



# TeachEngineering

STEM Curriculum for K-12

## BACTERIAL ADAPTATIONS AND THEIR APPLICATION IN GENETIC ENGINEERING



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# BACTERIA REVIEW: SIX KINGDOMS

**Plantae – All Plants**

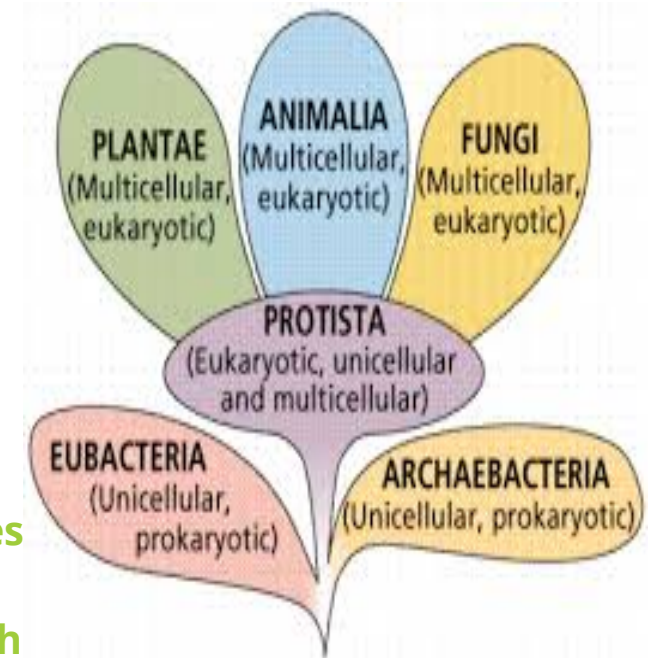
**Fungi – Mushrooms, Molds**

**Animalia – All Animals**

**Protista – Protists, Algae**

**Eubacteria – “True Bacteria”, commonly found in most places**

**Archaeobacteria – bacteria found in extreme environments th like the hydrothermal vents in the ocean and the hot springs in Yellowstone Park. Sometimes called extremophiles.**



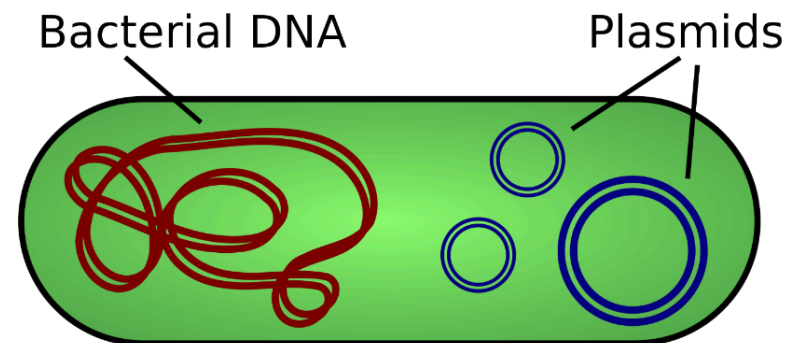
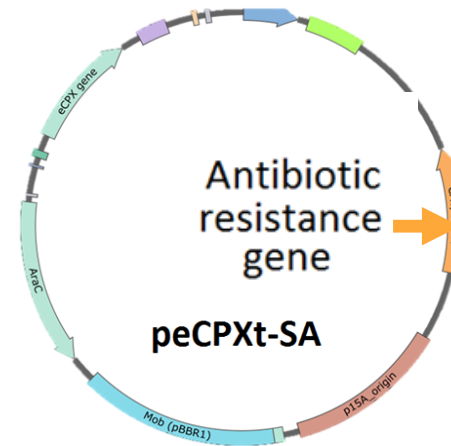
# BACTERIA OVERVIEW

All bacteria are **prokaryotes**, meaning they do not have a true nucleus

Instead, their large, circular DNA is free-floating in an area called the **nucleoid region**.

Bacteria also have smaller, independent, circular pieces of DNA called **plasmids**, which hold a small amount of genes.

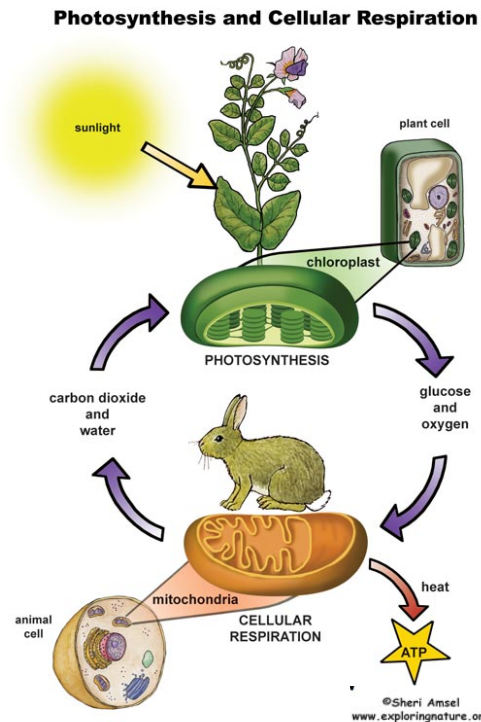
These have various uses and give them an advantage in certain environments, like antibiotic and heavy metal resistance.



# RESPIRATION REVIEW: CELLULAR RESPIRATION

Most organisms require oxygen to survive, and go through a process known as **cellular respiration**

Occurs in all organisms



Also known as **aerobic respiration**

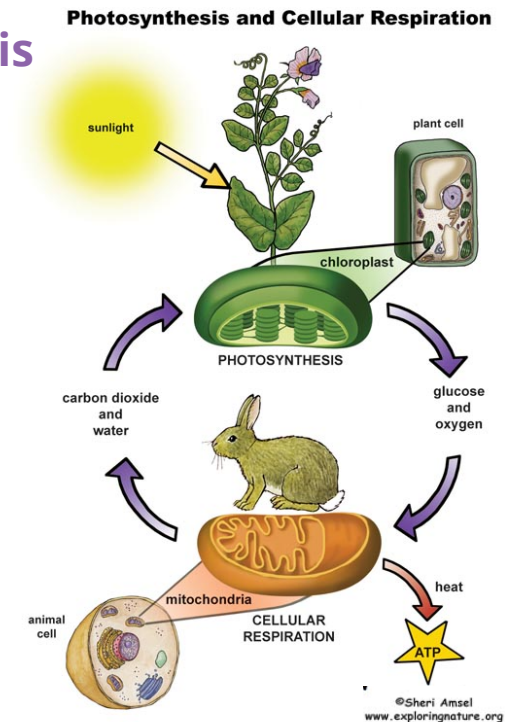
Organisms use oxygen to break down glucose and create energy molecules (ATP-adenosine triphosphate) then creates carbon dioxide and water as a waste

# RESPIRATION REVIEW: CELLULAR RESPIRATION

Cellular respiration is the exact opposite of photosynthesis

Occurs in all plants and some protists, like algae

Organisms use energy from light and water ( $H_2O$ ) to use carbon dioxide ( $CO_2$ ) to create glucose ( $C_6H_{12}O_6$ ) for food and oxygen ( $O_2$ ) as a waste.



# AEROBIC VS. ANAEROBIC

**Aerobic**

**Occurs when an organism uses oxygen to respire (breathe).**

**Aero - means  
"air"**

**Anaerobic**

**Organisms can respire even  
when there is no oxygen  
present in their environment.**

**Produces much less energy  
than aerobic respiration and  
is much more limiting.**

**An - means  
"without"**

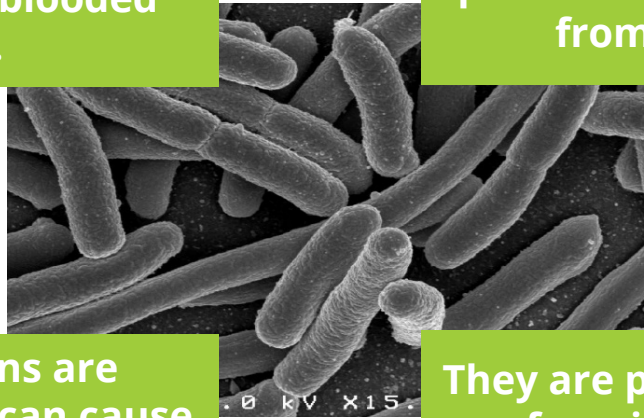
To review, watch [this video](#) discussing aerobic vs anaerobic respiration.

# E. COLI

A rod-shaped bacterium of the kingdom Eubacteria that is commonly found in the lower intestine of warm-blooded organisms.

The strains in our intestines have a symbiotic relationship with their hosts: the bacteria produces vitamins and prevents harmful bacteria (pathogens) from colonizing our intestine

*Escherichia coli*



Most *E. coli* strains are harmless, but some can cause serious food poisoning in their hosts, and are occasionally responsible for product recalls due to food contamination.

They are part of the normal microbiota of our intestines and can exit our bodies through our fecal matter.

# E. COLI

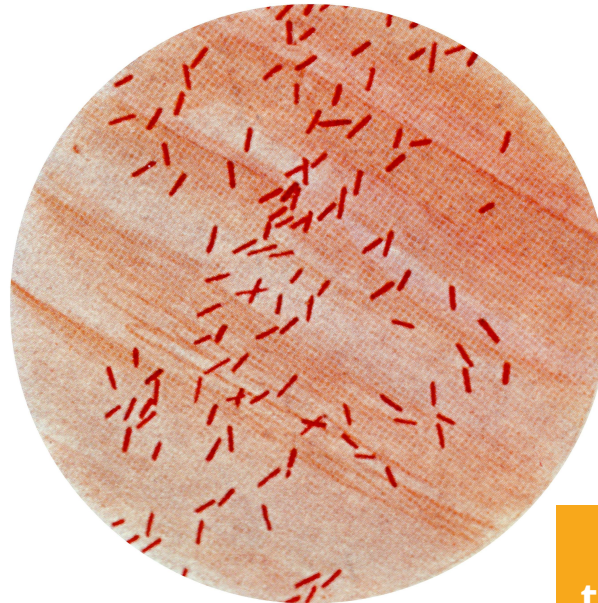
*E. coli* can survive in both oxygen and in environments lacking oxygen.

Under favorable conditions, it takes up to 20 minutes to reproduce.

It can be grown and cultured easily and inexpensively

It is an important species in the fields of biotechnology and microbiology

It is the most widely studied prokaryotic model organism



It has been intensively researched and used in lab settings for over 60 years.

*E. coli* has been used as the host organism for the majority of work with recombinant DNA.