if it becomes too hot. This can happen when animals are exposed to extreme heat, such as an animal locked in a car during the summer with the windows closed. In both cases, **if the temperature inside of the cell becomes too cold or too hot, the cell dies.** If enough cells die, then the whole organism dies. All living things have a temperature they prefer. If the temperature changes, either by getting warmer or colder, they have to move, suffer, or die.

***Interesting Scientific Fact:** Your internal body temperature is considered normal if it is near 98.6 °F. Your body has a very narrow range of temperatures. If your temperature gets above 105 °F or below 93 °F, then you are probably very sick and need immediate medical help.*

### 3. Light

**All living things prefer certain levels of light.** Some living things, like plants, require certain levels of light for photosynthesis to occur. Some living things require a lot of light. Examples of this type of organism are the grasses that thrive in the areas near the equator. They receive a lot of light! Other organisms, like moths, prefer less light. Both have a preferred light level. The equatorial grasses would not grow in the darkness that the moth prefers. Likewise, the moth would not survive in the bright light found along the equator.

**All living things have a light level they prefer. If the light level changes away from their preferred level, they have to move, suffer, or die.**

REMEMBER THIS!!!

**Light is required for photosynthesis to occur. Some green plants can survive with low levels of light while others require stronger light. No green plant can photosynthesize in the dark. If green plants die because of a lack of light, it affects all of the other organisms in their food web. Maybe even you!**

### 4. Water

**Water is essential for all living things.** Water is needed for photosynthesis and all chemical reactions that a cell needs to survive. Remember, water dissolves most substances and allows them to react. **If a cell has too little or too much water, it can die.**

***Interesting Scientific Fact:** A unicellular organism that is taken from salt water and placed in fresh water absorbs water because of osmosis and may burst. Likewise a unicellular organism taken from fresh water and placed in salt water will lose water and shrink because of osmosis. In both cases, if not returned to their native environment, the cells will die.*

### 5. Oxygen

Oxygen is a colorless, odorless gas that is found in the atmosphere. It is made as a waste product by green plants during photosynthesis. **Oxygen is also very important to animal cells.** All cells need oxygen to perform aerobic respiration. Remember, aerobic respiration is the process that cells use to create energy. Aerobic respiration breaks apart glucose to make ATP, the energy molecule. The cells then use the ATP for energy. So, **without oxygen, the cells could not make energy. With no energy, the cells would die.**

### 6. Carbon Dioxide

Carbon dioxide is a colorless, odorless gas that is found in the atmosphere. It is made by animals during aerobic respiration. Although carbon dioxide is a poison to animal cells, it is essential to green plant cells. **Plants require carbon dioxide during photosynthesis.** Remember, during photosynthesis, green plants mix carbon dioxide from the atmosphere and water through their roots while using the energy of light to make glucose and the waste gas oxygen. This is important because all cells use glucose as an energy source and to build other molecules for use by the cell. **If the amount of carbon dioxide is too low or too high, the cells usually die.**

***Interesting Scientific Fact:** Most people think we breathe to bring oxygen into our body. While this is true, we actually breathe to rid our body of carbon dioxide. A build up of carbon dioxide is a quicker death than a lack of oxygen.*

## 7. Radiation

**Radiation is invisible energy.** We know that radiation travels in waves. Light, heat, X-rays and ultraviolet light are all examples of radiation. **Some radiation is harmless, but certain types of radiation, like gamma and ultraviolet, and over-exposure to certain types of radiation can damage the DNA inside the nucleus of a cell.** This damage may result in DNA mutations or even cancer. Mutations are changes in the DNA structure that may be lethal or may create a different trait or traits within an organism. Cancer is defined as the uncontrollable division of cells. Cancer often makes the cells useless. Although most radiation is harmless, cells exposed to certain types of radiation, or over-exposed to certain types of radiation can be damaged or destroyed.

## 8. Toxins

**Toxins are poisons.** Toxins can be man-made or natural. The poison released during a rattlesnake bite is a toxin. Toxins often interfere with the ability of a cell to perform its function. Natural toxins are helpful to certain animals because it allows them to capture prey and defend themselves. However, the victim whether accidental or on purpose may die.

REMEMBER THIS!!!

**Cells live within a narrow range of abiotic factors. Too much or too little of any abiotic factor may damage or destroy a cell or the entire organism.**