

The Mystery of

Rat Lungworm Disease

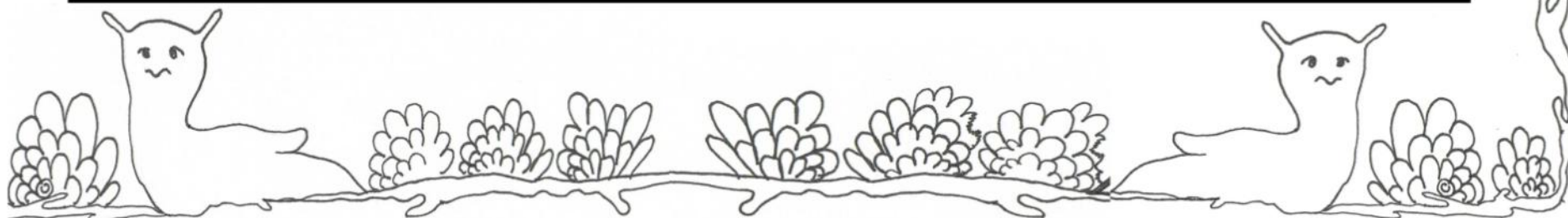


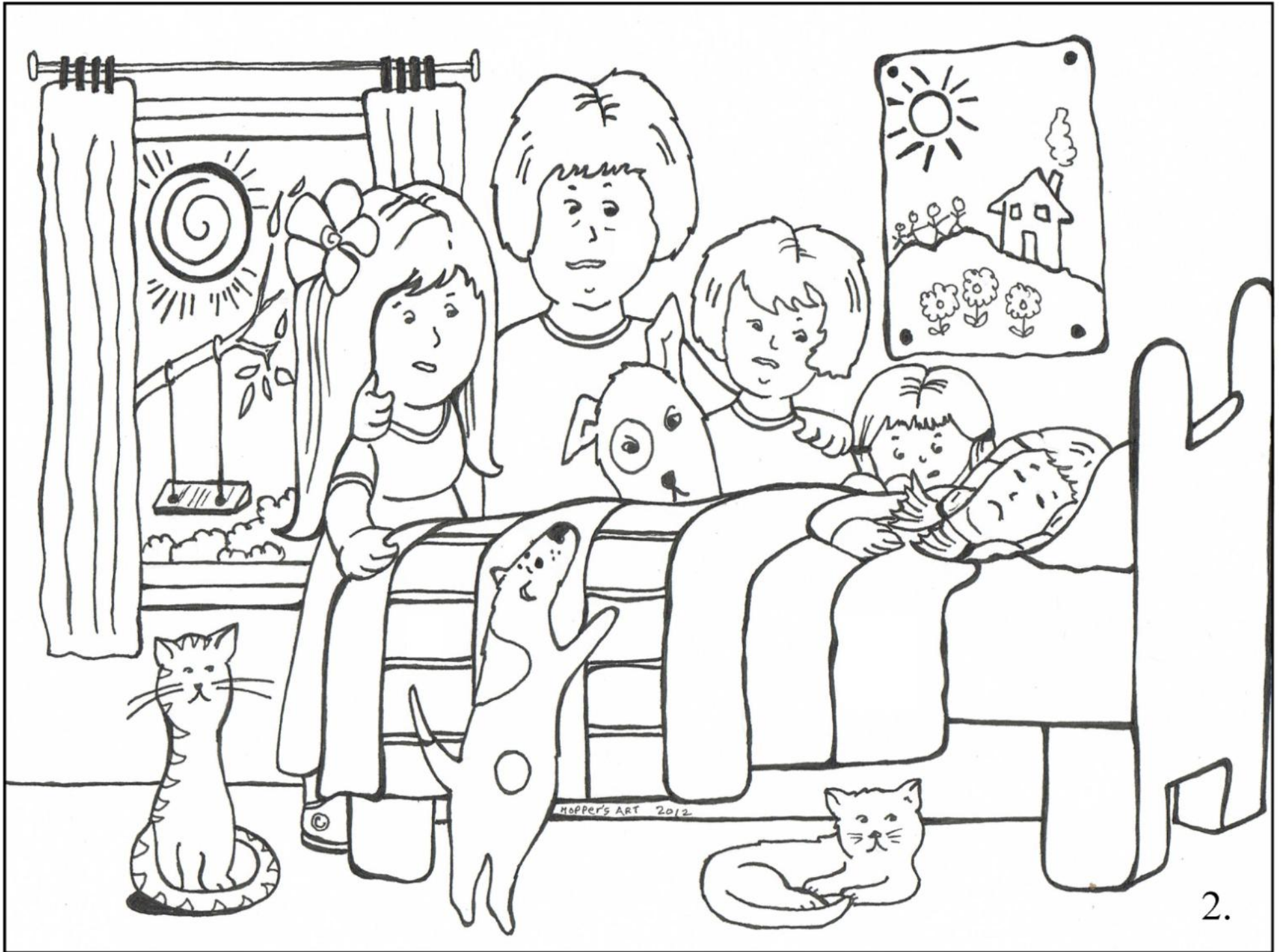
Name: _____

Oh no! Kaleo and Emma just discovered their sister, Lani, is sick! She woke up with a headache and stomachache. She is too sick to play. Maybe she has the flu?

But wait! Lani lives in Hawai`i. This illness might be something else and not the flu. Let's put on our detective hats and investigate some clues. What could have made Lani sick? Lani is usually active and healthy. She likes to eat fresh fruits and vegetables, which are so good for us. But maybe this is a clue...

Let's use the scientific method to find out. What is your hypothesis? A hypothesis is a guess. Write your hypothesis, or guess, below.





Clue #1: Rats... eek!

Lani's sickness reminds me of something I have heard of before. I wonder if there are rats living nearby Lani's home? Here are some facts to consider. Rats carry diseases (parasites, fleas, worms, and germs). Rats live in Hawai`i and are pests.

Meet "Pooper" a black furry rat found everywhere on the islands.

(Scientific name: *Rattus rattus*)

Fast facts: Rats are mammals.
Can you name another mammal?

Rats have affected Hawai`i's birds.
Can you say why?



Find the hidden words !

E G R D M S E

F S W A M Z V

A R A R T U I

C G E E G S T

T G U Q S F A

S I C K Y I N

T S E P J M D

FACT

RATS

SICK

GERMS

NATIVE



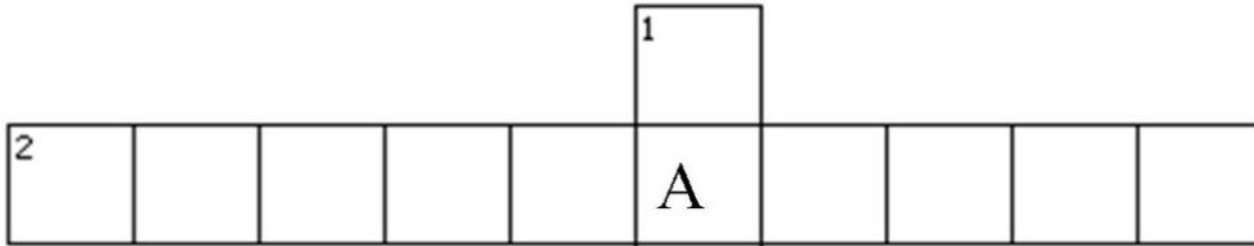
Clue #2: Slugs, snails and all things slimy.

Meet “Slimo” the slug! Slugs and snails live in moist, leafy *habitats* in Hawai`i - especially in the *ecosystems* on the wet sides of islands. Like the rats, most of the slugs and snails we see are introduced species that came from far away. Most of them came here by accident, hitchhiking a ride on plants. Slugs are garden pests, they eat fruits and vegetables. Slugs are also decomposers, they eat dead leaves...and they especially love eating rat feces! Slugs and snails carry *parasites* just as rats do. One *parasite* they can carry is a tiny worm called “rat lungworm.”

Fast fact: A parasite is any living thing that lives on or in another living thing while stealing nutrients from its host.

Slugs and snails do not have backbones.



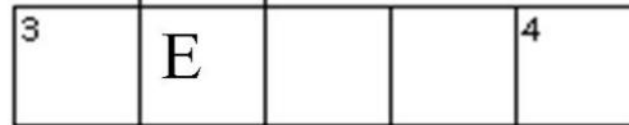


Across

2. These grow in the garden

3. Slugs and snails love to eat this

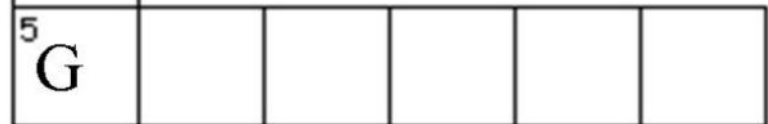
5. The place where vegetables grow



Down

1. A tiny worm is one of these

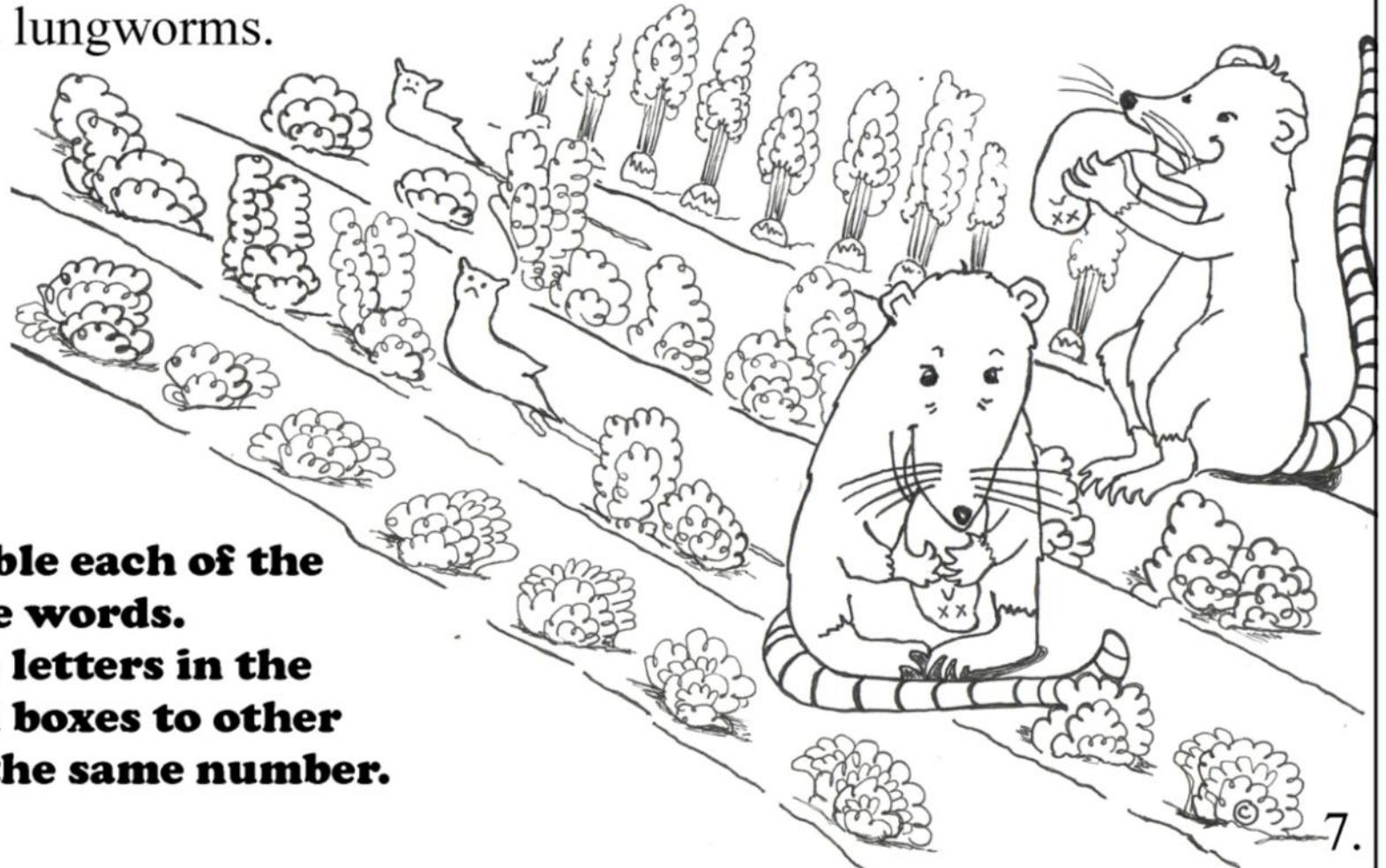
4. A garden pest



Key : feces, garden, parasite, slug, vegetables

Clue #3: Fine dining - rats eat slugs and snails.

Most native snails of Hawai`i are *extinct* or *endangered species* because rats eat them. The Hawaiian Islands once had many species of snails found nowhere else. Now we have slugs and snails from many places outside of Hawai`i, such as China, Cuba, and Africa. These slugs and snails can be infected with thousands of tiny, parasitic, rat lungworms.



**Unscramble each of the
clue words.
Copy the letters in the
numbered boxes to other
boxes with the same number.**

TRA

	A	
--	---	--

1 9 7

SLGU

			G
--	--	--	---

10 5 12 13

LINAS

	N			
--	---	--	--	--

14 2 11

PETS

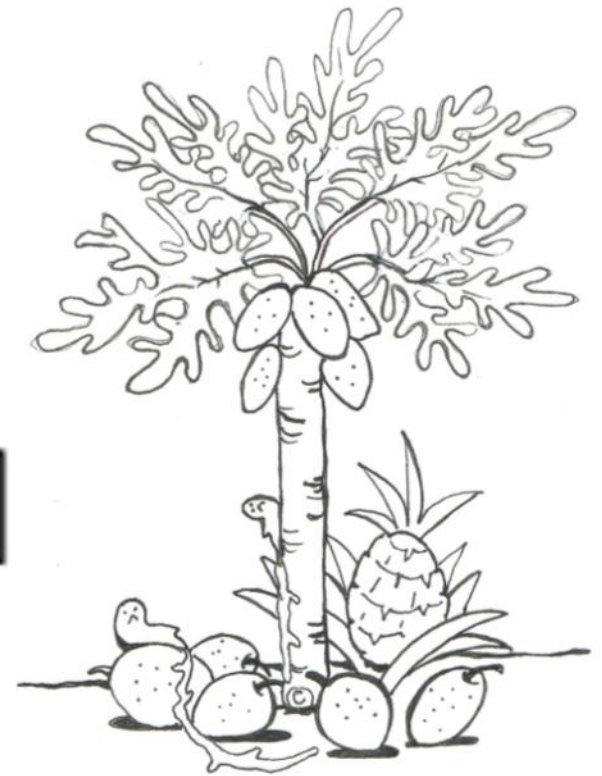
		S	
--	--	---	--

6 3

PISSECE

	P			I		
--	---	--	--	---	--	--

8 4



--	--	--	--

1 2 3 4

	O	V	
--	---	---	--

5 6

	O
--	---

7

--	--	--

8 9 3

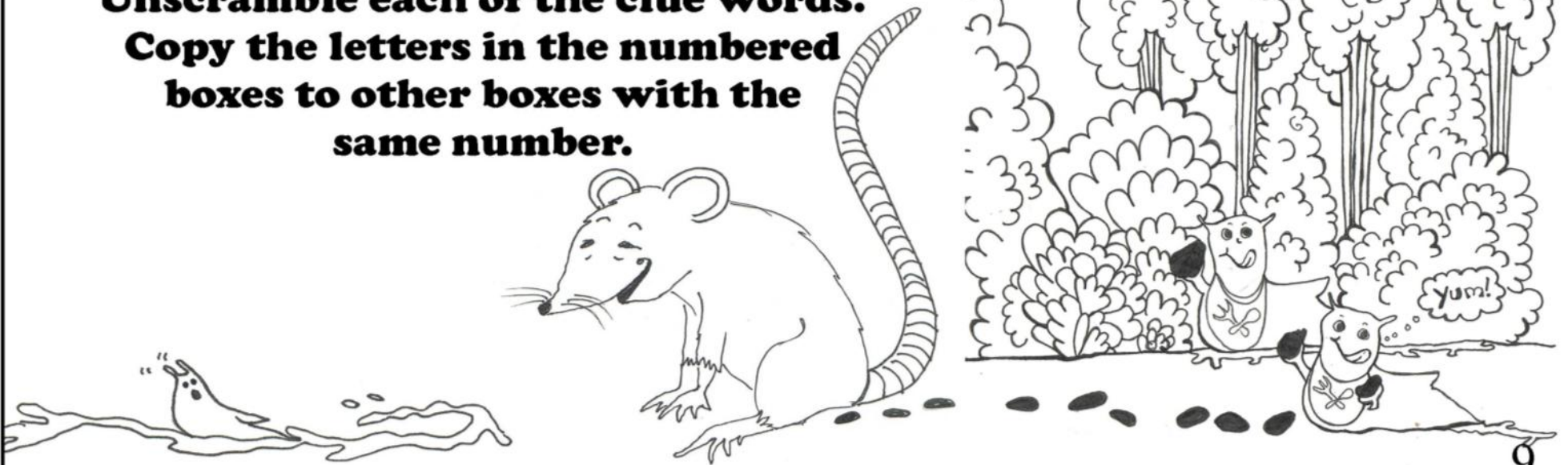
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10 11 12 13 14

Clue #4: The trail of feces leads to...

How did the slugs and snails become infected with rat lungworms? This *lifecycle* involves two *hosts*: the rat, and slugs or snails. The little rat lungworm begins and ends its life inside the rat. It spends the middle of its life living inside slugs or snails. How does the rat lungworm move from the rat to the other host? By none other than rat feces! We have learned slugs and slugs LOVE to eat rat feces! Mmm, mmm, mmm yummy! Let's take a look at this *lifecycle*.

**Unscramble each of the clue words.
Copy the letters in the numbered
boxes to other boxes with the
same number.**



HOTS

H [] [] []

9 1 11



PATSEARI

[] A [] A [] [] [] []

4 14 6 5 7 13 10



ILEF CYLEC

[] I [] []

2 15 12

[] [] C [] []

17 8 16

CEFSE

[] [] C [] []

18 3



[] [] U G []

1 2 3

[] N D []

4

[] N [] [] [] []

5 6 7 8 1

[] [] V []

8 9 10

[] []

11 9

[] [] []

12 4 13

[] [] []

14 4 11

[] [] [] [] []

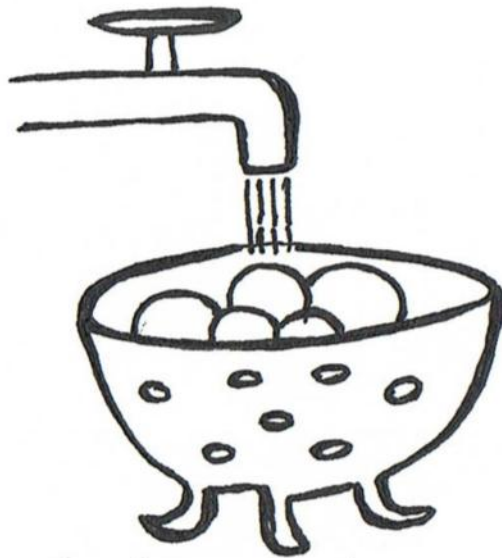
15 16 17 18 3

10.

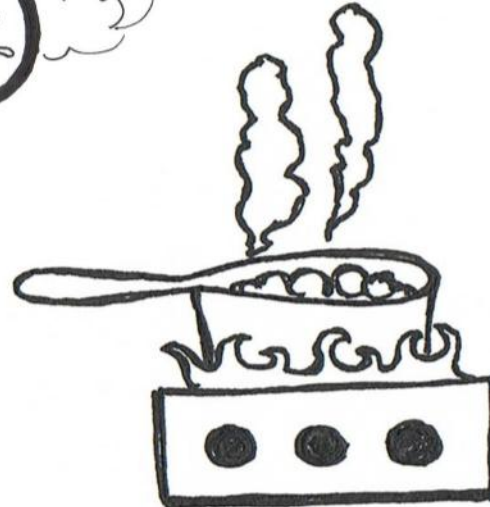
Rat lungworm life cycle ... what comes around goes around!

Welcome to the microscopic world, the world of the very small.

That which we cannot see might sometimes hurt us unless we know how to avoid the problem.



**check
&
clean**



cooked = safe



Fast fact: Cooking food kills parasites.

If You're Healthy and You Know It

(to the tune of "If You're Happy and You Know It")



If you're *happy* and you know it, clap your hands!

(CLAP ! CLAP !)

If you're *healthy* and you know it, wash your hands!

(WASH ! WASH !)

(CHORUS)

If you wash your fruits & veggies,
And they're clean and good to eat,
Then you're really living healthy hand-in-hand!

(join hands, SHAKE, SHAKE !)



If you're *hungry* and you know it, rub your belly!

(RUB ! RUB !)

If you're *smart* and you know it, wash your veggies!

(WASH ! WASH !)

(repeat chorus)



If you're *happy* and you know it, clap your hands!

(CLAP ! CLAP !)

If you're *healthy* and you know it, wiggle your hips!

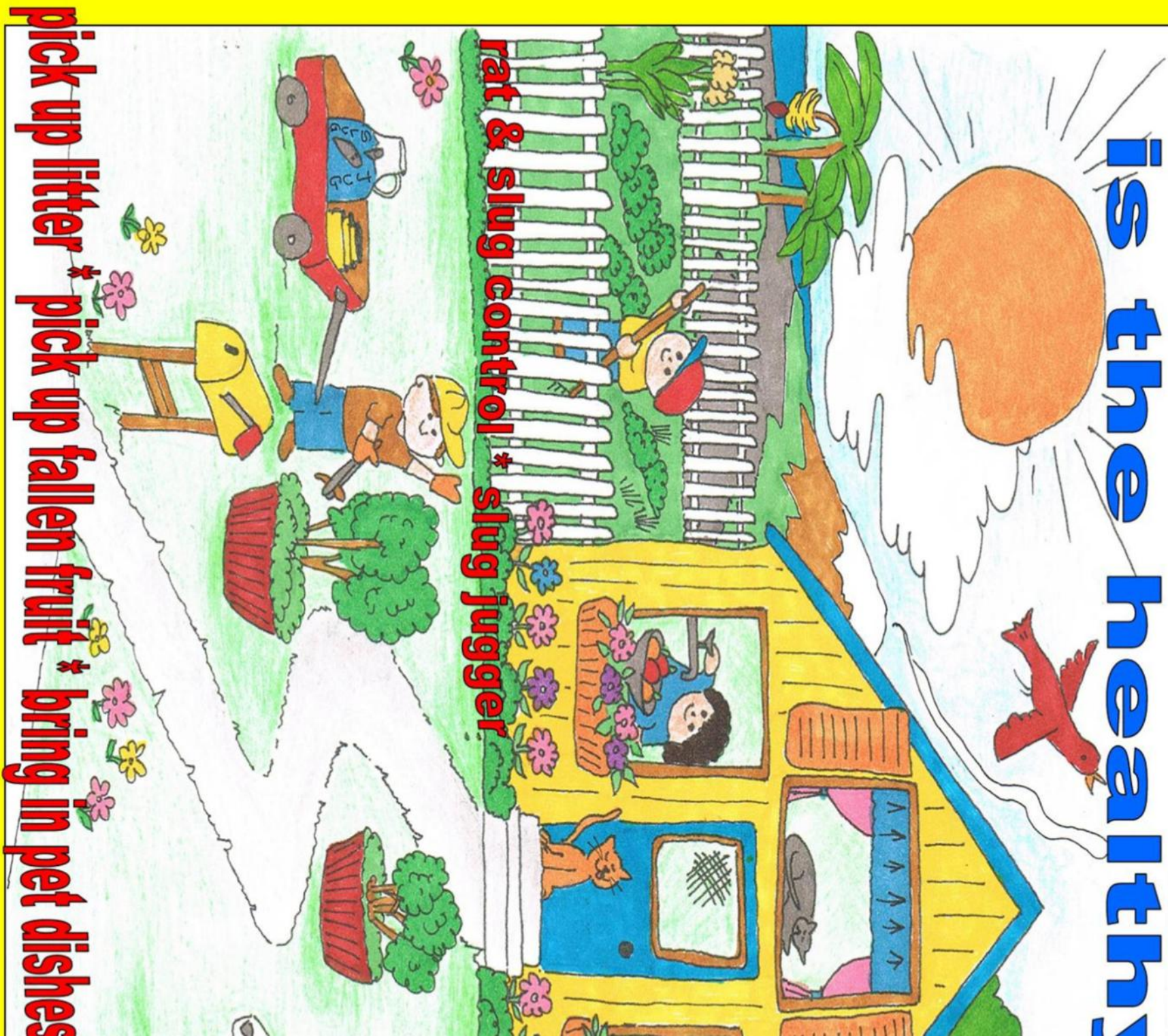
(WIGGLE ! WIGGLE !)

(repeat chorus)



Living Rat Lur

is the health



rat & slug control * slug jugger

pick up litter * pick up fallen fruit * bring in pet dishes

ngworm FREEE

y way to bee !



educate family & friends

*** cook food * wash & check fresh fruits & vegetables**



Rat Lungworm Lifecycle

Worms in brain, eyes and body make us sick!



Rats eat slugs and lungworms.

Adult lungworms live inside rats.

Baby lungworms exit rats in feces.

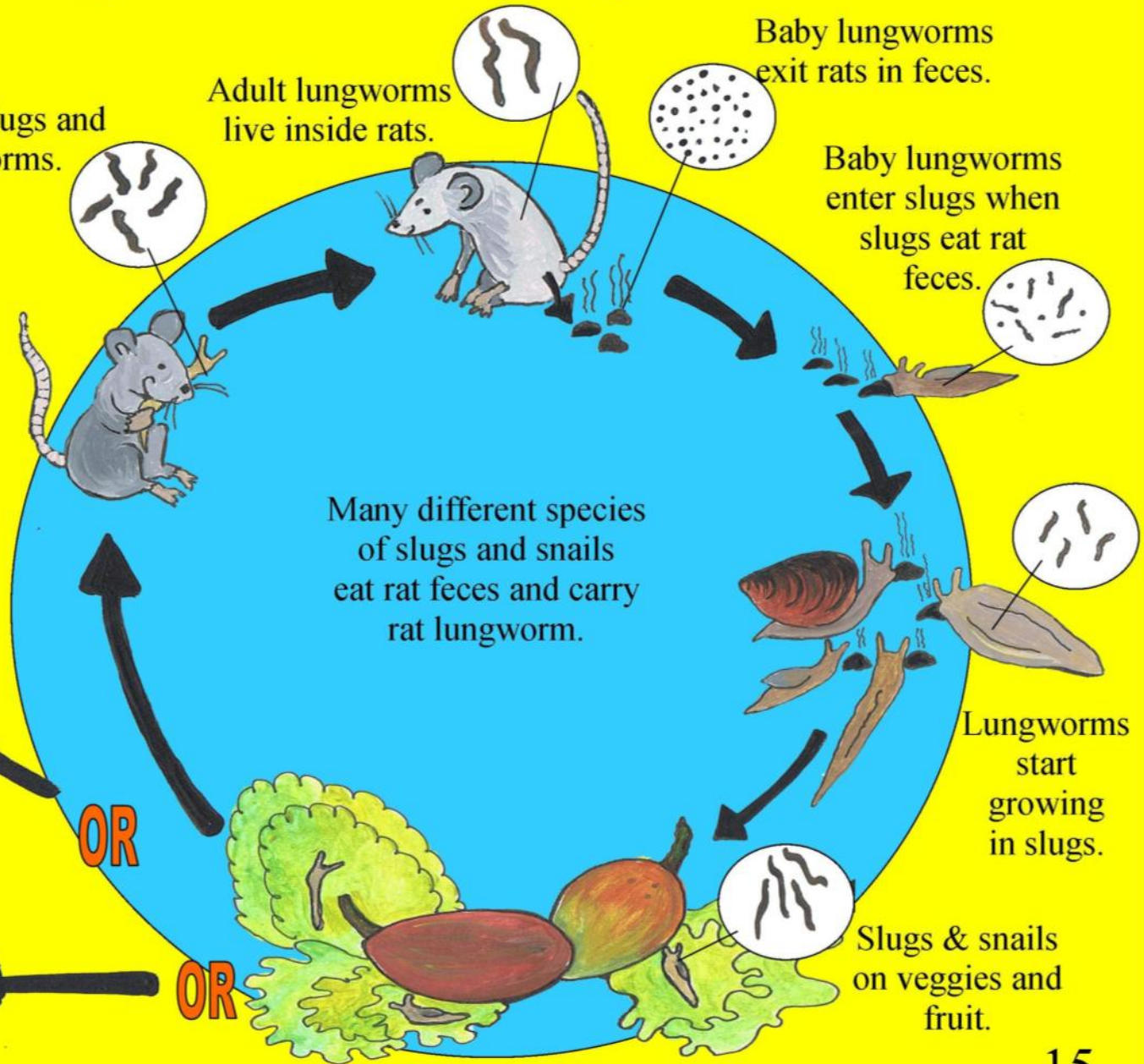
Baby lungworms enter slugs when slugs eat rat feces.

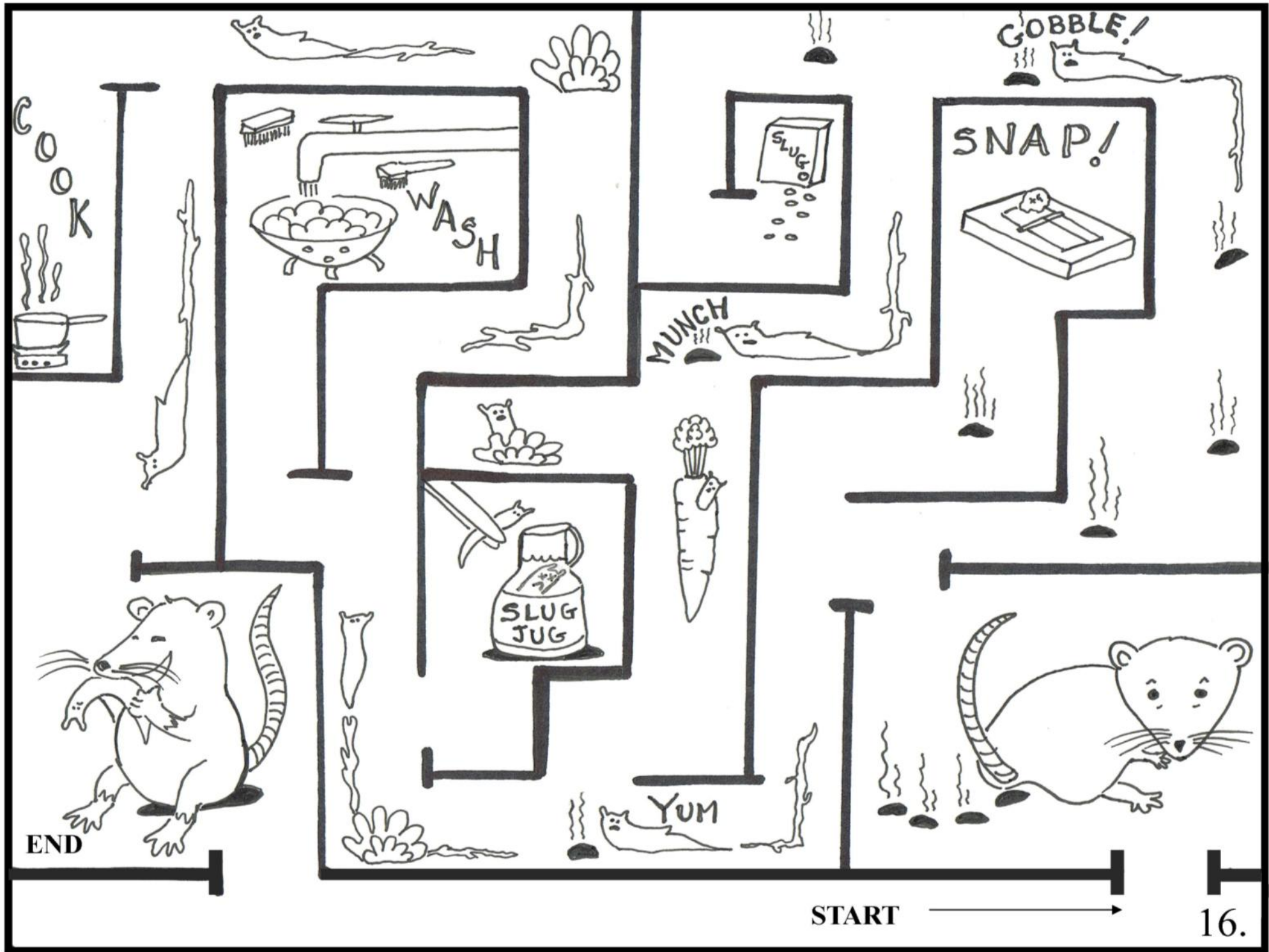
Many different species of slugs and snails eat rat feces and carry rat lungworm.

Lungworms start growing in slugs.

Slugs & snails on veggies and fruit.

SAFE TO EAT!
Check
Clean
Cook





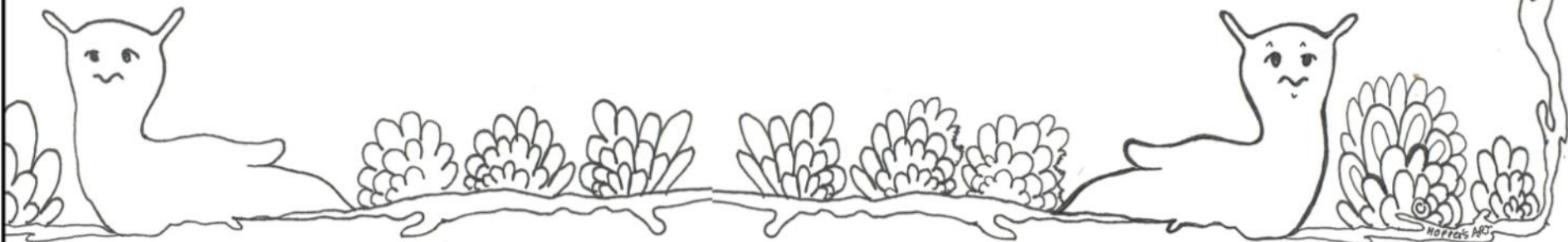
END

START →

The garden habitat.

I've come to the conclusion we should inspect Lani's garden. Lani, Kaleo, and Emma love the garden. It is a *habitat* for birds, bees, and butterflies. Their garden provides the children with fresh, nutritious fruits and vegetables. Let's see if it is a *habitat* slugs and snails like. Oh no! Slimo and his friends are eating the lettuce! Let's inspect more closely and see what we find inside. Uh oh, microscopic worms! Rat lungworms inside Slimo!

Fast fact: Farmers' markets and grocery stores are great places to find fresh fruits and vegetables. Be sure to wash ALL fresh fruits and vegetables before eating them!



SC.2.5.1. Unity and Diversity: Identify distinct environments and the different kinds of organisms each environment supports



Yellow = 1 Orange = 2 Red = 3 Light Brown = 4
Light Green = 5 Green = 6 Black = 7

Who else was in the garden?

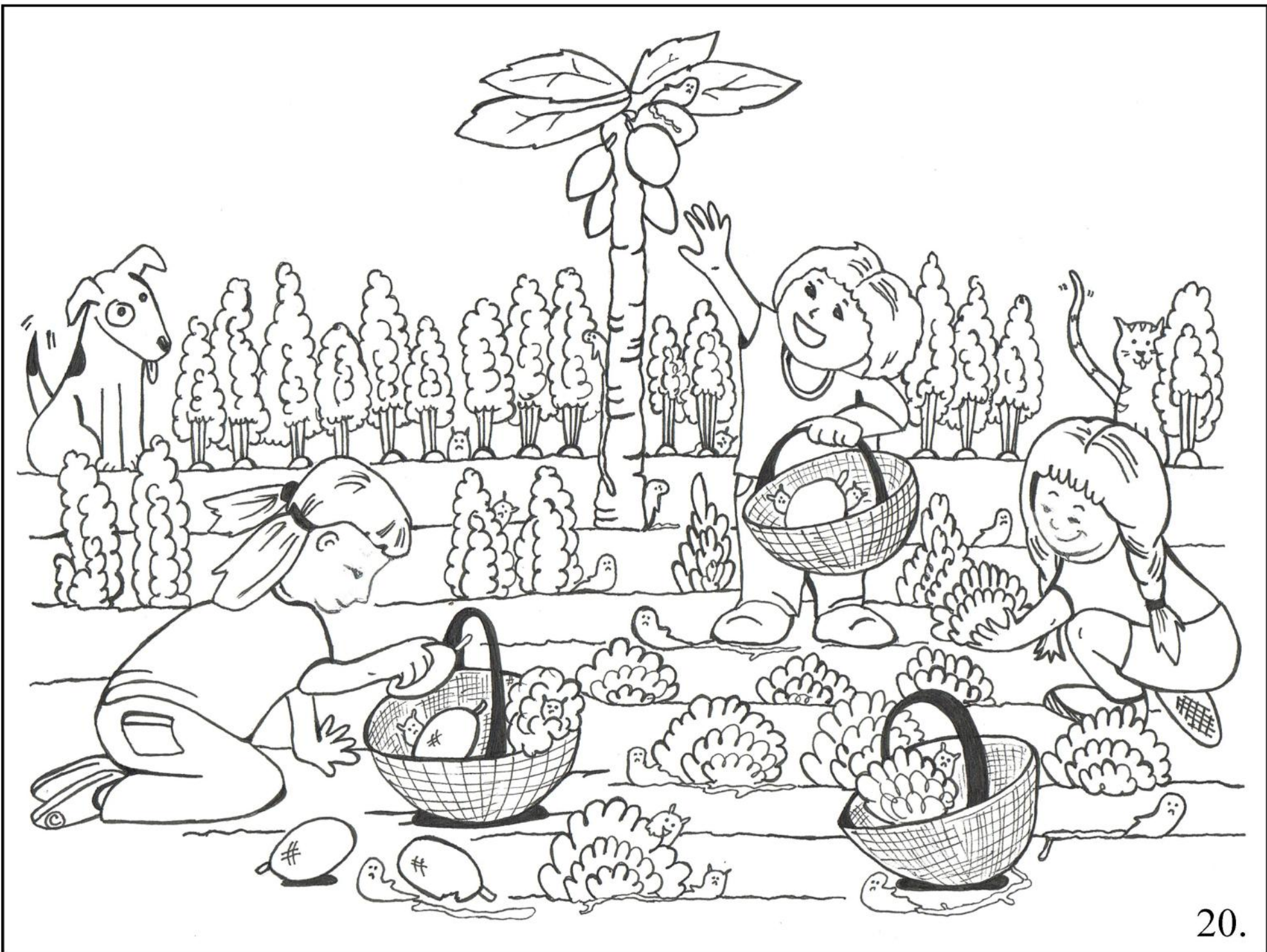
Lani, Kaleo, and Emma were harvesting vegetables for their dinner. They also picked up fallen fruit from the ground for dessert. Do you think they saw Slimo and his friends?

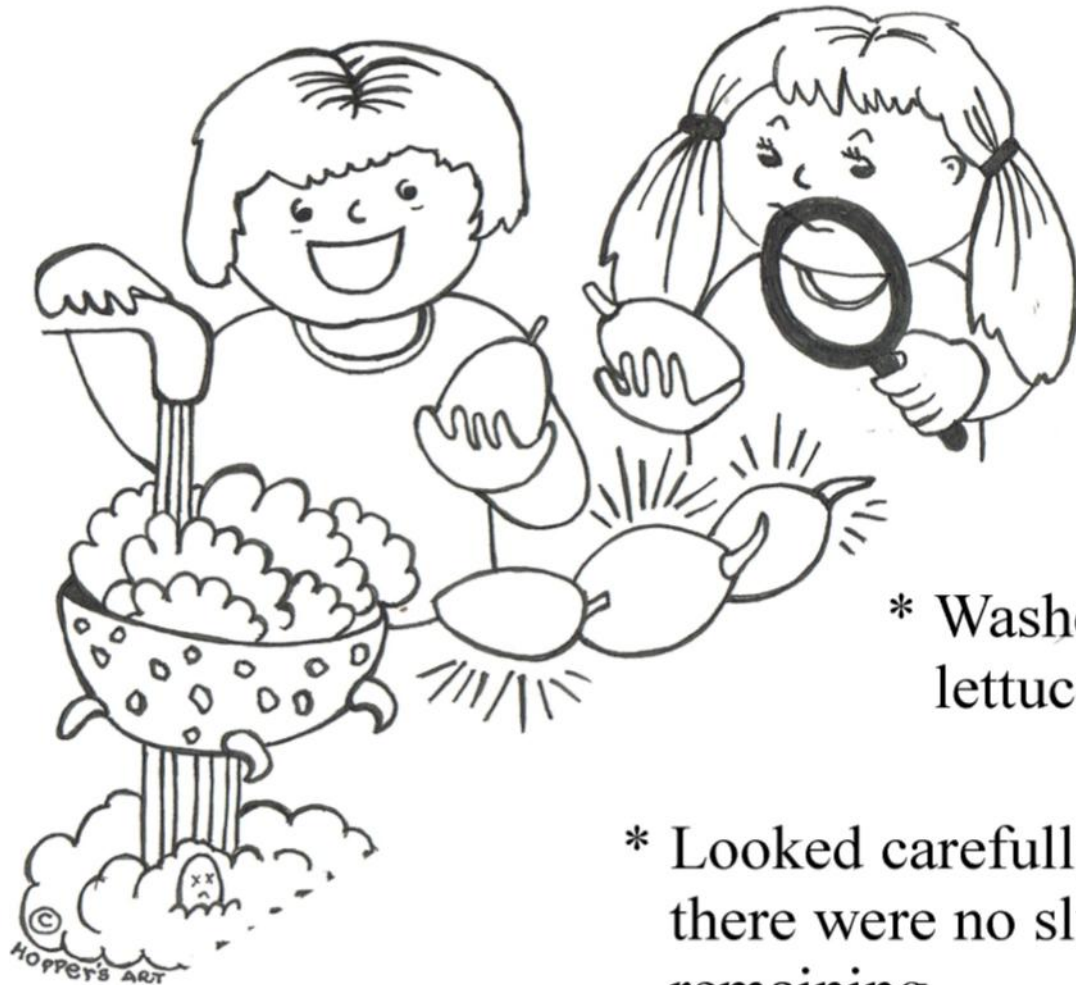
Fast fact: Baby slugs and snails hatch from eggs. They are very small and may also carry rat lungworm parasites!



**See if you can find the 20 hidden slugs
in Lani's garden**







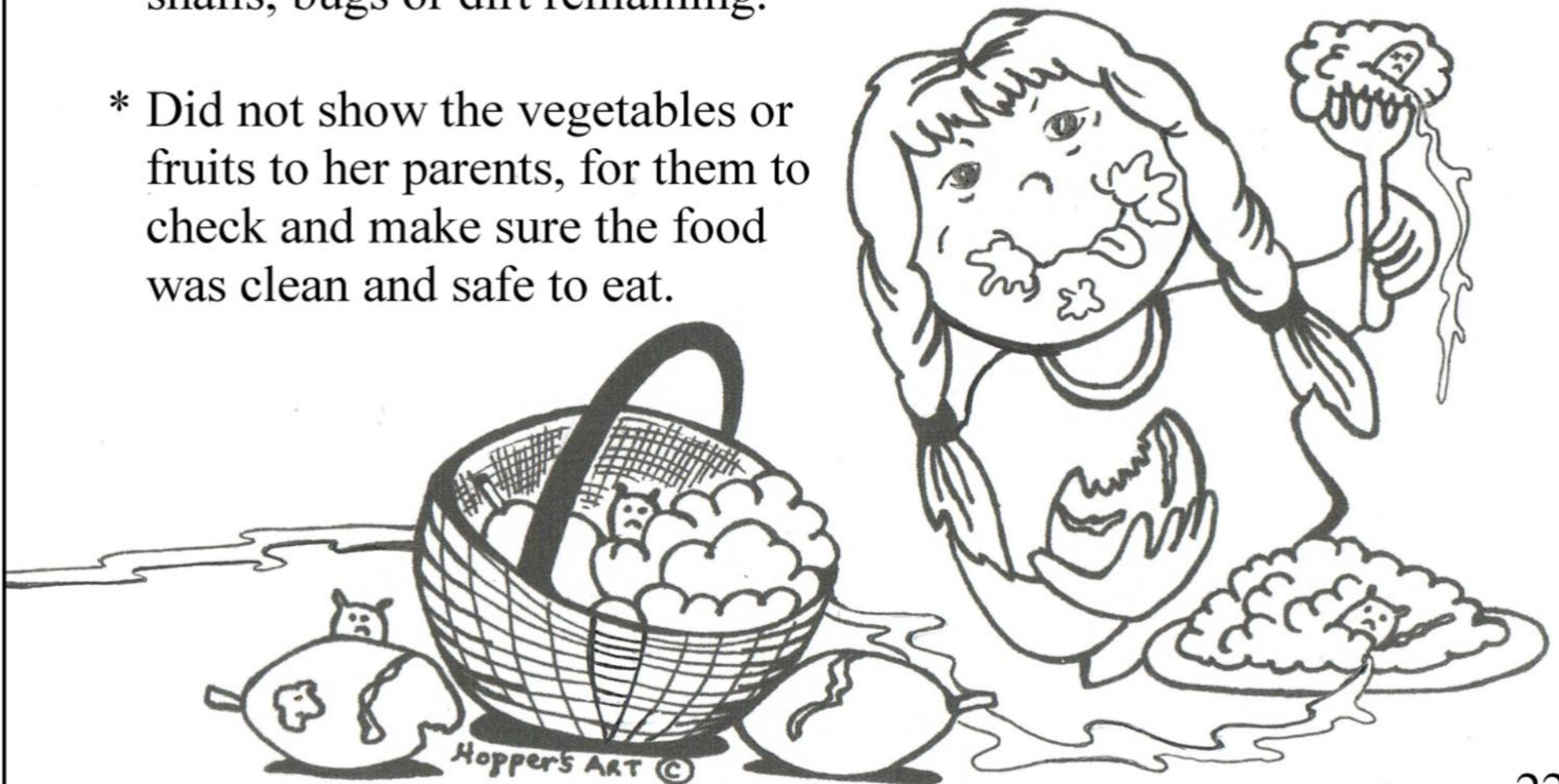
Find the difference.

Kaleo and Emma:

- * Threw away any chewed leaves or fruits and washed their vegetables and fruits very carefully.
- * Washed each and every piece of lettuce and fruit individually.
- * Looked carefully at each piece to make sure there were no slugs, snails, bugs or dirt remaining.
- * Showed the washed fruits and vegetables to their parents or to another adult to check and make sure the children had done a good job of cleaning their food.

Lani:

- * Did not wash her food at all. She ate the vegetables directly from the garden and the fruit from the ground.
- * Did not look carefully to make sure there were no slugs, snails, bugs or dirt remaining.
- * Did not show the vegetables or fruits to her parents, for them to check and make sure the food was clean and safe to eat.



The mystery is solved!

A few days after eating their clean, delicious vegetables and fruit, Kaleo and Emma feel happy and healthy. Lani feels so sick because she did not wash and check her vegetables and fruits. Now, the little rat lungworm parasites are living inside of Lani! Yuck! After a long time, when Lani is able to leave the hospital, she will be sure to wash before she eats!



**EATING CLEAN FRUITS AND
VEGETABLES IS GOOD FOR YOU.
MAKE SURE TO CAREFULLY CLEAN AND
CHECK ALL FRUITS AND
VEGETABLES BEFORE YOU EAT THEM.
ACCIDENTLY EATING RAT LUNGWORM
LARVAE ON UNCOOKED FOOD CAN GIVE YOU
RAT LUNGWORM DISEASE!**

Things we can do to be healthy:

- * **Carefully clean and check fruits and vegetables before eating them.**



- * **Bring in pet food and water dishes at night.**

Animals can get rat lungworm too. A slug or snail might crawl into the dish and be eaten by your pet.



- * **Clean up litter, such as old plastic flowerpots.**

Slugs and snails like to hide inside and underneath plastic.



- * **Clean up fallen fruits and vegetables.**

Rats and slugs love to eat them.

- * **Educate family and friends:**

Teach them what you've learned and spread the news.



- * **Slug and rat control.**

Reducing host numbers helps our families & pets to stay healthy.

- * **Stay away.**

Don't touch slugs and snails.



I've Been Juggling All The Slu-ugs!

(to the tune of "I 've Been Working on the Railroad")

I've been juggling all the slu - ugs,

All the live-long day!

I've been juggling all the slu-ugs,

Just to pass the time a-way!

**Don'tcha see them in there dying,
Drowning in the brine? (*That's saltwater!*)**

No rat lungworm in my gar-den

Vic-tor-y is mine!

Slime-o won'tcha go?

Slime-o won'tcha go?

Slime-o won'tcha go - oh, oh, oh, oh?

Slime-o won'tcha go?

Slime-o won'tcha go?

Slime-o won'tcha go away?

Pooper's in the garden with Slime-o,

Pooper's in the garden I know-o-o-o

Pooper's in the garden hunt'n Slime-o

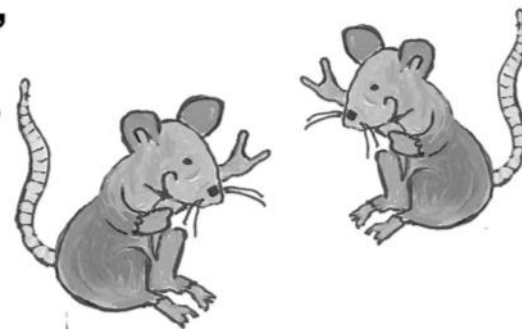
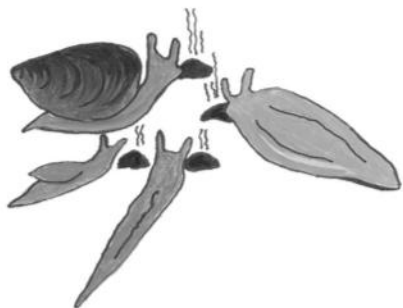
Pooper'll eat Slime-o, I know!

Fi, fi, fiddly-i-o

Fi, fi fiddly-i-o-o-o-o

Poop-er's gon-na eat Slime-o

Munching juicy slugs: oh no!



Glossary

Hypothesis: A good guess to explain an observation, phenomenon, or scientific problem. The guess can be tested by further investigation.

Habitat: The area or environment where an organism or ecological community normally lives or occurs.

Ecosystem: An ecological community together with its environment, functioning as a unit.

Decomposer: An organism that feeds on and breaks down dead plant or animal matter, so making organic nutrients available to the ecosystem.

Parasite: An organism that grows, feeds, and is sheltered on or in a different organism while stealing nutrients from its host.

Extinct: No longer existing or living.

Endangered: A species present in such small numbers that it is at risk of extinction.

Life cycle: The course of developmental changes through which an organism passes from its birth to the mature state in which it is able to reproduce.

Host: The animal or plant on which or in which a parasite lives.

Feces: The solid waste that is left after food is digested. Feces form in the intestines and pass out of the body through the anus.

Native: An animal or plant that originated in a particular place or region.

Species: A closely related group of living organisms, for example: dogs, cats, rats, or banana trees.



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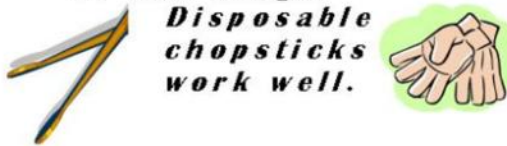
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Larvae from squashed slugs can infect other worms and slugs. Dispose of slugs properly.

1. Never pick them up with your hands, always wear gloves or use tongs.



Disposable chopsticks work well.

2. Prepare a 'slug-jug' with a 15% salt solution: *1 1/8 cups sea or rock salt in 1/2 gallon water*



3. When you find slugs, place them in the slug-jug for at least 24 hours.

As the slugs drown larvae will escape. They can live in a wet environment for a long time, but the salt will kill them.



I'M A CERTIFIED SLUG JUGGER !

THIS CERTIFICATE IS AWARDED TO

I HAVE LEARNED ABOUT RAT LUNGWORM DISEASE AND I KNOW HOW TO BEST STAY HEALTHY.

