Accompanies Episode 12 of the 13-part video series

—*Lair of the Earthworm*—

Written by Eric R Russell & Bruce J Russell

EXPLORATION GUIDE & JOURNAL

In this episode...

When a subterranean monster swallows their rover, the crew must pursue the beast into its volcano-like mound. Here they unearth the culprit – an earthworm. Within the worm's sunless burrow, they unravel the basic plan of annelid anatomy, and learn that it is not radically different from many more advanced land dwelling animals. From these observations they develop theories about the role earthworms play in maintaining terrestrial ecosystems.

Backyard Ecology: Lawn Soil

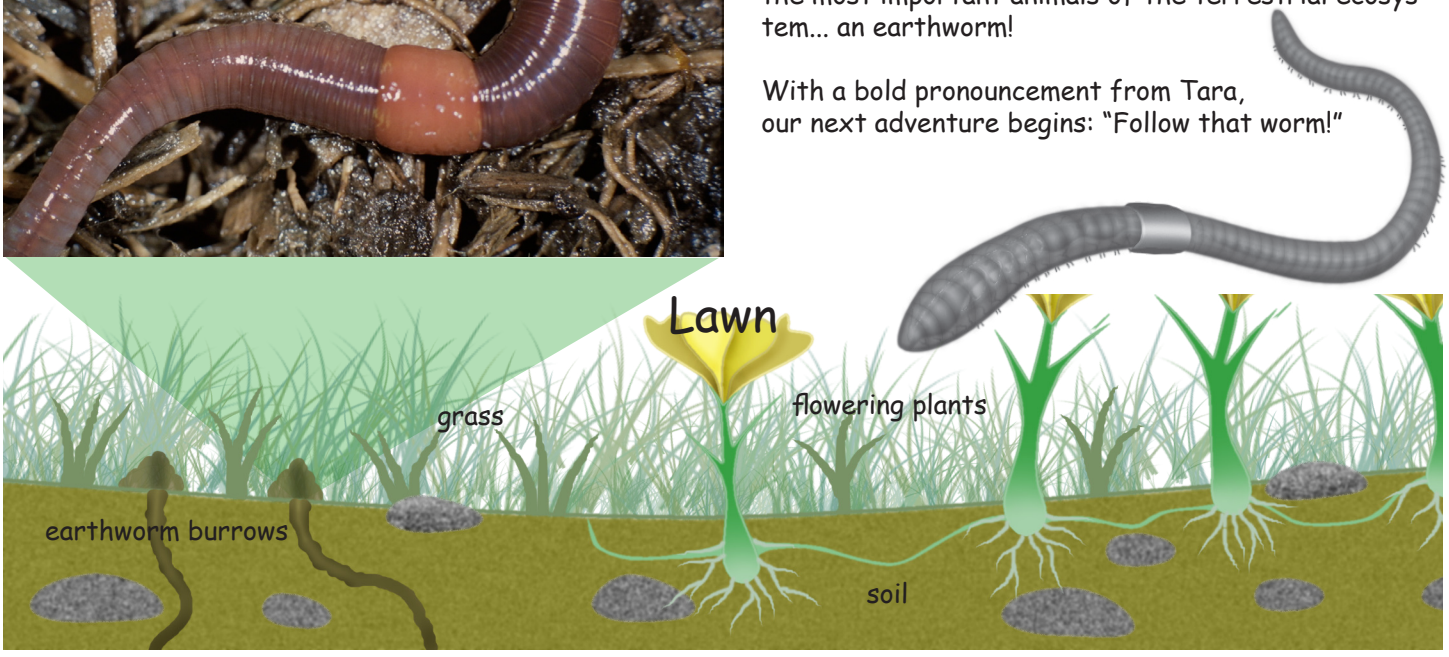
The Log of Captain Jonathan Adler

Day 18: 09:00 hours... It is with some embarrasment that I must report that we have misplaced our Terra Rover!

From the flyer we search the area where we believe we parked the rover – but unlikely as this sounds, the terrain seems to have changed while we were exploring the garden ecosystem. Nothing is familiar! And most mysteriously, there are fresh mounds of new earth throughout the lawn.

To my relief Tara's keen eyes find our missing vehicle. Eager to reclaim it, we land on one of the new earthen mounds nearby. We are about to hike over to the rover when the soil beneath it suddenly pushes upward! What is happening? We stare helplessly as the earth opens under the rover, and something swallows it whole! It is an animal! More specifically, it is one of the most important animals of the terrestrial ecosystem... an earthworm!

With a bold pronouncement from Tara, our next adventure begins: "Follow that worm!"



Flyer

Aerial auxilary to MS Cyclops

Vehicle Dimensions

LENGTH	.65 mm
WINGSPAN	.75 mm

Vehicle Mission

Maximum speed	1 meter per minute
Mission duration	2 days

The *Flyer* is an ornithopter, a machine that maintains flight by emulating the wing-beat patterns of flight-capable animals such as insects, bats, and birds.

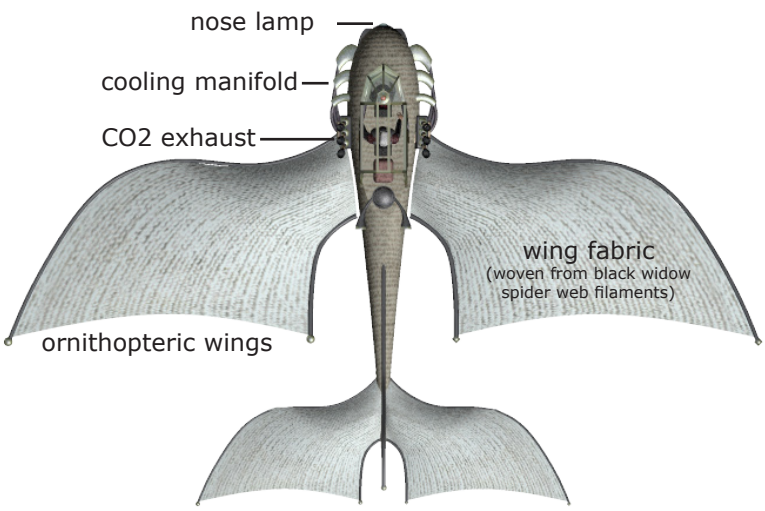
Launched from a base built in the molt of a dragonfly larva, a fleet of flyers patrol the pond surface and surrounding habitats, scouting probable exploration sites for the Micro Exploration Corps.

The flexible fabric of the Flyer's wings are made from a woven mesh of black widow spider web filaments. The fuselage is constructed from a basket-like weave of cellulose plant fibers.

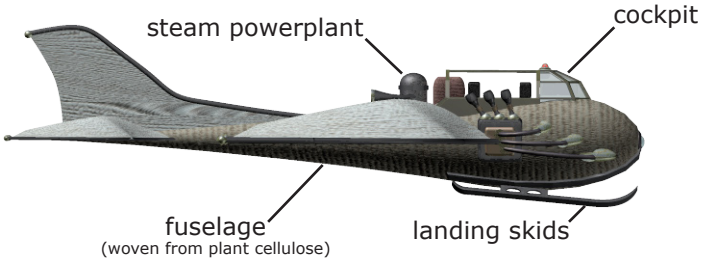
Power is generated from an onboard steam powerplant that uses alcohol as fuel. The alcohol is produced by decomposer bacteria and is carried in small tanks aboard the flyer.

Requiring a single pilot, the Flyer can carry a second microscopic passenger for aerial explorations and reconnaisance.

Top view



Right side view



Oblique view

Contents of this guide...

Terra Rover

Terrestrial auxilary to MS Cyclops

Vehicle Dimensions

LENGTH	.35 mm
BEAM	.22 mm

Vehicle Mission

Maximum speed	3 cm per minute
Mission duration	10 days

The *Terra Rover* is a durable vehicle designed for exploration of terrestrial surfaces with a minimum crew (2).

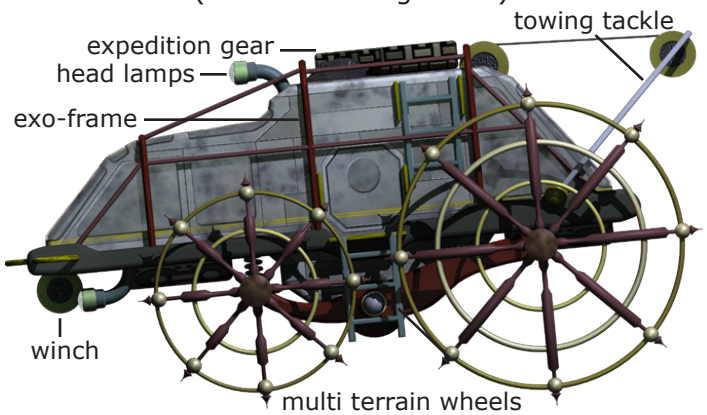
The rover's multi terrain wheels allow the vehicle to climb near-vertical surfaces of soil, wood, and soft plant tissue.

Power is generated from an onboard steam powerplant that uses alcohol as fuel. The alcohol is produced by decomposer bacteria aboard the *Cyclops* and carried in tanks on the rover.

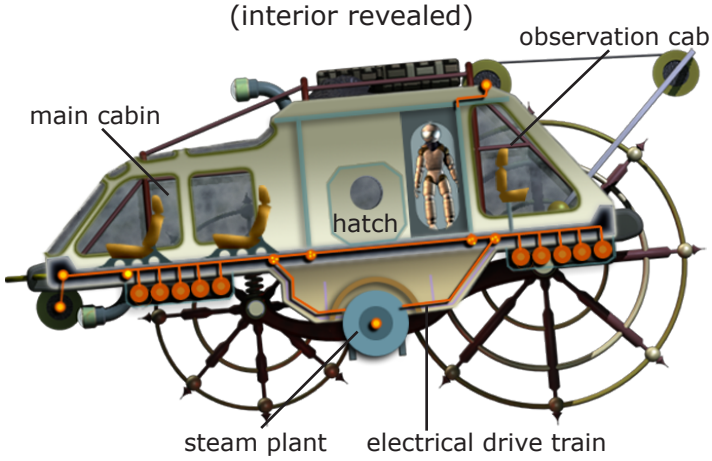
The *Terra Rover* carries equipment for exploration, including tackle for towing and climbing, and diving suits for immersion in fluid environments.

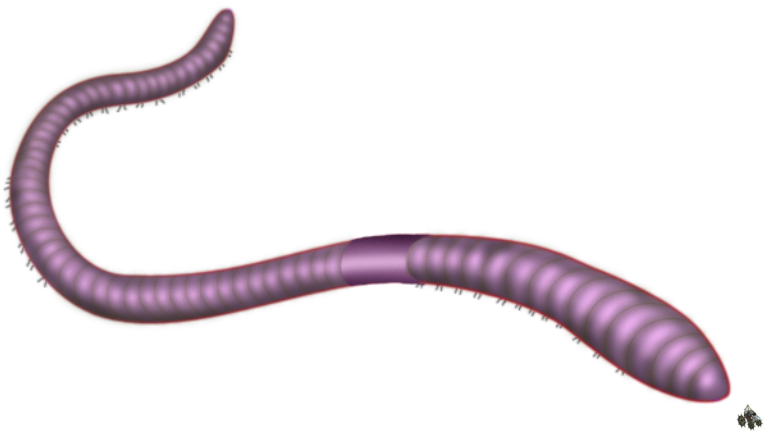
Protecting the rover are armored hull plates made of chemically resistant reinforced glass, in the unlikely event the vehicle is swallowed by some monstrous inhabitant of the terrestrial microcosm.

Left side view
(external arrangement)



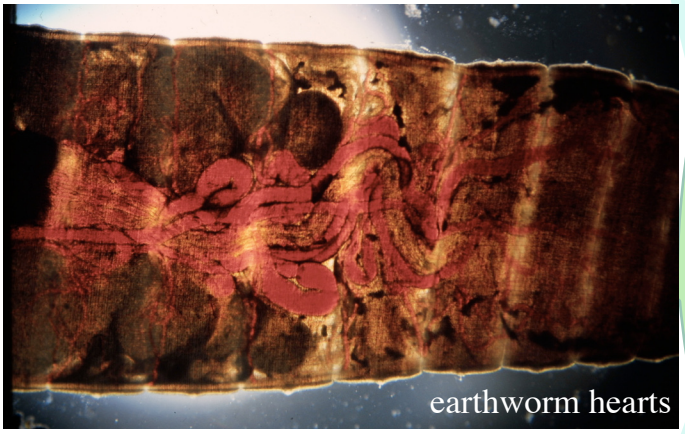
Left side view
(interior revealed)





About the Organisms

Earthworms are welcome inhabitants of yards, gardens, and agriculatural fields. They cultivate and process soil, coverting organic substances into waste materials to be used by plants.


earthworm hearts

The earthworm's anatomy clearly shows how they enrichen the earth with nutrients. Soil (containing insect eggs and decaying plant parts) is swallowed. It is then mixed and ground up in an organ called the gizzard, then passed down the long intestine where digestion and absorption take place. Finally it is eliminated above ground in the form of worm casings. Worm casings are extremely rich components of healthy soil and are very good for plants.

Surrounding the esophagus are five hearts that make up the pumping force of a well-devleoped circulatory system that carries nutrients to all parts of the earthworm's body. Blood flowing through capillary beds in its moist skin picks up oxygen and releases carbon dioxide. Earthworms are hermaphroditic – each is both male and female. Mating earthworms fertilize each other, and the eggs are deposits in a cocoon made of secretions produced by the clitellum – the ring like structure obvious on earthworms.


earthworm egg

EXPLORATION GUIDE & JOURNAL

The Log of Captain Jonathan Adler

11:30 hours... Equipped with climbing tackle and lamps, Tara and I descend into the earthworm burrow. A few millimeters below the surface we find the soil to be cool and moist, conditions we believe are ideal for healthy earthworms.

The monster is resting for the moment. It does not breath with lungs – its skin can evidently absorb oxygen from air, which explains why it must remain moist.

Tara suggests that shining one of our lamps through the worm might illuminate the beast and reveal more about its internal organs – and help us locate our rover.

Tara's lamp does the trick! The worm's internal organs are now easily visible. Its red-blood filled circulatory system travels down one side of its body, and back again up the otherside, carrying oxygen and nutrients to all parts of the worm. The organs that pump the blood surround the esophagus with a series of 5 steadily beating-hearts!

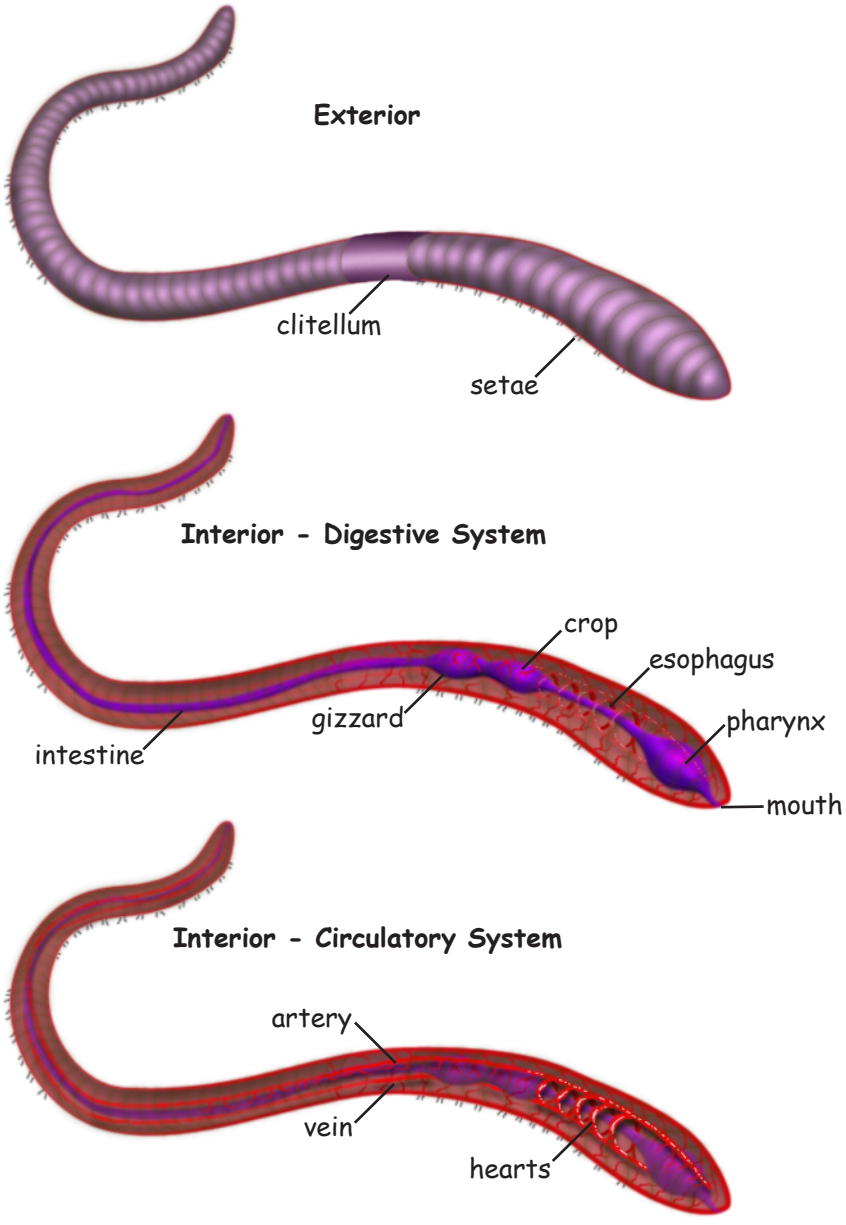
Running down the center of the earthworm is its digestive tract, where soil is mixed with organic debris such as fallen leaves and insect eggs (and our Terra Rover), and then ground by its gizzard into a muddy mixture. The intestine is where nutrients are absorbed before the enriched soil comes out the tail end. And that, we now see, is what makes those mysterious mounds!

Luckily it isn't long before the earthworm's efficient digestive system delivers our rover back to the surface, almost precisely where we left it!

Key to Organisms

Earthworm

Earthworms are the primary workers for returning nutrients from leaves and organic material back into the soil for use by plants. They make burrows, and use hair-like setae for anchoring and moving through soft humus. Each worm is both female and male. An earthworm's moist skin transfers oxygen to blood capillaries in the circulatory system, and expels carbon dioxide. Like humans, the earthworm's blood is red, based on hemoglobin. But instead of just one heart, a worm has five, which keep blood constantly circulating, moving nutrients and oxygen to all parts of the worm's body.



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