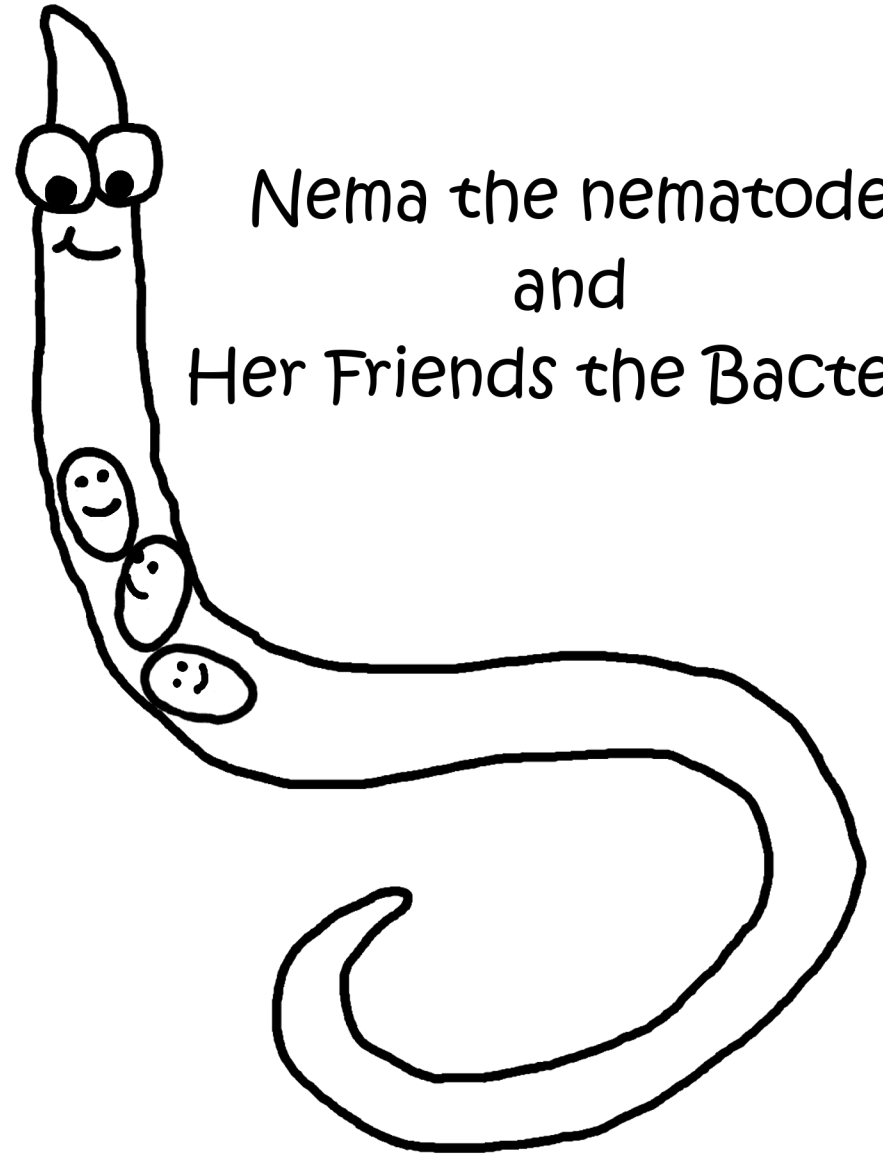


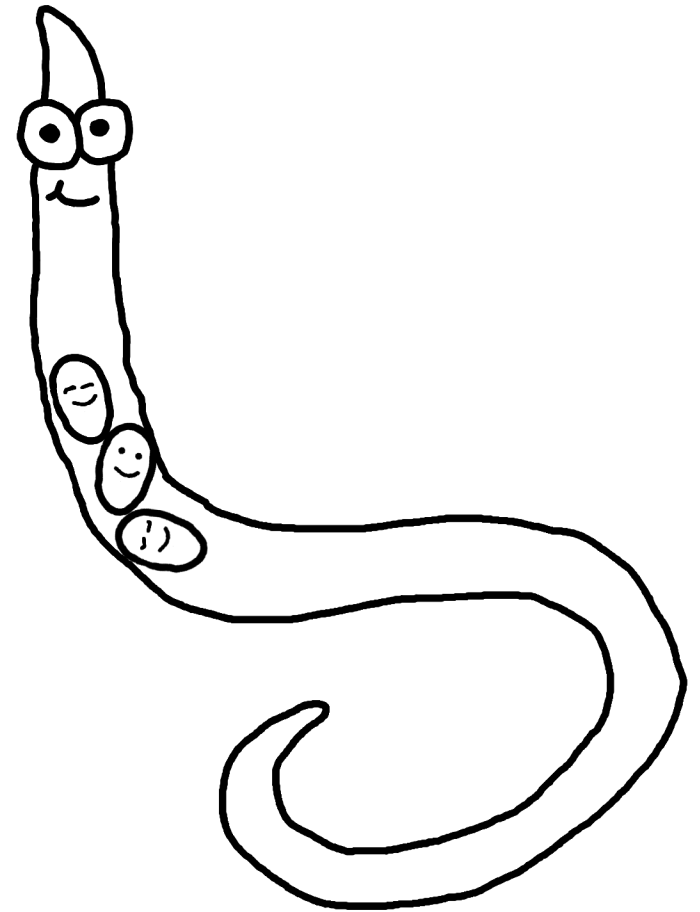
Friends Come in All Sizes:



Nema the nematode
and
Her Friends the Bacteria

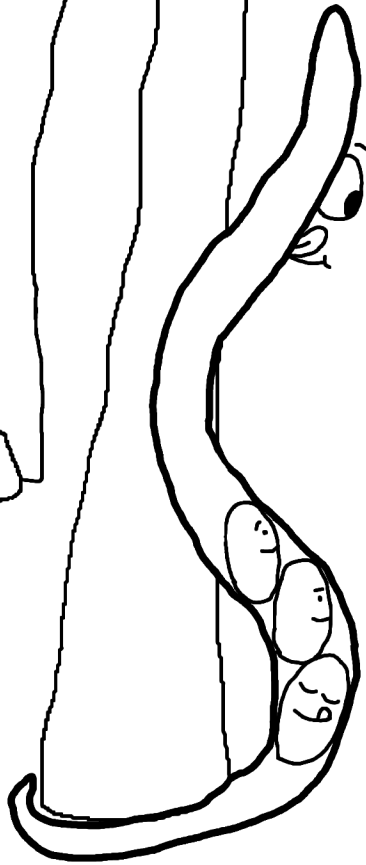
Nema the *nematode* lived in the soil and carried her *symbiotic* friends, the Bacteria, inside her wherever she went.

Story by: The Bashey Lab
Illustrated by: Zoe Dinges

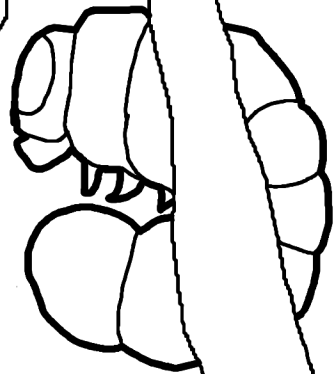


Fun fact: *Nematodes* are a diverse group of roundworms. Only a few types of nematodes carry specialized bacteria inside them. This close relationship is known as a *symbiosis*.

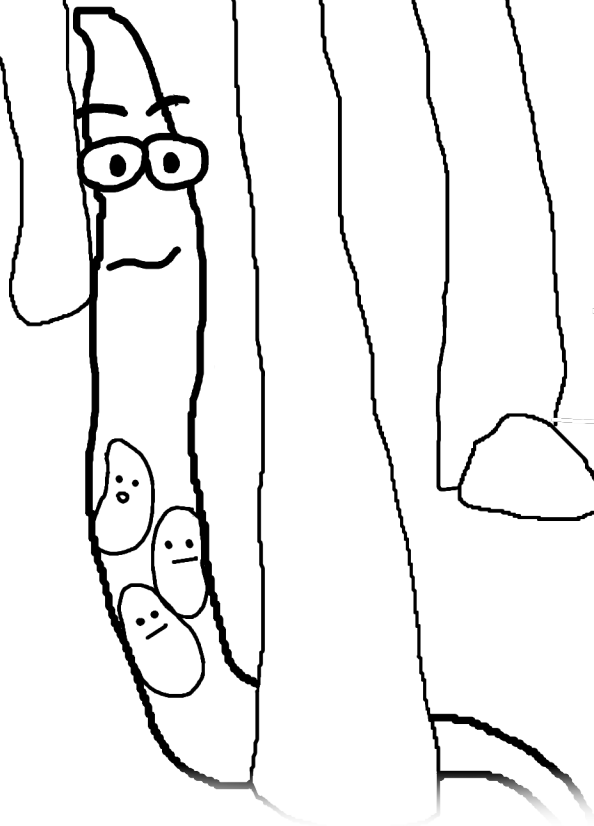
Nema and the Bacteria hungrily watched the big bugs eating the plants.



Fun Fact: Nematodes like Nema and her bacteria don't eat outside of an insect host. They can live for several months while searching for an insect!

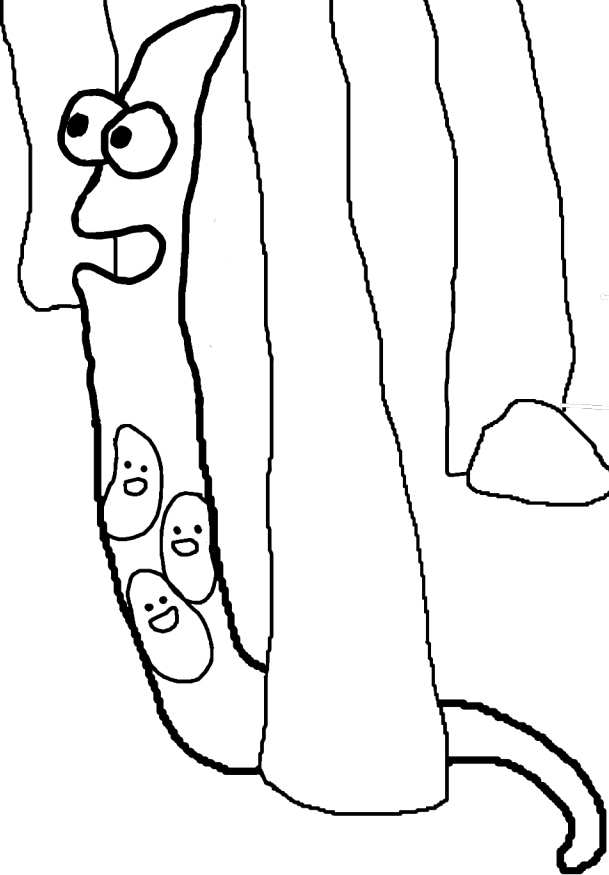


Nema and the Bacteria were a little tired and hungry out in the soil, but the bugs were so much bigger than them!



Fun Fact: These kinds of nematodes only eat insects – gardeners can use them to kill insects that damage their plants.

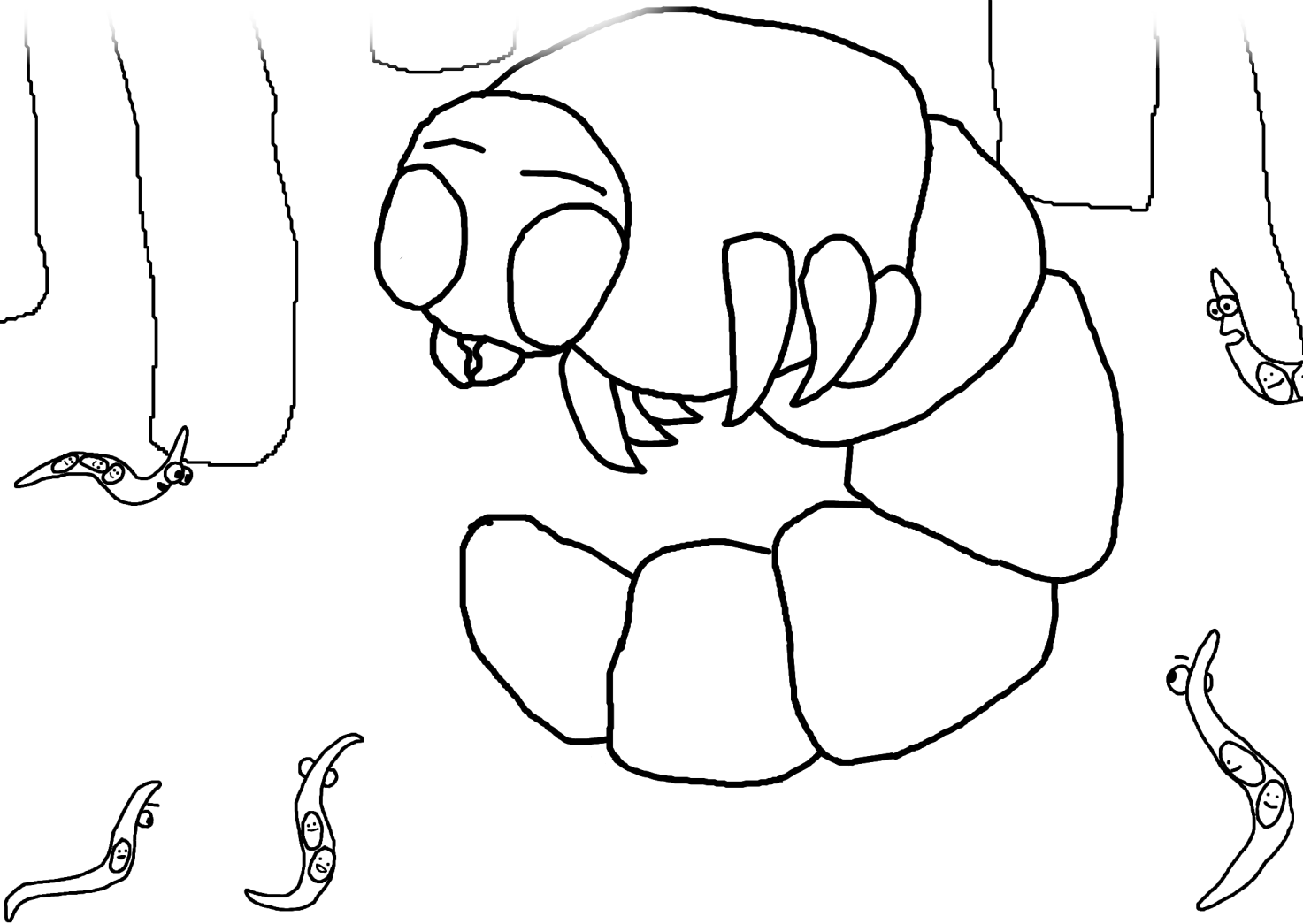
Nema knew with the help of some of her nematode friends and their bacteria, they could make a new home inside the big bugs.



Fun Fact: Nematodes do best when they enter an insect as a group. We don't know how they coordinate their behavior, but they do.


Nema's friends all came together and...

CHARGE!!!

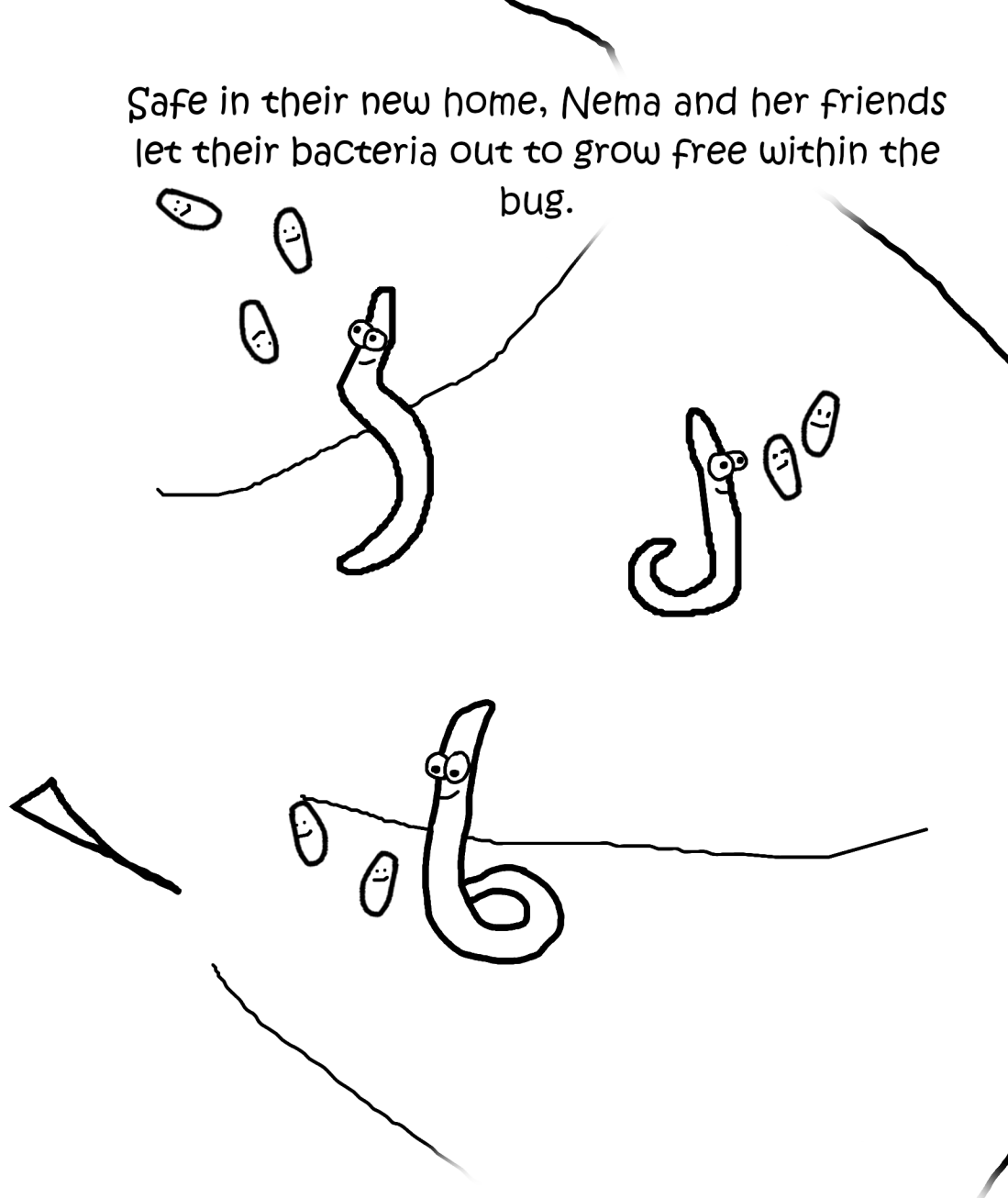


Fun Fact: Nematodes can move through the soil, but sometimes they wait for insects to come by and jump to get inside them.

Fun Fact: Nematodes can jump seven times their body length- more than if you jumped onto the roof of a two-story house!



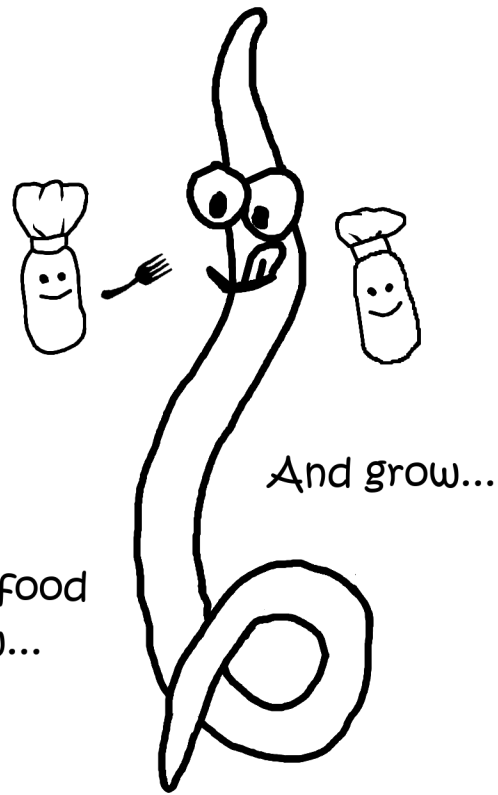
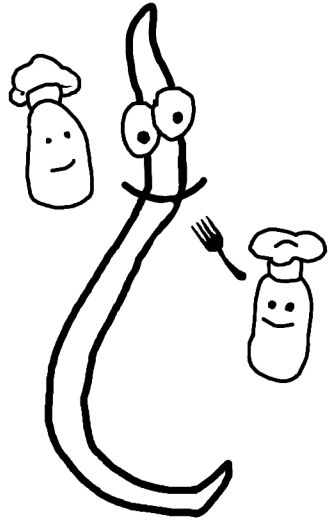
Yes! Nema and the Bacteria and their friends made it into the bug!



Safe in their new home, Nema and her friends let their bacteria out to grow free within the bug.

Fun Fact: The growth of the nematodes and bacteria can kill an insect within a day or two!

Bacteria helped make food
so Nema could grow...



And grow...

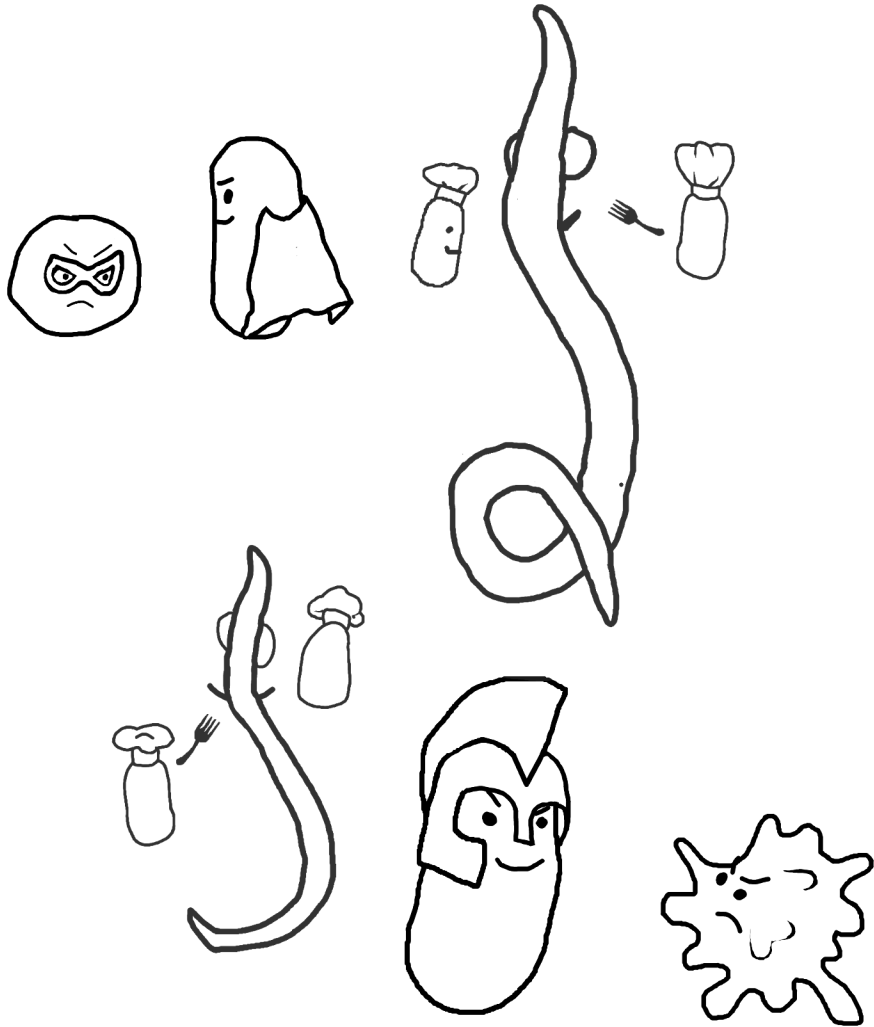


And grow!!!

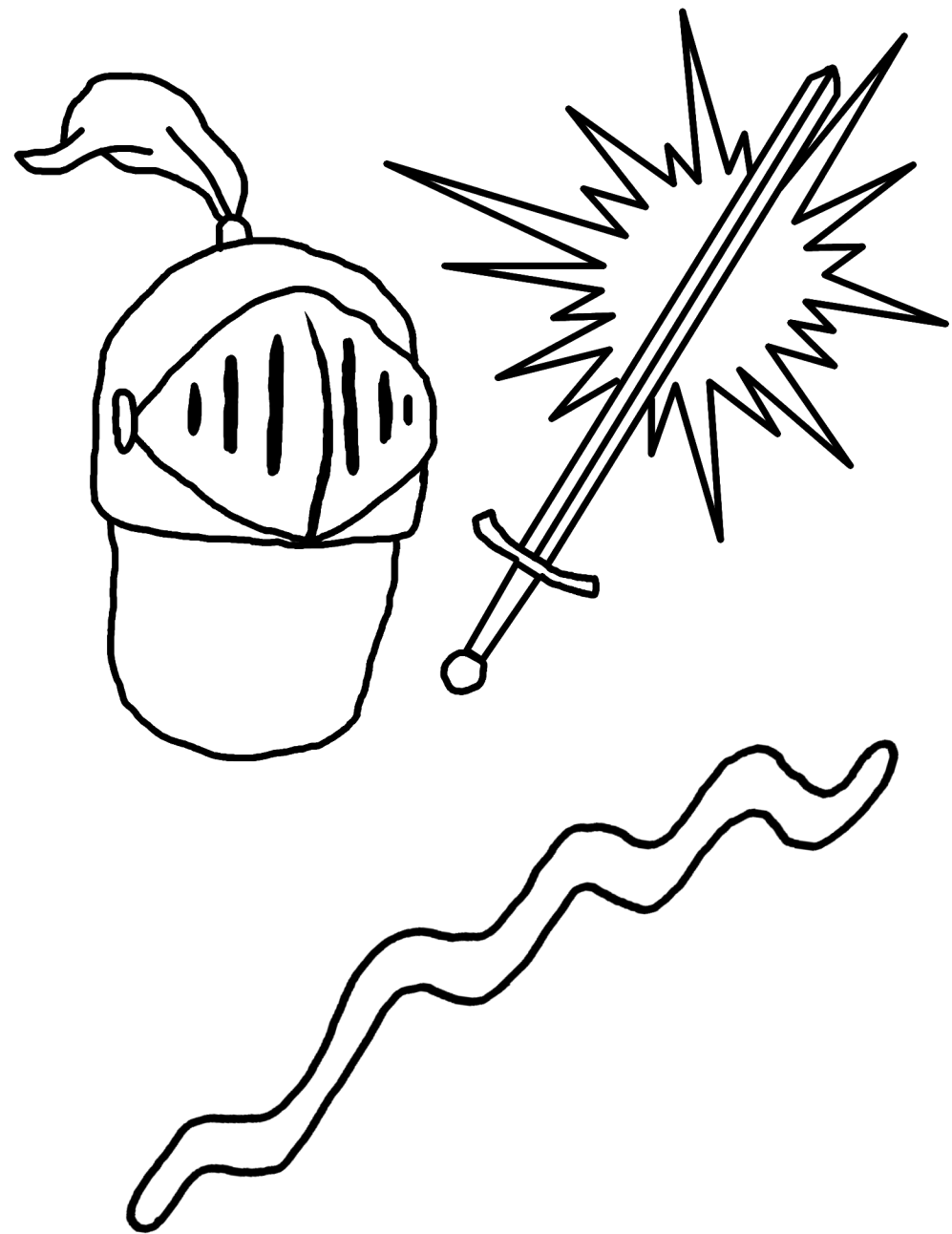
Fun Fact: Bacteria produce enzymes that digest the insect, providing food for the nematodes.

Fun Fact: Nema grew from less than a millimeter to 2.5 cm or about an inch long. That's like if a baby grew up to be 40 feet tall!

Bacteria also defend the nematode from fungus and other harmful bacteria that might hurt the nematode.

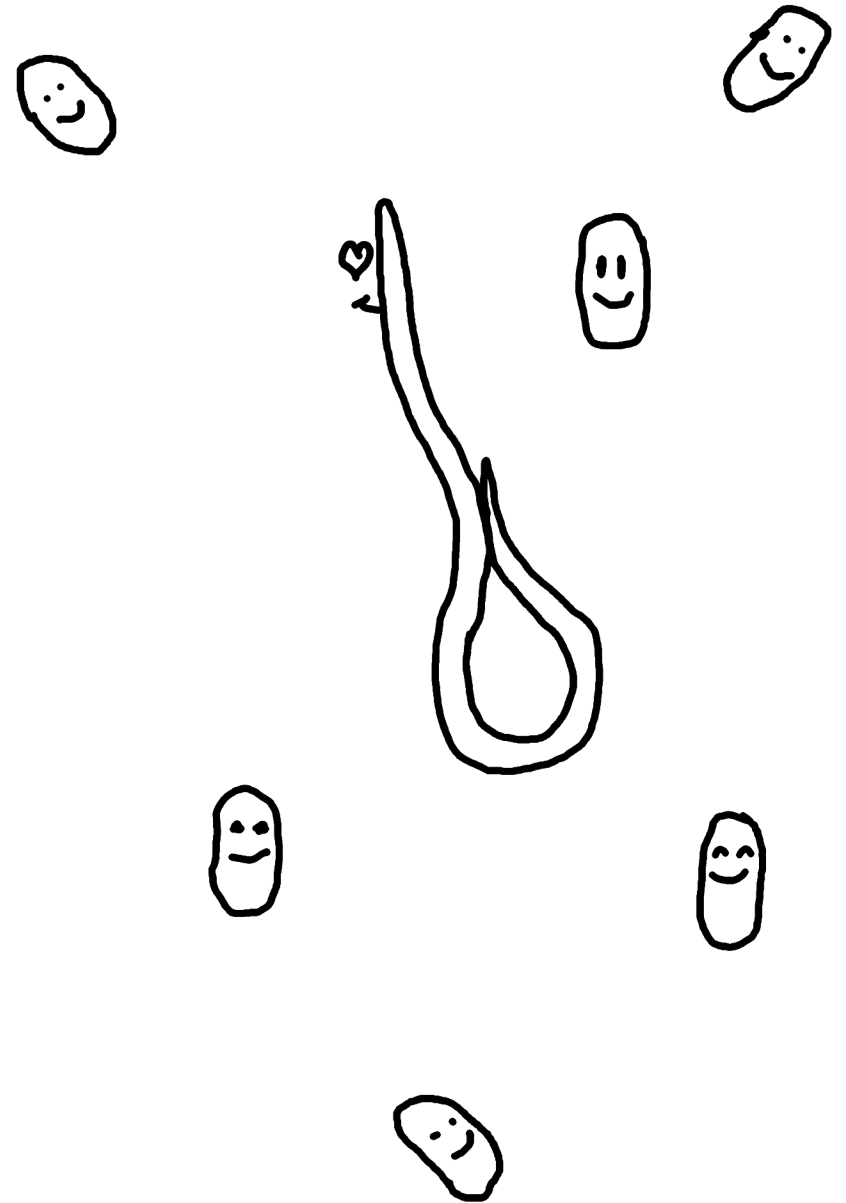
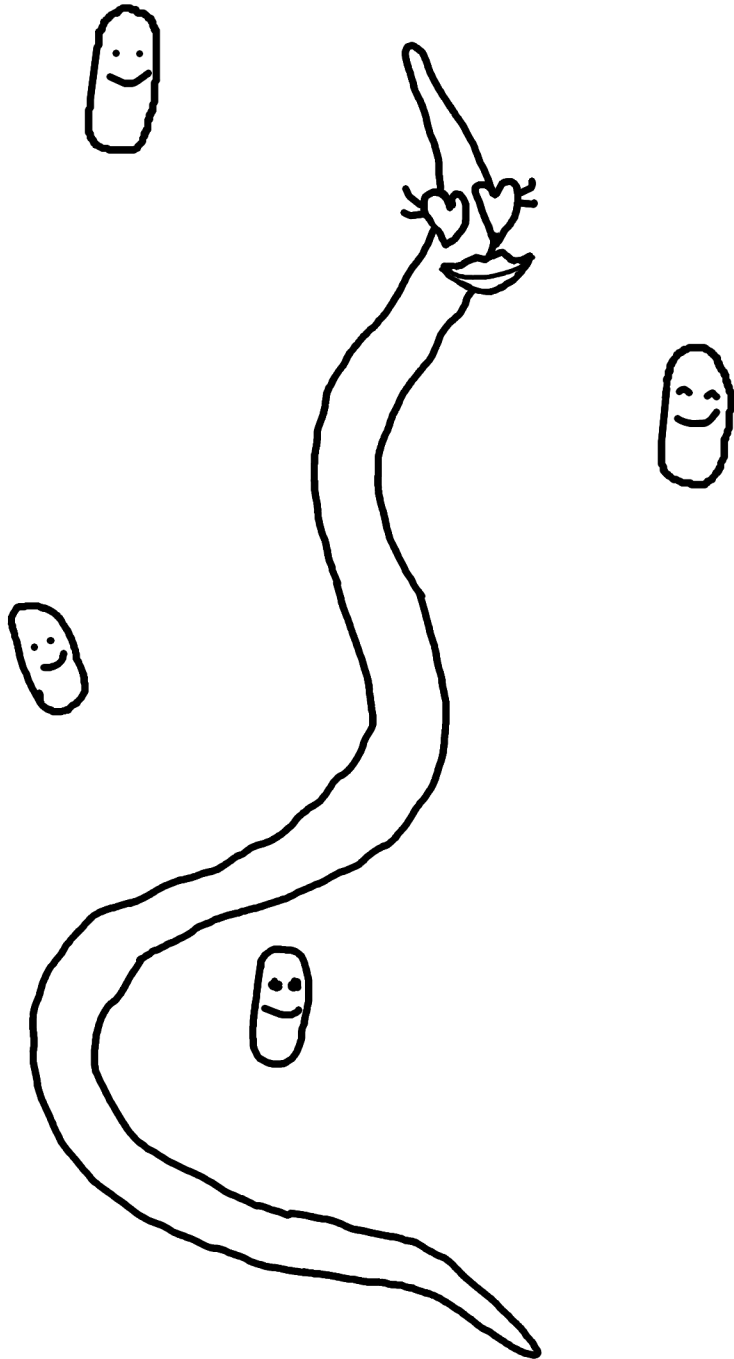


Fun Fact: The compounds produced by the bacteria prevent the dead insect from decaying before the nematodes can reproduce.



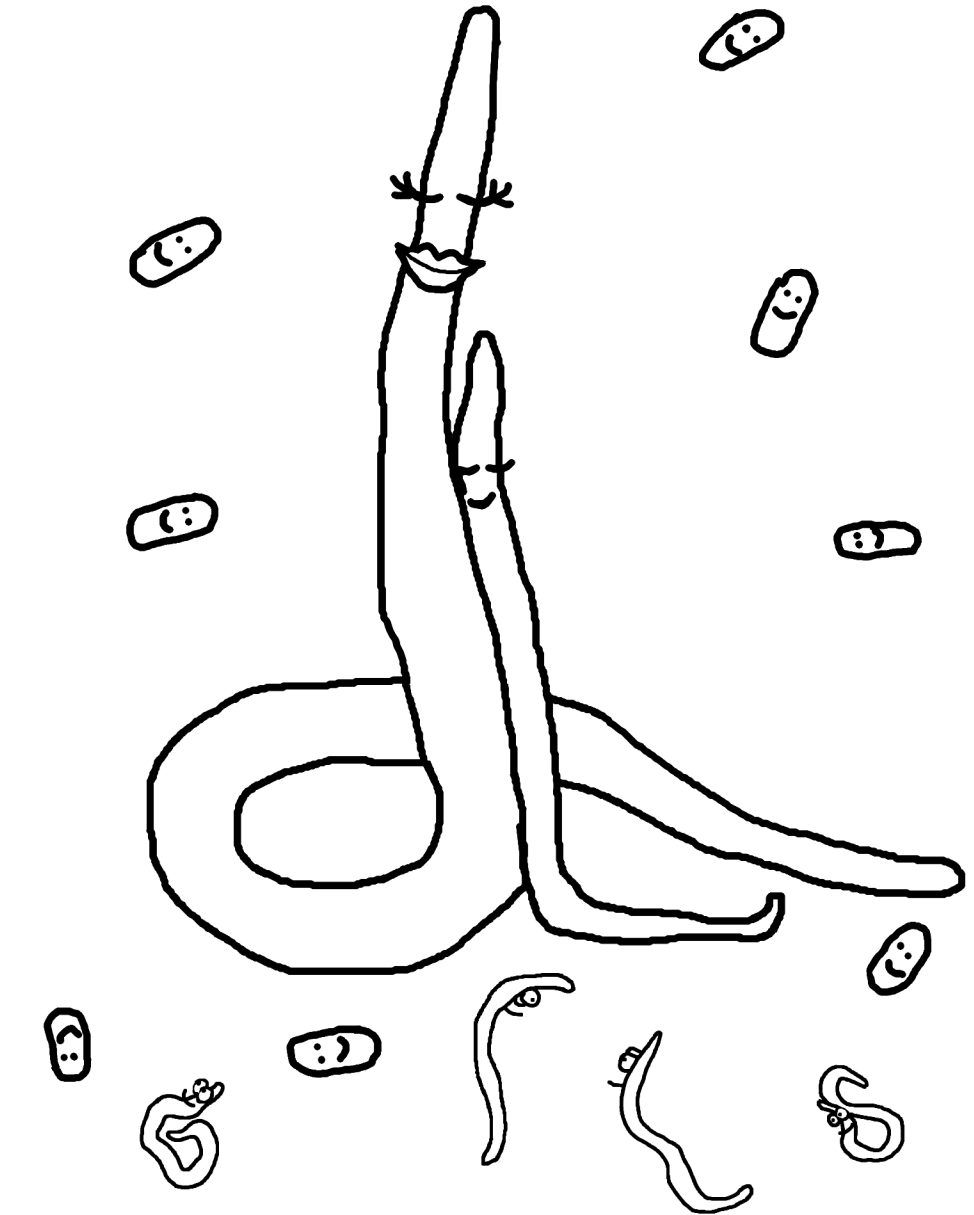
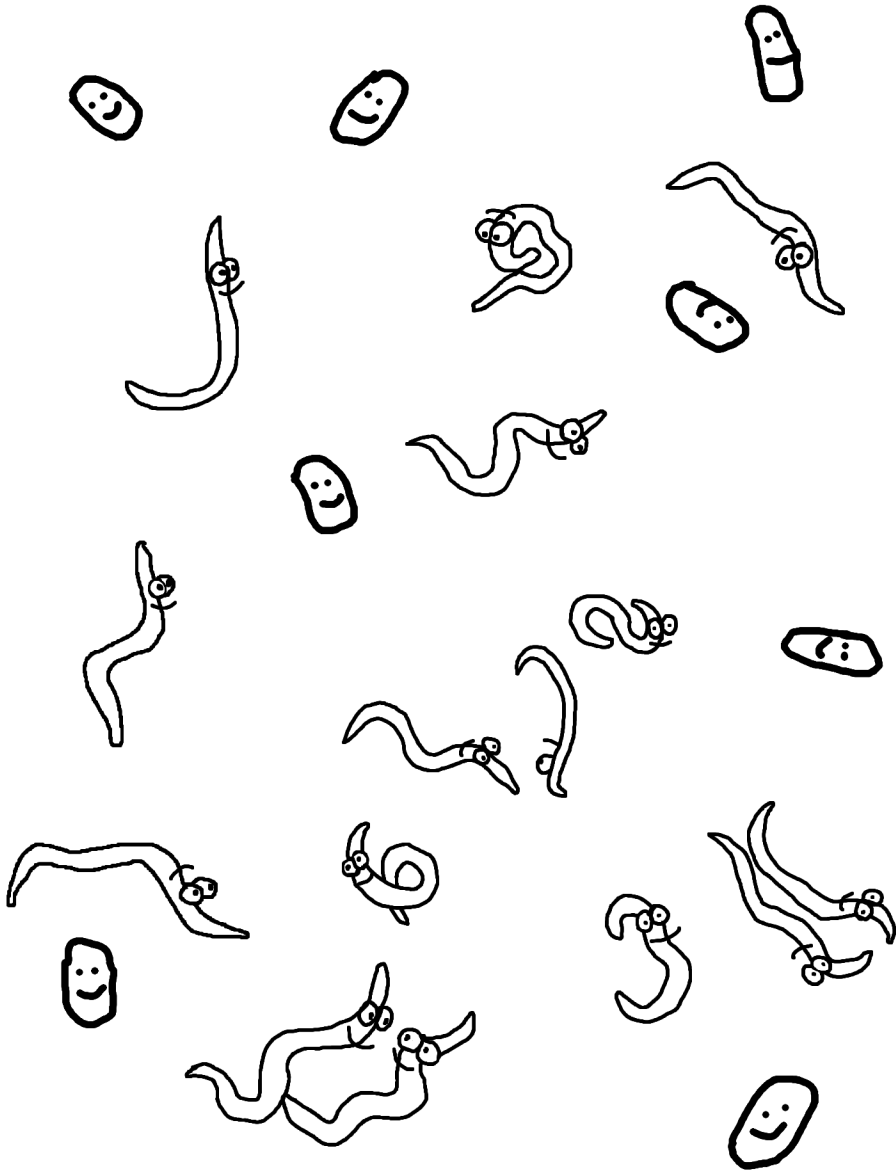
Fun Fact: The toxins the bacteria produce to fight other bacteria have potential to be developed into new antibiotics!

One day Nema met another nematode - her perfect match, Tode!



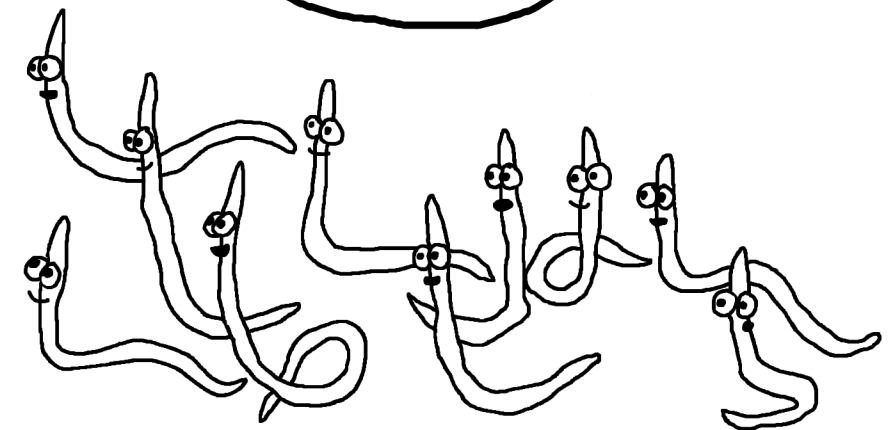
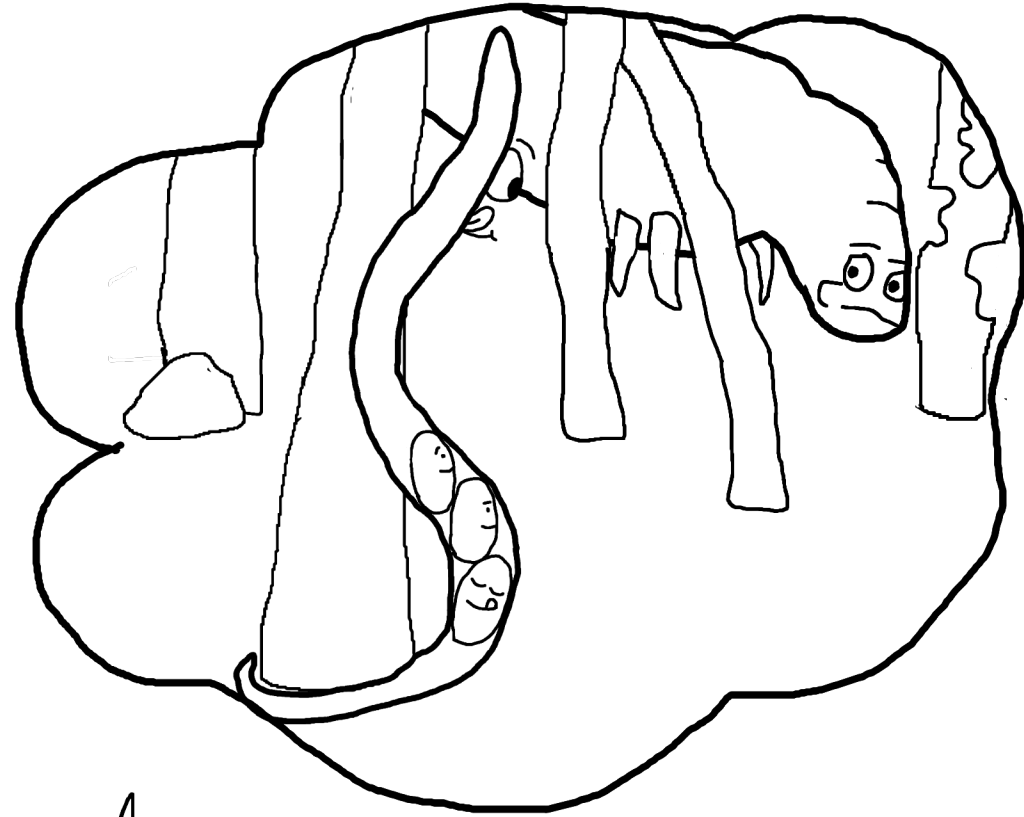
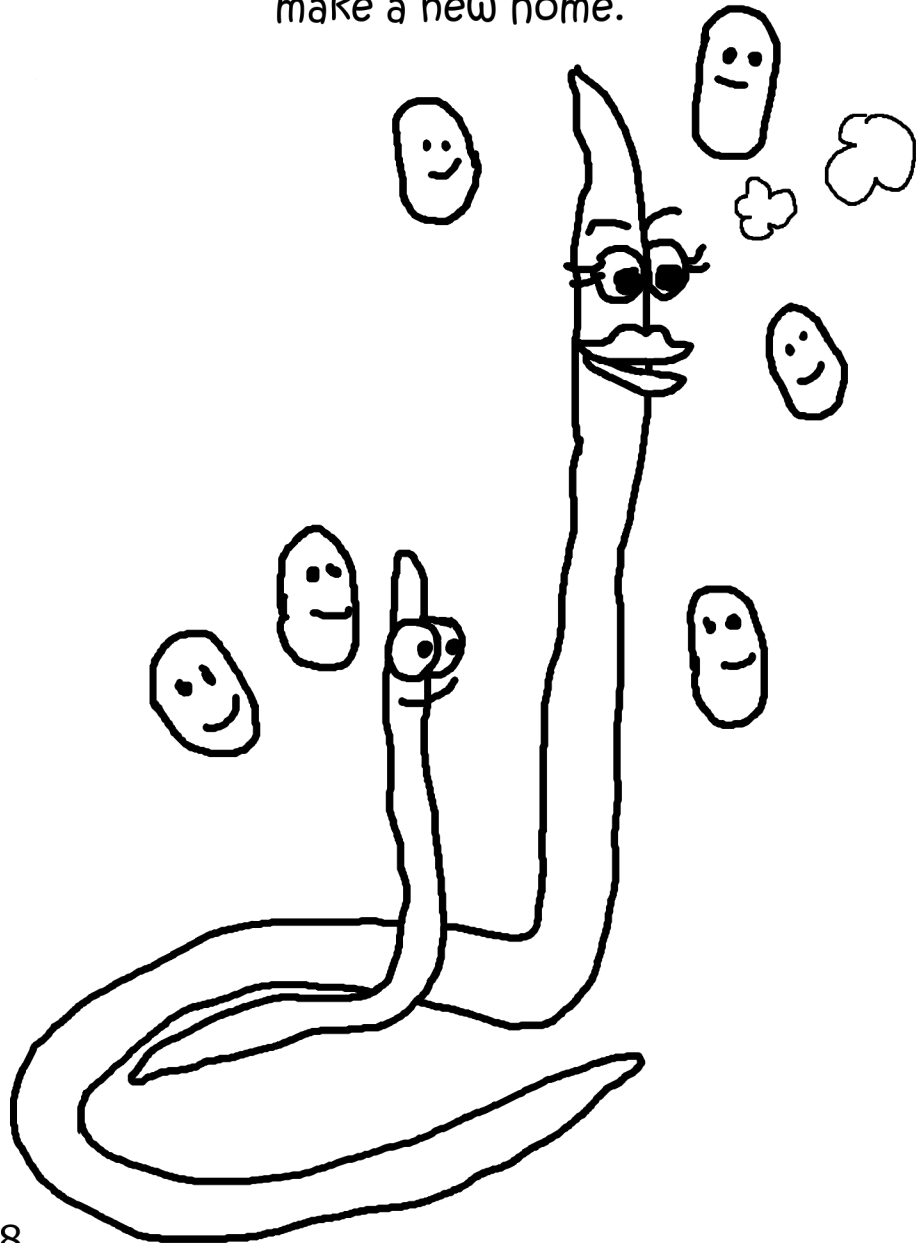
Fun Fact: Female nematodes are about four times as big as male nematodes, but you won't see a difference until they reach adulthood. 15

Together, Nema and Tode made new baby nematodes!



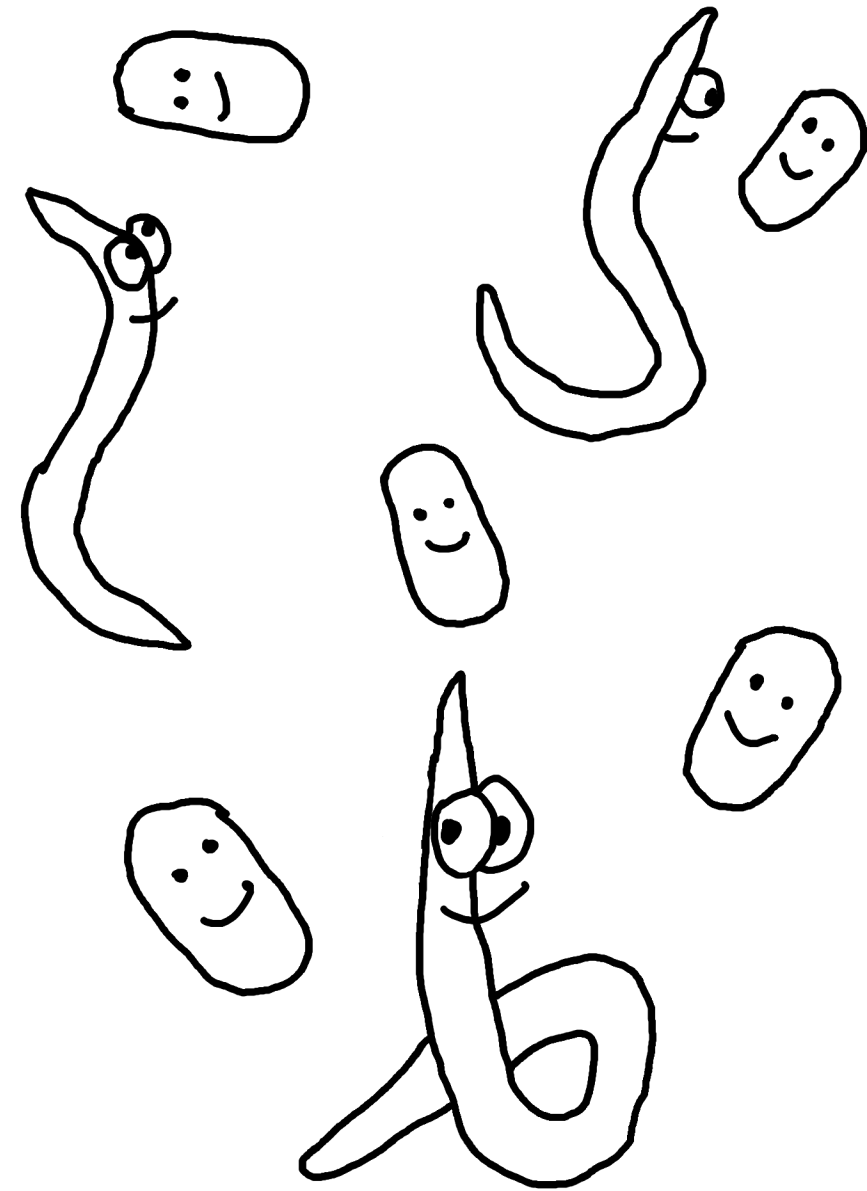
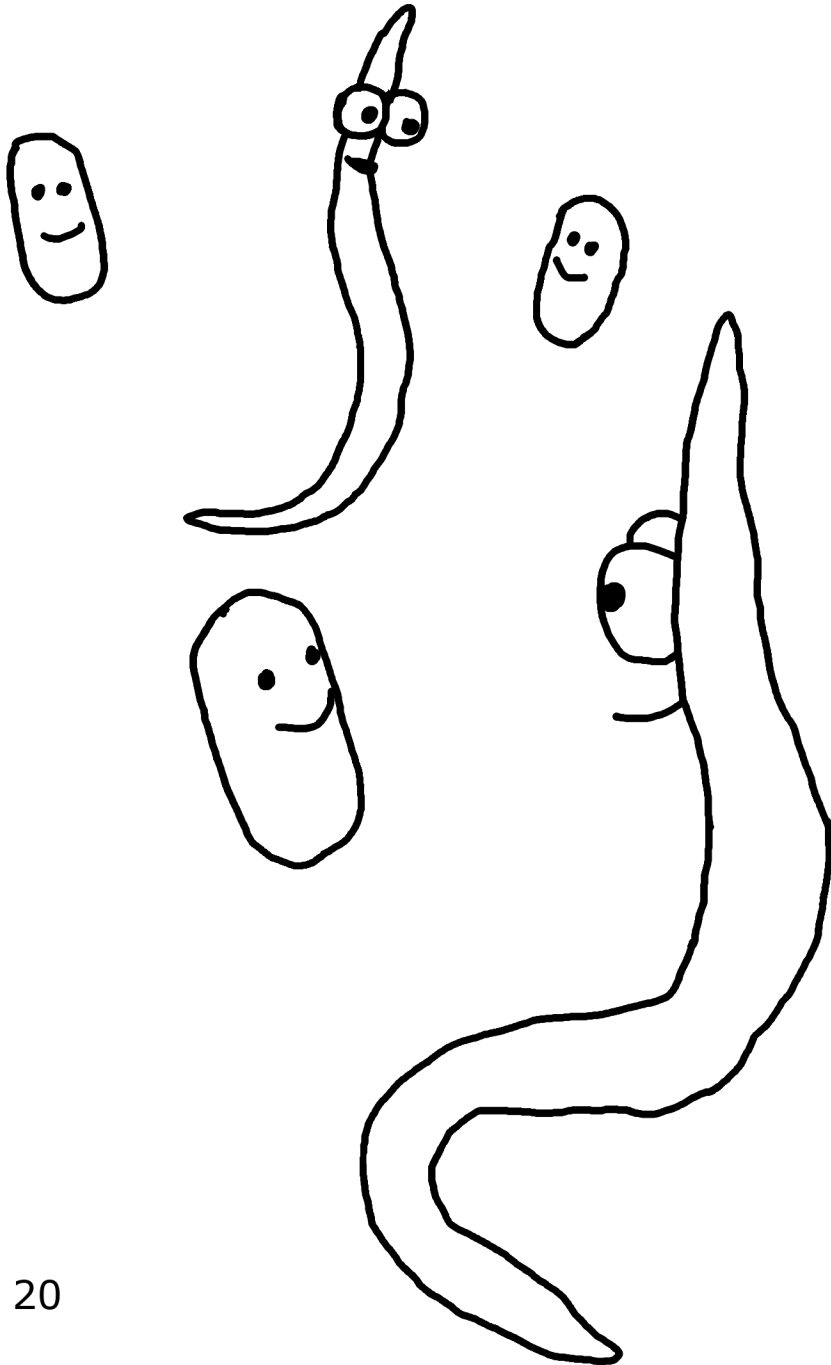
Fun Fact: Baby nematodes can't be seen without a microscope. Also, a single female nematode can produce hundreds of eggs inside the insect!

Nema, Tode, and their Bacteria told the baby nematodes about the outside world. They told them how important it was to carry the Bacteria buddies with them through the soil in order to make a new home.



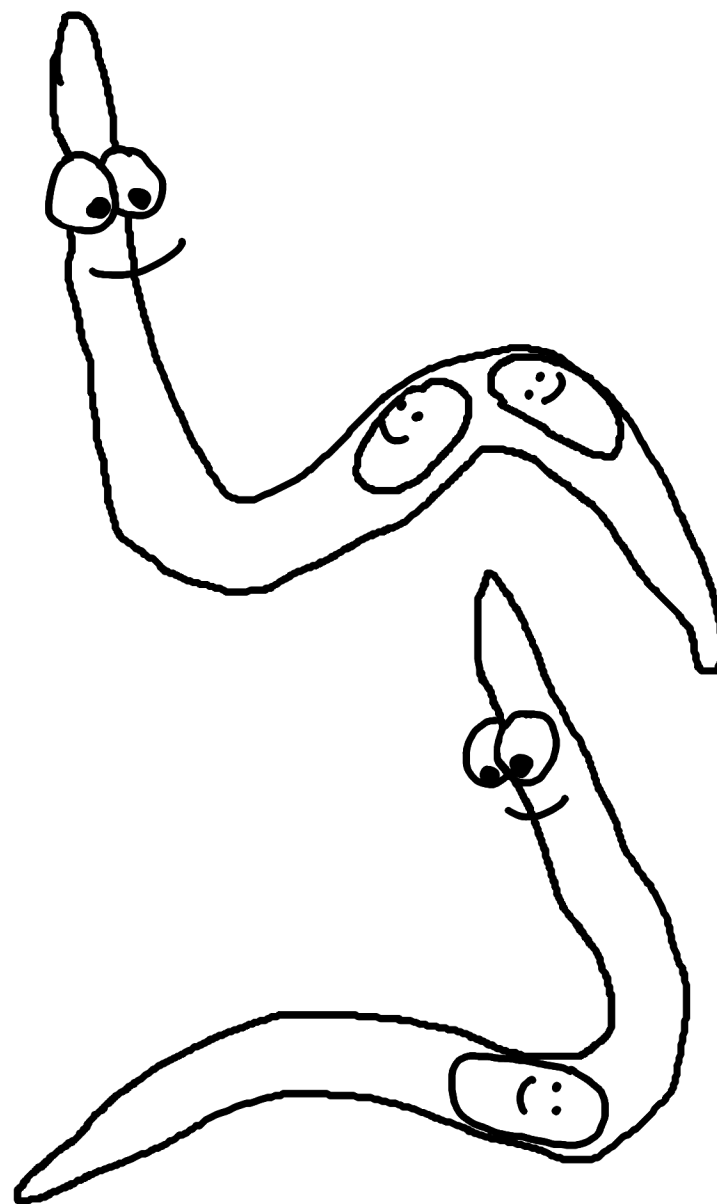
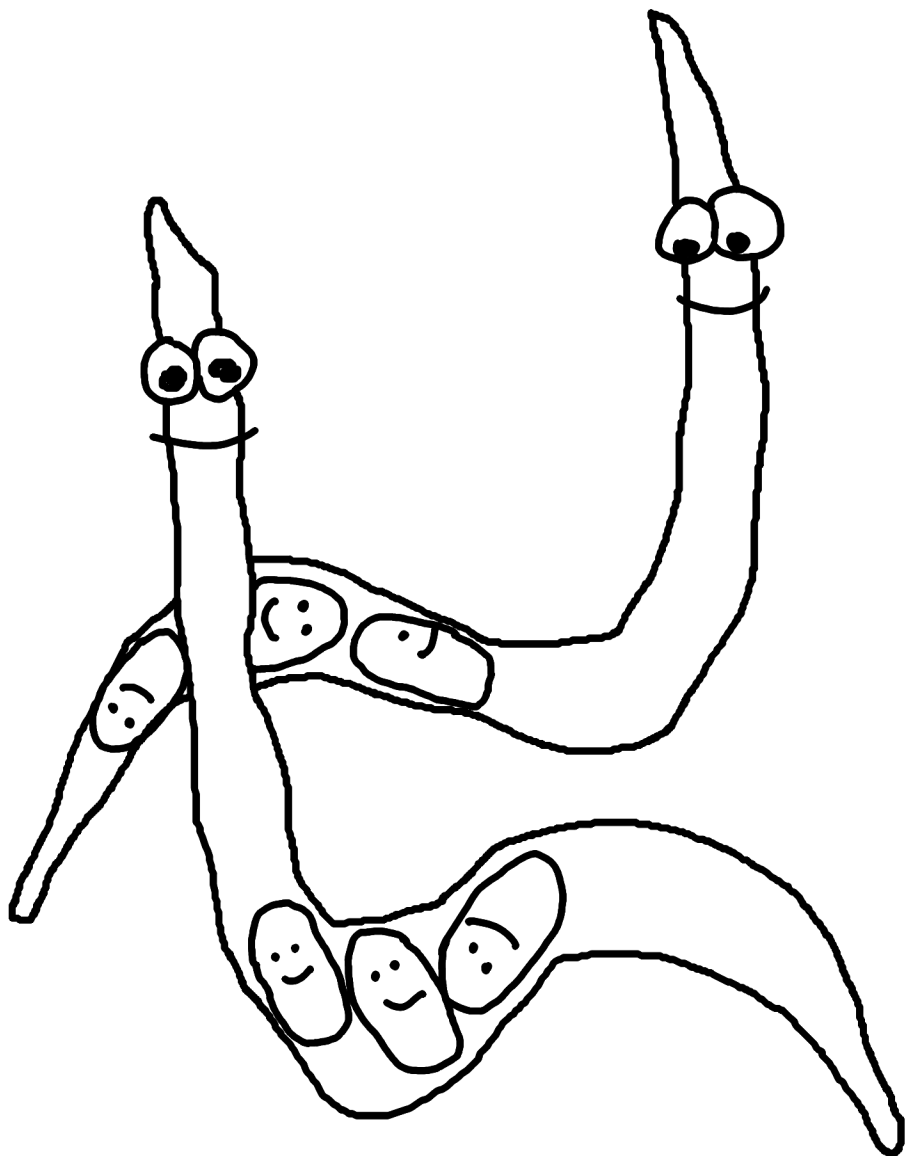
Fun Fact: The *symbiosis* between the nematodes and their bacteria is a *mutualism*, where each partner benefits the other. Nematodes carry bacteria from insect to insect, and the bacteria help kill the insect and feed and protect the nematode.

The baby nematodes each choose their favorite Bacteria.



Fun Fact: The bacteria, which are very small, keep reproducing inside the insect as the nematodes grow and reproduce. There can be **millions** of bacterial cells inside a single insect!

Now, each nematode was ready to go out into the soil and look for a new home with their buddies!



Fun Fact: Thousands of nematodes can emerge from a single insect.