



When you dig in your garden and find worms, you probably think that I have always been here in America. Actually, early European settlers brought me over to North America during the 1600's and 1700's. Many travelers back then would bring plants with them from their country. I tagged along in the soil around the roots of these plants.

A lot of people think that all foreign insects, weeds, and animals are bad. I'll bet you can think of several that are very common harmful pests such as Japanese Beetle, gypsy moth, and the Asian long-horned beetle. These were all brought in and soon became very harmful to plants we grow in our gardens. What damage do these insects cause?

As an imported foreign animal, I am a little different though. If I hadn't been brought over, your soils and gardens would be very poor. If I did have any ancestors in this country before I was brought over, they were probably wiped out during the last Ice Age 10,000 to 50,000 years ago. What other things can you think of that were brought to America by the immigrants?



What's the first thing you think of when you hear the word fossil? Dinosaur, right? A fossil is the remains, trace, or imprint of a plant or animal that has been preserved in the earth's crust since some past geologic time. Well, there is fossil evidence for members of my family that belong to the phylum annelid that you will learn about in my family tree. There are the thousands of worm-like animals that have segments.



The problem with our fossils is that we are all soft-bodied and have no bones. Our fossils are not easy to find and recognize as are the fossil bones of dinosaurs. Existing fossil annelids date back 500 million years ago. Some scientists now say that they may have found that some of my relatives might have lived on earth more than a billion years ago.

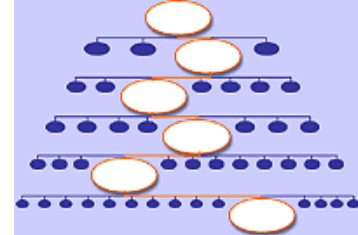
The problem is that scientists haven't found fossils of the worms themselves but "trace fossils." These are tunnels in rocks that may be burrows that were formed when the worms wriggled through the sand. Scientists have found these in India. Not everybody agrees because some think these "tunnels" were made in other ways.

Most scientists would agree that annelids, soft-bodied worm-like animals, appeared during the Cambrian period. Body fossils of soft-bodied worms are rare, but some places have very good preserved fossils. One of the better places to find these fossils is Mazon Creek, near downtown Chicago. Fossils Oligochaeta, which are closer to earthworms, are rare and harder to find.



Biologists have a way of classifying everything. By classifying, you put things into groups that have similar characteristics. This is sorting which is like the science of taxonomy. Taxonomy (*pronounced tacks-on-o-me*) is like building a family tree. Another way to look at it is like a pyramid.

The further down the pyramid you go, the more of us there are in each division or block. We are all related, but there are body parts (which you'll learn about) that either make us the same or different from our cousins down the pyramid.



**Kingdom** is the starting point. Under kingdom, you are either a plant (plant kingdom) or an animal (animal kingdom). Because I don't have much in common with my plant friends, I am classified as an animal, along with you.

Moving on down the line, you'll see that I belong to the **phylum Annelid**. A phylum is a smaller group than kingdom but bigger than the next division called a class. There are about 9,000 different worm-like animals that call themselves annelids. What we have in common is we all have very well developed segments (individual sections). The bodies of annelids are long and rounded with bristles or hairs. Some of my annelid relatives have lobes or bumps on their segments, eyes and feelers.

Then annelids are broken down into 3 major classes. I belong to the **class Oligochaeti** and there are about 3,100 of us. As you can see, a class is smaller than a phylum (there were 9,000 of us in the phylum). So what makes us different from the rest of the classes? Well, we Oligochaeti have fewer setae (hairs or bristles) on our segments and our bodies are really made for burrowing and digging. We don't have any eyes or feelers. The name Oligochaeti means "few hairs."

The group of worms that belong to Order Opisthopora are identified by having one pair of pores that are small openings located behind where the segments of a worm come together. Now, as a budding young wormologist, this is a very technical point and one that only those scientists with years of experience would need to know about. This shows you how technical the process of separating different types of worms from one another can be.

As a family member, I belong to the **Lambricidae family**. Among one of our unique characteristics is the fact that you won't find our clitellum start to show up until you count 18 or more segments from our tail. A real picky point when you get down to it, but this is just one way we are separated from the other segmented worms.

The real important part of the classification system and the part that means the most to us as worms and you as young scientists is the last two divisions: **Genus** and **Species**. The genus is made up of a group of individuals who are all closely related. My genus name is like your last name. Members of your family (brother, sister, father, mother) usually have the same last name because you are related very closely. My genus name is **Eisenia**.

The second part of my name is the **species**. Members of the same genus can and do have different species names because there is just a small difference that makes them unique. Kind of like members of your family. You all have the same last name but your first names are different. My species name is **fetida**.

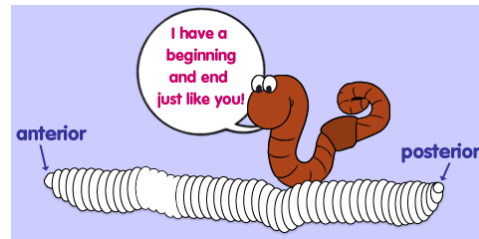
So when you put my genus and species name together, you get **Eisenia fetida**. Or as my friends call me—red worm, red wiggler, manure worm or fish worm. I'm the worm that really likes living in worm bins. My cousin, *Lumbricus (genus) terrestris (species)*, or earthworm really would rather live outdoors in your garden. We'll talk about him later on when you go to the section on making a worm bin.

Now that you know my family tree, let's see how your family tree is like mine! You have a family tree just like mine. We are both a part of the animal kingdom, but that's all we have in common. When most people talk about family trees, they mean the "tree of people" who make up their families. How far back can you go in your family tree?

# My Anatomy

GETTING TO KNOW SQUIRMIN' HERMAN FROM "HEAD" TO "TOE"

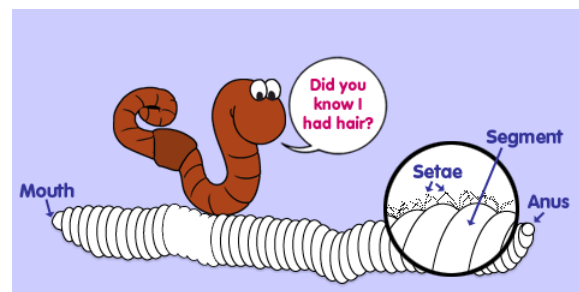
Hey kids! I said head to toe, but I don't really have a head like yours. But I do have a head end, the fancy word is anterior. Please remember that it is really different from the tail end, called the posterior. Just imagine how you would feel if someone said they could not tell the difference between your head and rear end (it's so embarrassing, and I get a little sensitive about that).



If you get a chance to feel me (hey worms need affection, too) you should notice that I am a little bit wet or slimy. It doesn't mean I need a shower . . . my skin is supposed to feel like that. I need moisture to survive.

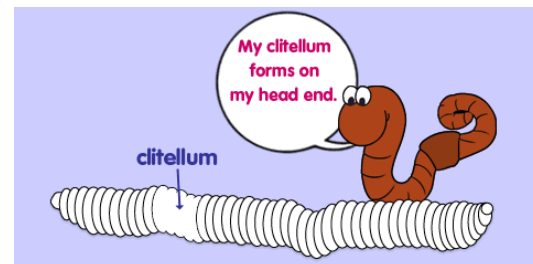
You will also notice that I do not have bones or arms, or legs, or eyes, or teeth (no one nags me about brushing or flossing). I just feel sort of squishy.

If you look at my body under a magnifying glass, you will see a lot of little rings across my entire body . . . looks kind of like corduroy or a lot of rings connected together. These rings are called segments. When I am all grown up, I will have 120-170 segments. On the first segment is my mouth and on the last segment is my anus—sort of like the beginning and the end.



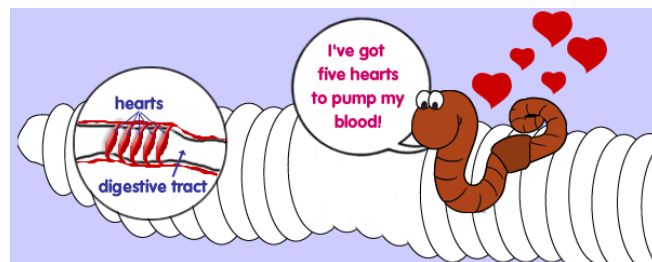
If you had a microscope and looked really, really closely at each segment, you will see something that looks like a bunch of small hairs or bristles. (And I'll bet you thought worms were bald.) These bristles are called setae (pronounced see-tee) and they help me move. I have four pairs of these bristly hairs on each ring or segment.

When I am a few weeks old you will notice a light-colored band forming near my front end. This is my clitellum. My clitellum will someday help to form cocoons. New baby worms will hatch from the cocoons and I will have a family.



At the very tip of my head (that's the anterior, remember), you will see a flap of skin that hangs over my mouth. It is called the prostomium. It keeps stuff I don't like from getting into my mouth. (Yeah, some things are even gross for worms). It is kind of like your upper lip. (Wanna kiss, baby?) Right under the prostomium is my mouth—you know what that's for. I have a pretty big mouth for a worm. It's big enough to grab a leaf and drag it around.

Guess what? I have five hearts! All of these hearts pump blood through my blood vessels just like your one heart.



It takes a lot of work to get where I want to go. I don't move very quickly, but think about how fast you would go if you had to slide around on your tummy.

I use some of my muscles and my setae (bristles, remember). My setae act like the brakes on a car, helping me to slow down or stop. I have muscles that go in circles around my body and other muscles that run the length of my body.

Actually, I'm pretty well-built, if I do say so myself. When my circular muscles tighten up, my body becomes thinner and longer. I sort of look like two birds are pulling me from each end.

(Now that's a scary thought. Let me take a minute to calm myself down....whew! Now where were we ... oh, yeah, moving right along.)

This movement by my circular muscles squeezes my front end forward. My other long muscles squeeze together and help move the rear end of my body towards the front end. So this is how I move forwards and backwards. Pretty slick.

My mouth is very small. So I can only eat very tiny things like bacteria, fungi and protozoa which you couldn't see unless you are looking through a microscope. I also eat organic matter like plants (mmmm, salad) and decaying animals. I guess that sounds sort of yucky, but you humans eat dead animals and birds too. Sometimes the bits of food are too big for my mouth, so I moisten them to make them soft and suck them right into my mouth. (Don't try this at home, human parents tend not to like this.)

Since I have no teeth, I cannot really chew my food like you do. I do have something inside of me close to my mouth called a gizzard. You might have heard this word before because birds, including chickens and turkeys, have a gizzard almost like mine. As I eat my food some grains of sand and soil get into my gizzard. These grains of sand and soil push against each other, mix with moisture and grind the food into tiny pieces (kind of like my own personal food processor).



When the food leaves my gizzard, it goes into my intestine. The food is dissolved there and absorbed into my blood. Then it is carried to all parts of my body to keep me strong, healthy and slimy.

Have you ever wondered how I breathe without a nose or lungs? You breathe through your lungs. Your lungs take in oxygen and give off carbon dioxide.



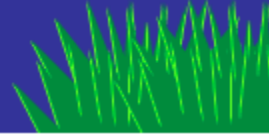
Worms do not have lungs but I breathe through my skin. I take in oxygen through my skin and it goes right into my bloodstream. My skin must stay wet in order for the oxygen to pass through it, but if I am in too much water I will drown. Just keep me damp, moist and slimy. Although if the water has lots of air in it, I can stay under for a long time.

I can tell the difference between light and dark . . . pretty good for someone who does not have eyes. I have cells in the front part of my body that are sensitive to light. This is called light sensitivity.



# Worm Facts

INTERESTING THINGS TO KNOW ABOUT WORMS



- An earthworm can grow only so long. A well-fed adult will depend on what kind of worm it is, how many segments it has, how old it is and how well fed it is. An *Lumbricus terrestris* will be from 90-300 millimeters long.
- A worm has no arms, legs or eyes.
- There are approximately 2,700 different kinds of earthworms.
- Worms live where there is food, moisture, oxygen and a favorable temperature. If they don't have these things, they go somewhere else.
- In one acre of land, there can be more than a million earthworms.
- The largest earthworm ever found was in South Africa and measured 22 feet from its nose to the tip of its tail.
- Worms tunnel deeply in the soil and bring subsoil closer to the surface mixing it with the topsoil. Slime, a secretion of earthworms, contains nitrogen. Nitrogen is an important nutrient for plants. The sticky slime helps to hold clusters of soil particles together in formations called aggregates.
- Charles Darwin spent 39 years studying earthworms more than 100 years ago.
- Worms are cold-blooded animals.
- Worms can grow a new tail, but not grow a new head if they are cut off.
- Baby worms are not born. They hatch from cocoons smaller than a grain of rice.
- The Australian Gippsland Earthworm grows to 12 feet long and can weigh 1-1/2 pounds.
- Even though worms don't have eyes, they can sense light, especially at their anterior (front end). They move away from light and will become paralyzed if exposed to light for too long (approximately one hour).
- If a worm's skin dries out, it will die.
- Worms are hermaphrodites. Each worm has both male and female organs. Worms mate by joining their clitella (swollen area near the head of a mature worm) and exchanging sperm. Then each worm forms an egg capsule in its clitellum.
- Worms can eat their weight each day.



# Worm Links

YOUR GUIDE TO SQUIRMIN' HERMAN'S FAVORITE SPOTS ON THE WEB

## [Worm World](http://www.yucky.com/worm/)

<http://www.yucky.com/worm/>  
Travel through Wendell the Worm's World.  
Learn about worms as recycling, worm body parts,  
worm fun, and view the worm art gallery.

## [Ask the Answer Worm](http://www.nhq.nrcs.usda.gov/CCS/squirm/skworm.html)

<http://www.nhq.nrcs.usda.gov/CCS/squirm/skworm.html>  
S.K. worm answers all your  
questions about soil and stuff.

## [Worm Woman](http://www.wormwoman.com/main.html)

<http://www.wormwoman.com/main.html>  
Meet the worm woman who started it all!

## [Worm Bin Project](http://commtechlab.msu.edu/sites/letsnet/noframes/Subjects/science/B2U1.html)

<http://commtechlab.msu.edu/sites/letsnet/noframes/Subjects/science/B2U1.html>  
Students will learn about decomposition  
and the worm's life cycle.

## [Mazon Creek Fossils](http://www.museum.state.il.us/exhibits/mazon_creek/index.html)

[http://www.museum.state.il.us/exhibits/mazon\\_creek/index.html](http://www.museum.state.il.us/exhibits/mazon_creek/index.html)  
Information on worm fossils in the Chicago area.

## [Science Museum of Minnesota Online Worm Project](http://www.sci.mus.mn.us/sln/tf/w/worms/worms/worms.html)

<http://www.sci.mus.mn.us/sln/tf/w/worms/worms/worms.html>  
See first graders at the Museum Magnet  
School exploring the world of worms.

## [Questions & Answers about Earthworms](http://www.oldgrowth.org/compost/frames/wormfaq.html)

<http://www.oldgrowth.org/compost/frames/wormfaq.html>  
Get the answers to the most frequently  
asked questions about worms.

## [The Earthworm](http://www.gov.ab.ca/env/fw/watch/inve/e.html)

<http://www.gov.ab.ca/env/fw/watch/inve/e.html>  
Learn the lifestyles, habits and life  
history of the earthworm.

## [Leave Leftovers to Worms](http://www.taunton.com/fg/features/techniques/worms/1.htm)

<http://www.taunton.com/fg/features/techniques/worms/1.htm>  
Good step-by-step guide to worm composting  
from Fine Gardening magazine.

## [Build a Worm Composting System](http://www.dnr.state.mo.us/alpd/swmp/Worm1.htm)

<http://www.dnr.state.mo.us/alpd/swmp/Worm1.htm>  
Learn how to build a wooden worm bin.

## [Worm Words Glossary for Teachers](http://www.cityfarmer.org/wormgloss82.html)

<http://www.cityfarmer.org/wormgloss82.html>  
Learn the words that pertain to  
worms and worm composting.

## [The Burrow](http://gnv.fdt.net/~windle)

<http://gnv.fdt.net/~windle>  
One of the most comprehensive worm  
composting sites on the Web. Everything, and I  
mean everything, you would want to know about worms.

## [Plowing Through Garbage](http://soundprint.org/nstw/activities/earthworm/earthworm.phtml)

<http://soundprint.org/nstw/activities/earthworm/earthworm.phtml>  
An online curriculum from National Science and  
Technology Week detailing how earthworms are  
an important part of the soil's environment.

## [Let's Get Growing](http://letsgetgrowing.com/)

<http://letsgetgrowing.com/>  
An online catalog with hundreds of  
environmental science and nature education  
products including worm bins for K-12 classrooms.

[Worm Supplies](http://www.cityfarmer.org/wormsupl79.html)<http://www.cityfarmer.org/wormsupl79.html>