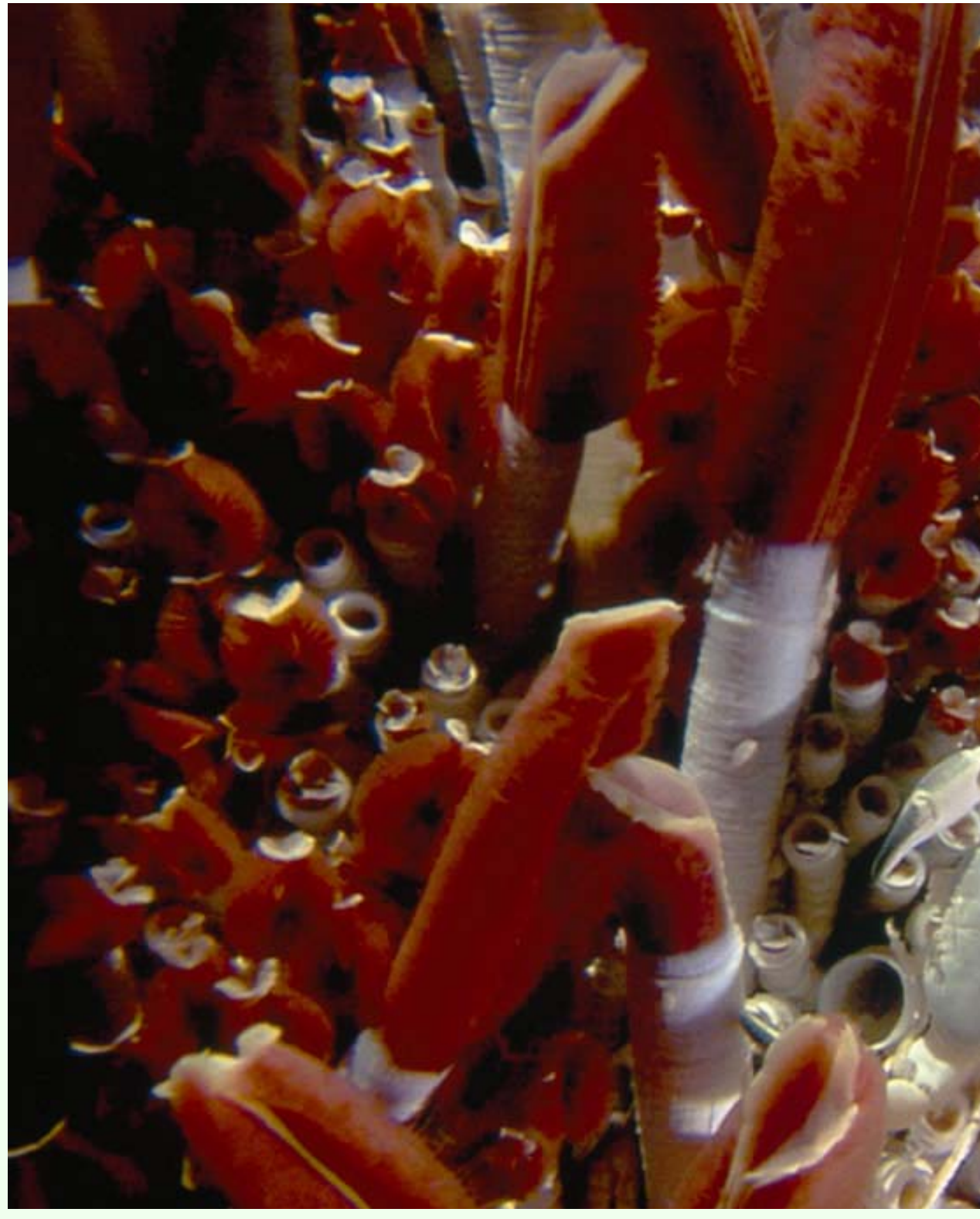


## The many styles of annelids (worms)



Giant tube worms of the deep ocean:

These worms are a part of the same family as earthworms. However they may or may not have a digestive system and can rely on bacteria inside them to make food. Some have been found in the most toxic and hostile environments on the planet, around “black smokers”. These are vents from deep inside the earth which are extremely hot (near the boiling point of water) and filled with sulfur and methane!



Tape worms:

These parasites are again in the same family as earthworms and are one of the nastiest of all the worms. Stealing food from the host organism, they cannot live without the protection of an animal, but their eggs can. They can grow to a length of several feet if left alone and well fed.



The Red Wiggler:

The champion in waste recycling and fishing, the red wiggler is tough enough to survive large amounts of organic matter or less than ideal conditions. These worms are able to eat up to their weight every day and double their populations every 3 months.



Nematodes:

Nematodes are one of the smallest members of the worm family and can be one of the most destructive. Nematodes can live on either decaying matter and bacteria or on living plants. With the same ability as earthworms to reproduce in large quantities, damage to crops can be extensive. Controlling nematodes without harming earthworms is very difficult. When nematodes are found in worm bins, it usually means there is too much acid in your bin and too much food for the composting worms.

This is just a sample of over 6,000 different varieties of worms in our world, how many different worms can you find in your garden?

# Earthworms are the soils caretaker



**Topsoil:**  
Large amounts of organic matter provides good nutrition for plants, aeration for roots and water retention.

**Subsurface:**  
Far less organic matter in this area with clay does not allow much air to penetrate or water to remain. Many tree roots will grow in this area for mineral nutrients. This area contains more iron, zinc magnesium sulfur and calcium than topsoil.

**Subsoil:**  
This area is rich in minerals and clay but very poor in organic matter. Roots have a hard time using these nutrients.

Earthworms are needed to improve the quality of all these layers.

The nightcrawler (*Lumbricus Terrestris*) is able to burrow down 7 feet into the soil! During the winter months they take organic matter (leaves) deep into their burrows to feed on during winter. The simple act of making a burrow will bring air and water to the subsoil region and allow roots to take advantage of the minerals in this area. Since worms have a gizzard like structure, the minerals in the subsoil are eaten and then deposited on the surface.

## Wash Your Hands!

Worms are not picky eaters and live with a lot of bacteria, fungus and mold. Washing your hands after working with worms is important!



### Water Retention:

Organic matter acts as a sponge in your soil. The cells of plants soak up moisture and hold it much better than clay or dirt can. Worms must breath through their skin which must be kept moist. The mucous made to keep their skin moist rubs off onto the soil and works far better than organic matter at retaining moisture!



### Aeration (bringing air into the soil):

By bringing air into the lower reaches of the soil, roots are able to grow deeper making the plant more stable in drought and high winds. Air also increases the amount of healthy aerobic (air breathing) micro organisms. When these organisms die, they add organic matter and nutrients to the soil. Unless you dig 7 feet deep, worms do a better job than you!



### Medicine for the soil!

Worms need to keep themselves, and the organic matter plants produce healthy. To do this they produce an antibiotic in their manure which targets unhealthy micro organisms. Worms also eat micro organisms which can be harmful to the plants and to humans. By making the soil healthy in this way, the plant does not need to use as much energy repairing sick roots. All this energy now is available to grow more fruit, leaves or stalks.



### Feeding the plants:

Plants make the food they need through photosynthesis. Sunlight is combined with water, carbon dioxide and minerals to create sugars for the plant to use. When a plant dies, the minerals and carbon it has been using is locked in the cells of the plant and takes an earthworm to release these nutrients for the next generation of plants to use.

**ADD NUTRIENTS  
TO YOUR  
SOIL  
COMPOST**

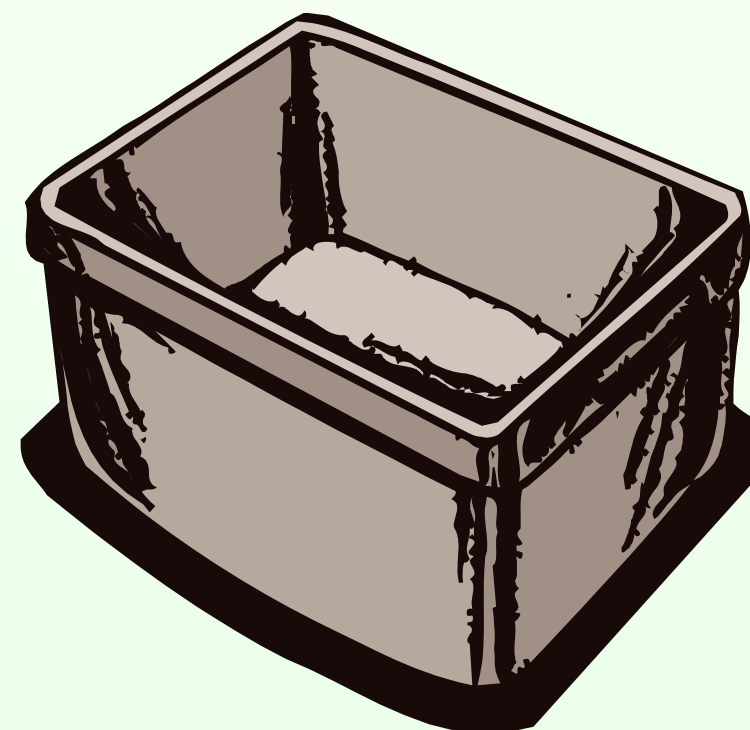
# Be your own worm farmer!

## Worm farming is easy!



Begin with making a home for your worms. This can be as easy as starting a compost pile in your backyard with a tarp on the ground or as complex as creating a continuous flow vermidigesting reactor. Most people will start with a rubber or plastic storage container and drill 1/8 inch holes in the bottom and cut large holes in the lid. Put this in a garage or basement near a drain so access water will drain away.

Having a container handy even when adding worms to an outside container is beneficial. Most composting worms are tropical worms and do not survive frozen winters. Bringing in a batch of worms from your compost pile during winter and feeding them vegetable waste until springtime will keep you from having to replenish populations yourself.



Prepare a bed for your worms. You can use shredded newspapers, shredded white paper, peat moss, or coir (shredded coconut shells). Be sure to moisten to about 70% moisture content. If you give the bedding a firm handshake and a couple of drops of water squeeze out, that is just about right. Peat moss and coir are the easiest to work with but are nutritionally poor for the worms, and it is not good recycling. This is where the holes on the bottom of your bin are necessary.



Add your worms. If you are adding worms to a compost pile, you will need to do this in the evening just before sunset so the birds don't eat your stock. For worms in bins inside, leaving a light on over night will keep them in the bin. Water your worm bed to help them be comfortable in their new home.



Feed your worms. This can be a little tricky until you understand how much worms will eat and how many worms you have. Pick a spot in your bin or compost pile. Add a handful (margarine cup) or two of worm food for every thousand worms (1 pound) in one location and water lightly. Two days later add the same amount of food to another area. Do this for 2 weeks. At the end of 2 weeks, look at the original spot you fed your worms and see if food is still there. If it is, you are over feeding, cut back on the amount you are feeding. If no food remains there or the second place you fed, you need to increase the amount you feed.



### What is worm food?

Worm food is anything that was once alive. Tree products like paper and cardboard is nutritionally poor and is considered to be a bedding, not food. The greener the food (radish tops, blue grass, etc.) or the darker in color (coffee grounds) are normally richer in nutrients. Size matters as well. Corn dust is much easier to eat than corn on the cob and will be eaten faster. Do not use meats or dairies. Harmful bacteria may remain in your worm bin and it will smell horrible!



Separate your worms from their manure. You can simply pile everything onto a table during the day and let the light force worms to the center. Scrape the outside layers of worm poop into a bucket to use in your garden until you find worms. Wait about 30 minutes and repeat scraping until you are left with a large pile of worms. You can make a sifting box out of 2x4's and 1/4 inch carpenters screen nailed or stapled to the bottom to separate worms and large uneaten organics from the worm poop. Put everything on the screen and shake like mad. Return to step two and restart the process over.



Mechanical sifter



Pile and separate



Shaker box



Use your castings!  
The rule of thumb when working with castings is 1/8 or 1/4 of an inch of casings on the surface of the soil will provide nutrients for your plants for the entire year. Some plants do not like worm castings and should get very little. Most desert plants do not get the benefit from worms and shouldn't get castings. Either shovel it on, or use a broadcast spreader to evenly add to a large area. Drier castings will work better with broadcast spreaders by not sticking together as much.

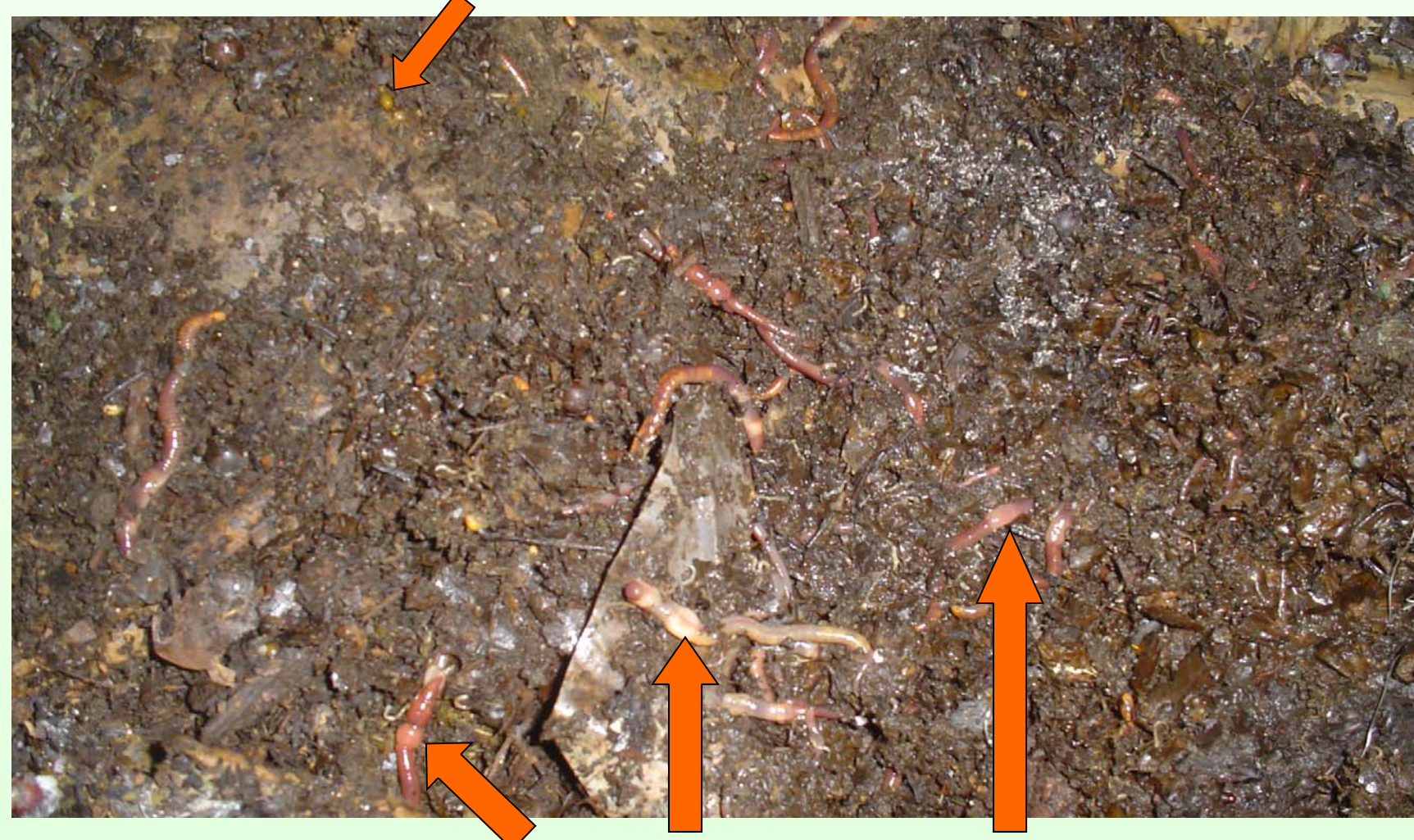
### Worm farming:

Reduces the amount of waste going to landfills, increases productivity of soil, improves plant health, sequesters carbon in the soil, improves aeration of the soil, reduces pathogens in the soil, retains water for dry times of the year, reduces runoff from heavy rains, increases organic content of soil, deepens topsoil layer, reduces chemical usage on plants and is just plain fun!

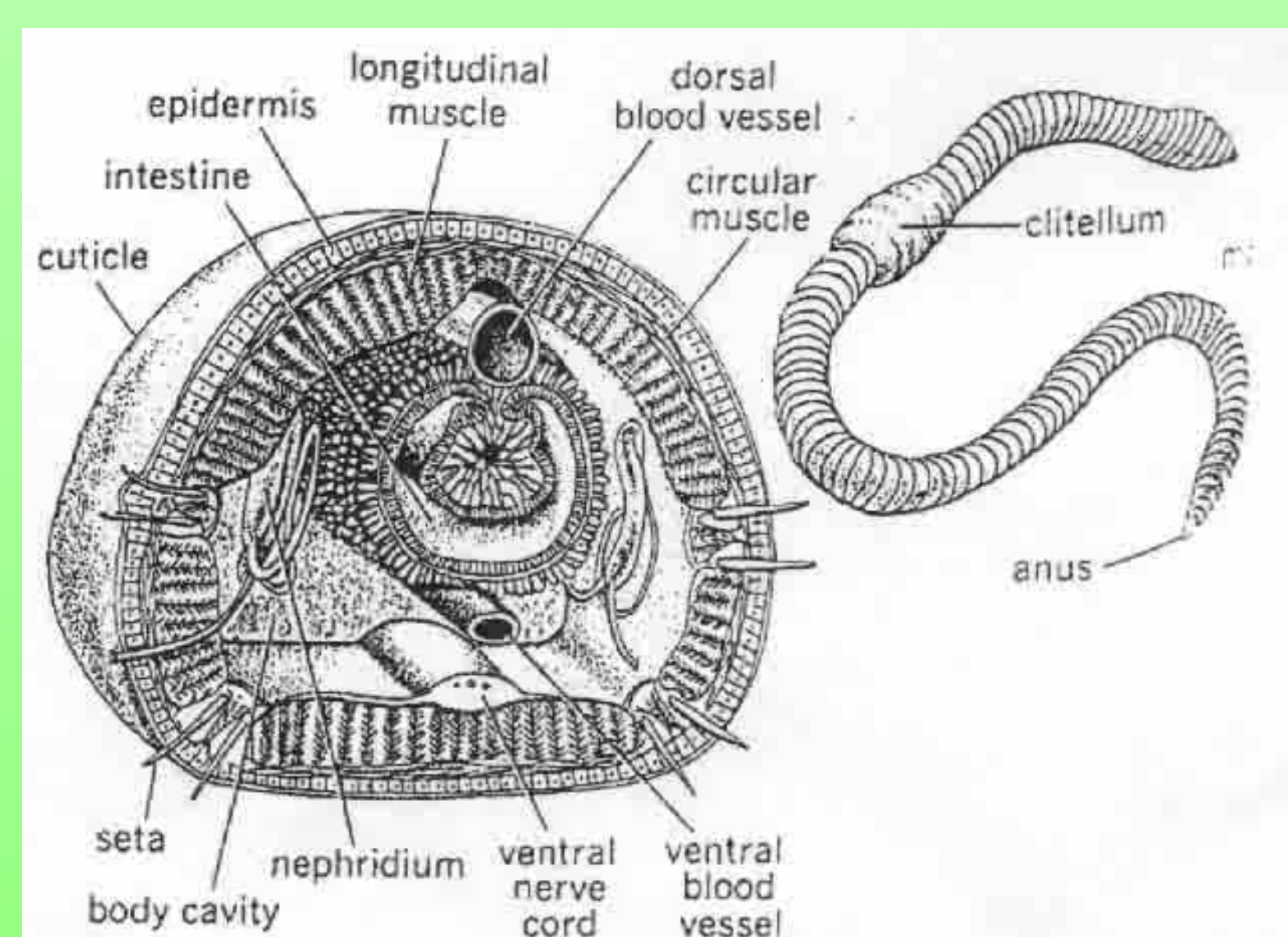
# Lifecycle of an earthworm



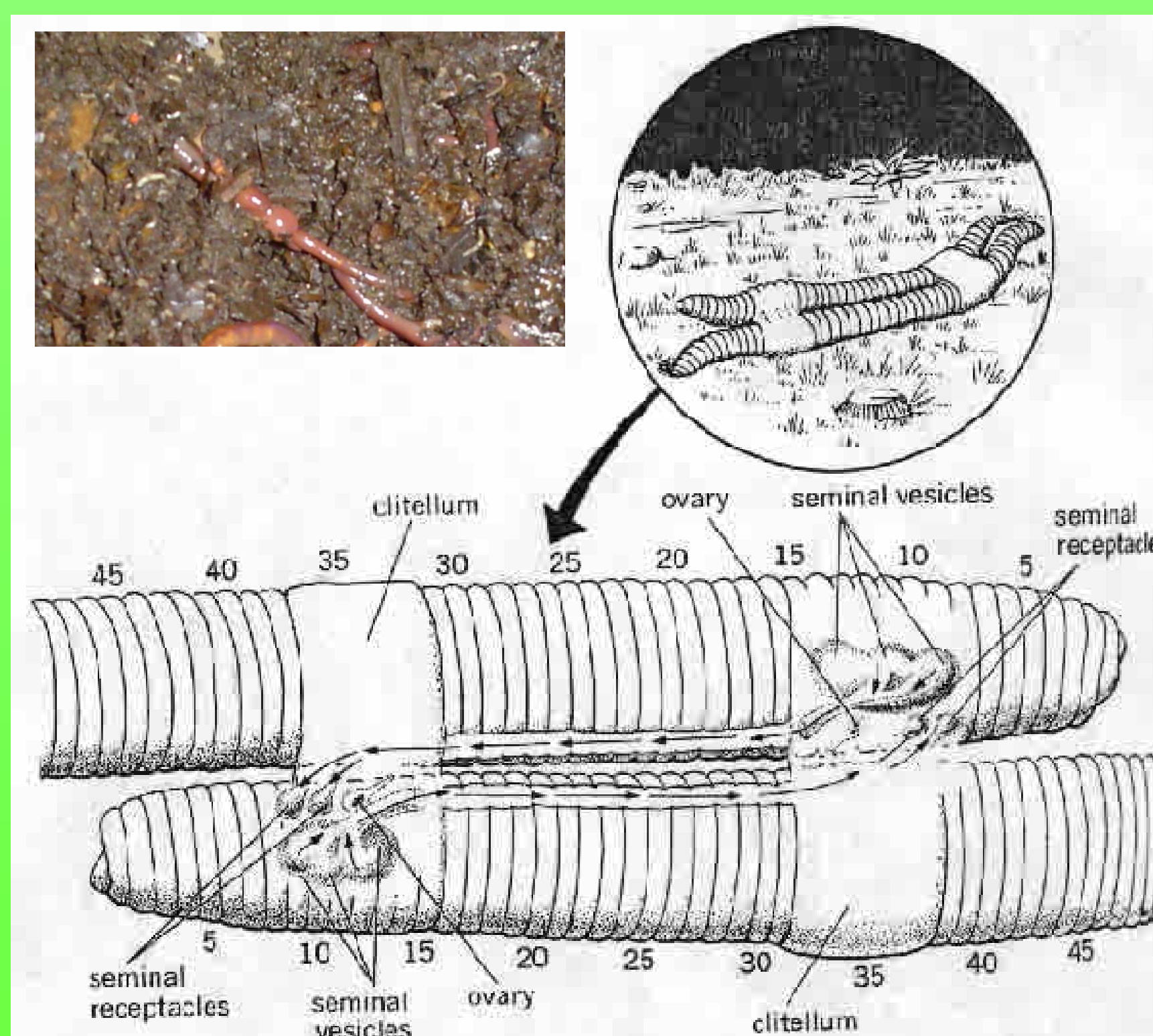
It all starts with an egg. These tiny eggs begin yellow and turn red as they mature. As many as 22 baby worms have come from a single egg. Depending on conditions and worm type, in about 20 days this egg will hatch and worms will begin to eat.



In roughly one month a worm will become an adult. You can tell an adult from the appearance of the clitellum (collar or band). This is where the reproductive organs are and much of the digestive system.



Worms move around with the help the seta and strong longitudinal muscles throughout their entire body. The mouth also helps in creating holes for the worm to crawl through. The intestine runs the length of the tail and absorbs nutrients from the feed that has been ground up in the clitellum.



Earthworms are both male and female (hermaphrodites) and both worms become pregnant each time they mate. They lay nose to nose and form a mucous membrane between them which makes them look like one worm with two collars. The process doesn't take long, usually less than a minute to fertilize each worm. Roughly 14 days after fertilization, an egg is laid.