

Biodiversity

Learning Objectives:

- Understand how life on Earth is classified.
- Learn the four kingdoms of Eukarya
- Identify characteristics that define each kingdom

Key Vocabulary:

- | | |
|-------------|----------------|
| • Taxonomy | • Eukarya |
| • Phylogeny | • Biodiversity |
| • Archaea | • Microcosm |
| • Bacteria | |

INTRODUCTION (15 MIN. OPEN DISCUSSION)

So far, in our time together, who can tell me some of the organisms we've talked about?

Sample answers

- E. Coli
 - Belongs to Domain Bacteria
- Dogs & Wolves
 - Belongs to Domain Eukarya, Kingdom Animalia
- Humans
 - Belong to Domain Eukarya, Kingdom Animalia
- Rabbits
 - Belong to Domain Eukarya, Kingdom Animalia
- Elephants
 - Belong to Domain Eukarya, Kingdom Animalia!
- **Viruses?**
 - Trick question! They're not alive and therefore not classified into domains and kingdoms.

All of the species we know of, are classified into one of three domains: Archaea, Bacteria and Eukarya. This classification is what we call Taxonomy.

And these are only some of the species we know! There are so many living organisms on Earth, that their numbers have to be quantified based on mass: 75 billion tons of living mass on our planet, and we are discovering new ones every day!

As of May, we've discovered 11 new species, in 2018 alone!

Where do you think most of our undiscovered species live? *The ocean!*

One million species live in the ocean, and two-thirds of those have yet to be discovered! In fact, it is said we know more about the furthest side of the moon than our very own deep sea!

Who can tell me something about Archaea?

Prokaryotes that often live in extreme environments.

These are some of the oldest organisms on Earth. They live where no one else dares, places with high or low temperatures, high salt concentrations, or a ton of methane like in the guts of animals. Their environments are so extreme, we use them to model life on Earth billions of years ago!

In fact, archaea are being subjected to conditions similar to those on Mars to see if they'll survive, and some are doing quite well: [show image]

Deinococcus radiodurans is being subjected to a crazy amount of radiation that would kill us a few times over and temperatures we couldn't bear. It is the frontrunner model for life on Mars!

Who remembers our previous workshops and can tell me something about Domain Bacteria? *We share the planet with five million trillion trillion bacteria!*

They come in all sizes and shapes and live in all corners of the world because of how easily they can reproduce and share genes!

While we've talked about bacteria that make us sick, they're also some we can't live without! It is bacteria in your gut that helps you get the most nutrients out of your food, breakdown milk and vegetables !

The different bacteria and organisms that reside within our bodies are called microbiomes. They're so important to human life, that when our microbiome is in disarray, we take probiotics or more extremely, undergo fecal transplants to get in you the bacteria you need!

Now, who can tell me about Eukarya? *Us, and all other animals and plants!*

Eukarya encompasses all organisms made up of eukaryotic cells. This domain is so vast and radically different, it has been separated into Kingdoms!

Lets play a game, I will tell you some characteristics of a kingdom, and you'll have to guess which one it corresponds to. The four kingdoms in Eukarya are Protista, Fungi, Plantae, Animalia.

[Mini-Activity]

Answer: Plantae

1. These guys depend on water, though some have found ways to live with a limited amount of it

Plants, like all life on Earth, originated in water. As they moved out of the water and into land, plants had to find a way to keep themselves hydrated, so they developed **cuticles**, which surround their leaves to keep water from evaporating, and developed roots to suck up water as

needed, much like a straw. In the desert, plants survive with little water by spreading far apart and having super long roots, so that they each have enough water!

2. They make their very own food, and serve as food to others.

Plants are autotrophs Photosynthesis! They turn energy from the sun into the sugars they consume to carry out their daily functions. In turn, they serve as food to herbivores, and send their energy up the food chain.

3. Their sperm travels either in the water, through the air, or is carried.

When plants are in the water, their sperm swim, but when on land, their sperm is packaged into pollen, which bees and other animals spread around.

Answer: Fungi

1. These guys grow as filaments that come together

These filaments are called hyphae, and they not only make up their structure, but also their appendages, which are used for movement, or even made pointy to penetrate a host.

2. If you break up one of these filaments, a clone will grow from that little piece

Fungi can reproduce both sexually and asexually. Asexually includes fragmentation, where a piece of the hyphae just breaks off and a new mushroom grows. They also have spores, which will travel around and either grow into an exact replica of its parent fungi, or join another spore and make babies.

3. These guys cannot make their own food, but they don't kill for it either

Fungi are heterotrophs, but, they feed themselves by simply releasing chemicals into their surroundings that break down their food and then sucking the little food fragments up.

4. Some of these are infectious to us, Hint: Athlete's Foot

Fungal infections are very common in humans, with 3 millions people suffering from Athlete's foot every year!

Answer: Animalia

1. These guys cannot make their own food, and need someone else to do it for them in order to survive

Animals are heterotrophs and therefore must find food in order to survive. They are not self sufficient. They obtain their food by hunting, feeding on other decaying animals, or simply feeding on whatever bits and pieces they find floating around in their environment.

2. Most of these guys move around, for at least some part of their lives

↳ While fungi and plants are mostly immobile, animals move around and explore their environment, a skill necessary to find suitable food, mates, and protection.

3. These guys are made up of at least 2 cells

↳ All animals are multicellular! While plants, fungi, and bacteria can be unicellular, all animals are made up of a variety of cells, with higher order animals having their cells specialize into tissues and organs

Answer: Protista

1. These organisms are wildly varied: they can be fungi-like, algae-like, fungus-like, multicellular or unicellular.

↳ The relationships between the members of Protista are often poorly understood, or have very weak bonds. This kingdom is where we store those we cannot place anywhere else. In fact, when you're teaching this subject yourself years from now, Protista as a Kingdom may not even exist, that's how flimsy it is!

We've talked about just how many organisms inhabit the earth. Organisms can live anywhere from the bottom of a glacier, the inside of a volcano, or within you!

Now, who can tell me what Kindgom Owls belong to? *Animalia*

Do you know where they live? *Almost everywhere on earth, except Antartica*

Do you know what they eat? *Other birds, small mammals, insects, some even eat fish!*

OWL PELLETS

Materials:	Procedure:
Large Owl Pellets	1. Break up the students into groups of 3 and give each group an owl pellet, dissecting kit, and plate.
Wooden Probes	2. Discuss what an owl pellet is and the contents they should expect to find. Help the students set up a log sheet to write down all the different kinds of bones they see.
Disposable Dissecting Trays (or paper plates)	3. Finish the experiment by discussing the diversity of the owl meals which reflects the diversity of the environment it lives in.
Forceps	
Hand Lenses	

Reinforcement. As the students sort through the pellets, have them sort the small bones and attempt to identify what they belonged to. Point out the varying prey of the owl, and discuss how having so many different food options helps them survive almost anywhere.

Wrap-Up! After the students have written down their observations and completed a concluding discussion about the results, review the learning objective by asking the students what new information they have learned and reviewing the key vocabulary words.