## WORD PUZZLE: MICROBE FARMS, JUST ADD WATER!

by carmen

SORGMMOINRCAI (5, 1)

RHTEE SONMIAD (3)

RACTIABE (6)

LULLINAUERC (2, 13)

YRCOKTIORAP (12, 9)

RACAAEH (11)

CIKTAUYREO (14, 10)

NODMGKI (16, 4, 7, 15)

SOCLED SYTMES (8)

Unscramble the vocabulary words and use the numbered boxes to solve the puzzle

W (1) _ _ _ _ _ _ _ _ _ (10) (11) _ _ _ _ _ _ (16)

## COMIC By Ernie






# EL PASO WATER CHRONICLES

*Water and Science News from El Paso*

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IN THIS ISSUE



## TESTING THE EL PASO SOIL FOR LIFE

*By TecH$_2$0*

We know that water is needed for all of the organisms that we can see, but what about those living things that we cannot see? Even though we live in a desert, we still see pill bugs, earthworms, grubs, and beetles in our El Paso dirt. These animals are known as decomposers. As the name suggests, decomposers break down and eat smaller things that live in dirt, like algae, fungi, and bacteria. If they are living in our El Paso soil, what on "Earth" is keeping animals like these alive? While not readily visible, our El Paso soil has a world of organisms that form food webs. In our dirt, mud, and gardens, bugs and worms feast on organisms that feed on even smaller microorganisms, also known as microbes, too small to be seen by the naked eye. These microorganisms then eat smaller and smaller microorganisms, until the smallest living things have only chemicals like sulfur, carbon, and nitrogen left to eat.

When scientists gather soil samples to test for the presence of microorganisms, they run into a problem. Microorganisms are so small and so far apart from each other, that it is nearly impossible for scientists to determine what type of living things are present in the sample. It wasn't until about 100 years ago that scientists figured out a way to test the soil for these microbes.

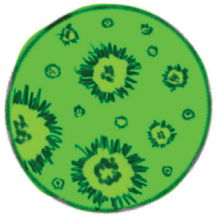
In order to do so, microbiologists had to create microbe farms! In fact, kids can create their own microbe farm to test the soil. Before starting a microbe farm, we will need to know how to identify our microbial crops. To do this, we will take a short detour to talk about how scientists classify organisms.

## Classifying Organisms: Using Domains

There are many kinds of microorganisms that live in the ground just beneath your feet. Scientists classify microorganisms into 3 domains (or categories): Archaea, Bacteria and Eukarya. Organisms belonging in the Archaea and Bacteria domains are microbial and have only been discovered since the invention of the microscope. All other living things, including plants and animals, fall under the domain of Eukarya. As we have learned about living things, we know that all living things have basic needs and are comprised of cells. How their cells are structured, however, are what separates these living things into the three domains.

ARCHAEA

The first domain that we will learn about is Archaea. Archaea are believed to be the first type of life that ever existed on Earth. Though all of the organisms found in the domains of Bacteria and Eukarya have the basic needs of water and food, most Archaea do not need oxygen to survive and have probably existed before the Earth had formed its current oxygen-rich atmosphere. Archaea are unicellular, meaning they only consist of a single simple cell. Archaea cells are so simple that they don't even have a nucleus like the more complex cells of plants, animals, and fungi, which are all found in the Eukarya domain. Scientists call cells that do not contain a nucleus prokaryotic- "pro" meaning before and "karyo" meaning kernel (nucleus). Archaea have been detected in harsh conditions and at extreme temperatures. Because most archaea can survive extreme conditions, it is speculated that archaea could likely be found living outside of planet Earth, in places in our Solar System that contain icy oceans of water, such as Jupiter's moon, Europa, or Saturn's moon, Titan.



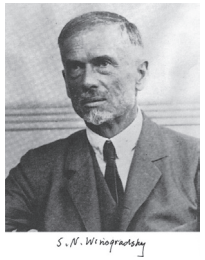
BACTERIA

The Bacteria domain is the most successful group of organisms known, growing in almost any type of environment, ranging from thermal hot springs to thunderclouds. It was once thought that archaea and bacteria belonged in the same domain, originally being separated into different kingdoms. Only recently were these microbes cast into separate domains. All bacteria, like archaea, are unicellular, meaning they too only consist of a single cell and they are both prokaryotic or lacking a nucleus. Both archaea and bacteria can be aerobic (oxygen-dependent) or anaerobic (oxygen-independent), meaning that they both have species living in conditions with or without oxygen. The difference between archaea and bacteria is that bacteria have a different cell structure and DNA replication process than archaea.

The last domain is Eukarya. The Eukarya domain hosts microorganisms, plants, fungi, and animals. What separates Eukarya from the other two domains is that Eukarya organisms have cells WITH a nucleus, "eu" meaning good, and "karyo" meaning kernel (nucleus). The nucleus of a cell is like a brain, in that it controls the activities that a cell is able to do. Under the Domain Eukarya, scientists have classified four main kingdoms: Plants, Animals, Fungi and Protists. While we can easily observe plants, animals, and some fungi, the protist kingdom is a kingdom of microorganisms that can only be seen with the help of a microscope. In our last chronicle, we described many protists that can be grown in the huecos of Hueco Tanks State Park, including species that are found only there at the state park. Can you name some of those microorganisms that we studied?

EUKARYA

## Microbe Farms, Just Add Water!




All soils in El Paso contain microorganisms, but they are difficult to see. The Winogradsky Column, named after a Russian scientist, Nikolaievich Winogradsky, who invented it, makes viewing these microbes a lot easier. This device is still used today by scientists to see what microorganisms exist in a sample of soil. Just like a farmer, if we want to grow a lot of one type of food, we grow it as a crop in a farm. By creating a Winogradsky column, we will be able to grow and "see" these tiny microbes that aren't normally visible. "Farming" large amounts of these microbes in spots large enough to see will make them visible. How do we grow a large amount of microbes? We will do this by providing some basic needs: food and most importantly, water. To grow the microbes, scientists will mix a sample of soil with water, along with a type of food they are known to eat, such as sulfur or carbon. The soil mixture is then placed in a clear cylinder container, often referred to as a column, and is left in a closed system for a period of weeks to see what grows. The column resembles a terrarium for bacteria. Imagine that you are growing billions of crops, in fact, 1 billion bacteria are known to fit on the head of a pin. It takes billions upon billions of bacteria cells to make a colony large enough to be seen with the naked eye. The colors produced and where they appear will help to identify the strain of bacteria or archaea based on the presence or absence of oxygen. Figure A shows an example of the Winogradsky column.

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Since Winogradsky columns are closed systems, they can be maintained for years and even decades! Some of the oldest Winogradsky columns still growing microbial colonies today were actually created in the 1940s. They also can become so colorful that people have actually grown them as art to decorate a house, just like an aquarium or terrarium. We have provided a Winogradsky Column procedure so that you can create your own Winogradsky column from El Paso soil samples!