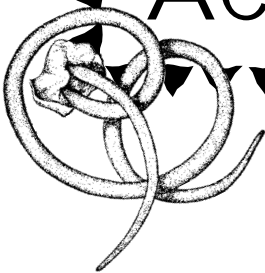


PARASITE SLEUTH



ACTIVITY BOOK



Parasite Sleuth Activity Book

.....

This book features five hands-on activities designed for 8- to 12-year-olds. Each activity includes one 30- to 45-minute project and extensions. Activities can be used in any order. Also included are objectives and learning outcomes, assessment questions, ideas for a presentation or exhibit and topics for further investigation. Wonderwise learning outcomes are based on national science education standards identified by McREL (Mid-continent Research for Education and Learning), the Nebraska Educational Standards, and the National Science Education Standards developed under the direction of the National Research Council. This book incorporates concepts of inquiry-based learning and the 4-H Youth Development experiential learning model.

Each youth participant should receive a copy of the activities. Copies of this book can be downloaded from the Parasite Sleuth CD-ROM.

WONDERWISE Women in Science Learning Series

Wonderwise introduces you to women who have made science their career. Each kit is a comprehensive instructional package that includes a video, CD-ROM, and activity book. With these materials, leaders and youth explore the world of women scientists and discover together the fun of learning about science. For more information about Wonderwise, including free samples, Web activities, resources, science education standards and ordering information, visit our Web site:

wonderwise.unl.edu



Project Director: Judy Diamond. **Developers:** Suzanne M. Gardner, Monica Norby, Linda Allison. **Design/Illustration:** Michael Davis, Linda Allison. **Produced by:** University of Nebraska State Museum, Gary Heusel and the Nebraska Cooperative Extension 4-H Youth Programs. Thanks to Judy Sakanari, William S. Wells, Beth Schenker, Amy N. Spiegel, Mary Knudson, Scott L. Gardner, Mark St. John, Roger Bruning, Marian Langan, Dana Esbensen, Rosemary Thornton, Edith Meints, Sarah Disbrow, Kathy French, Janet Fox. Permission from Suzanne Weber and Linda Meisel for the use of their "Construct-a-Gut" activity from Science and Children (1987) Volume 25(2), pages 27-29.



Funded by: Howard Hughes Medical Institute and the Informal Science Education Program of the National Science Foundation

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Watch a video about parasitologist Judy Sakanari, and then create a classification system for parasites.

Learning Outcomes: Youth develop an understanding of the work of a scientist and of systems, order, and organization.

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Observe, create and dissect a model Ascaris worm.

Learning Outcomes: Youth develop an understanding of the characteristics of living things and the ability to select appropriate tools.

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Observe and draw a tick and a flea, and then examine a pet for these ectoparasites.

Learning Outcomes: Youth develop an understanding of evidence, models, explanation and scientific inquiry, and the ability to use simple tools to gather scientific data.

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Solve four mystery diseases by finding the problem parasite.

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Place the developmental stages of a beef tapeworm in a life-sized human gut.

Learning Outcomes: Youth develop an understanding of life cycles, structure and function in living systems, and of personal health.

PULLING IT ALL TOGETHER 47

Create a story about a scientist who works with parasites.

Learning Outcomes: Youth draw on what they have learned in the activities to construct their own understanding of what it means to be a scientist.

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Here are some ideas you might like to use for projects or exhibits.

Learning Outcomes: Youth develop an understanding of science and technology in society and of science as a human endeavor.

INFORMATION FOR LEADERS

What You Will Need for Each Activity

Listed below are the materials and preparations you will need for each activity. Most of the materials can be purchased locally. The more difficult-to-find items, such as flea combs and pipets, can be purchased from Wonderwise. The symbol ☉ indicates that an item can be ordered from the Wonderwise Web site or GPN, the Wonderwise distributor. To purchase supplies, kits, videos, or CD-ROMs contact:

GPN (Great Plains National)
P.O. Box 80669 ▪ Lincoln, NE ▪ 68501-0669
Phone: 1-800-228-4630 ▪ FAX: 1-800-306-2330
e-mail: gpn@unl.edu ▪ Web site: gpn.unl.edu

Activity 1 Classy Parasites	Activity 2 A Model Parasites	Activity 3 Pet Parasite Detective	Activity 4 Parasite Sleuth	Activity 5 Traveling Tapeworm
<p>For the entire group: ☉ 15 min. video <i>Judy Sakanari, Parasite Sleuth</i></p> <p>For each team of 2:</p> <ul style="list-style-type: none"> glue scissors 1 cup of objects like buttons, nuts, leaves, seeds, seashells or Pattern Blocks 	<p>For each person:</p> <ul style="list-style-type: none"> a handful of clay (non-hardening modeling clay or Play Dough) 1 dissecting needle or plastic knife scissors string in one color, and thread in another tape toothpicks cardboard or stiff paper sheet, at least 9 x 12 inches plastic bag to store clay centimeter ruler 	<p>For the entire group: ☉ 4 plastic flea combs ☉ 1 plastic pipet or dropper ☉ Vials of fleas and ticks</p> <ul style="list-style-type: none"> tape 2 small jar lids (see instructions below) rubbing alcohol adult volunteer with pet dog or cat on a leash and an old blanket or towel <p>For each team of 4: ☉ 2 magnifying lenses</p> <ul style="list-style-type: none"> centimeter ruler <p><i>A single-sided copy of p. 22 of this book sent to adult volunteer ahead of time.</i></p> <p>To prepare jar lids: <i>Use tape to label one lid "flea" and one "tick."</i> <i>Place one flea in the appropriate lid, and one tick in its lid.</i> <i>Use the pipet to cover them with alcohol.</i></p>	<p>For each team of 4:</p> <ul style="list-style-type: none"> glue 1 pair of scissors per person 1 light-colored marker or highlighter per person 	<p>For the entire group:</p> <ul style="list-style-type: none"> stapler (1-2 for teams to share) <p>For each team of 4:</p> <ul style="list-style-type: none"> 1 large poster board blue and red pencils or crayons 1 large plastic bag meter stick 1 pair of scissors per person glue or glue stick tape <p><i>1 copy of the Mouth and Esophagus (p.36) on white paper.</i> <i>1 copy of the Stomach (p.37) on pink paper.</i> <i>6 copies of the Small Intestine (p.38) on pink paper.</i> <i>2 copies of the Large Intestine (p.39) on pink paper.</i></p>

CLASSY PARASITES

ACTIVITY
ONE

Watch the 15-minute video on Judy Sakanari, a parasitologist working in San Francisco. Then, learn about classification by trying it out yourself.



Before You Begin

Teams of 2

Length:
Part I - 45 mins.,
including 15 min. video
Part II - 30-60 mins.

What You Need

For the entire group:

© 15 min. video
Judy Sakanari, Parasite Sleuth

For each team of 2:

- glue
- scissors
- 1 cup of objects like buttons, nuts, leaves, seeds, seashells or Pattern Blocks

What We Know. Scientists have estimated that there are more than 50 million different species of plants and animals living on the Earth today. You may wonder how scientists keep track of this amazing variety of living things. They use a system called scientific classification. This system was developed almost 300 years ago by a Swedish naturalist named Carolus Linnaeus.

Classification is a method of organizing things by groups in an orderly and logical way. In science, this involves comparing and grouping things that share common physical characteristics. For example, we can divide the entire animal kingdom into two huge groups. Animals **WITH** backbones are called vertebrates, and animals **WITHOUT** backbones are called invertebrates.

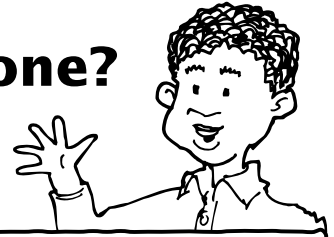
These groups can be further divided. The vertebrates include animals like mammals, birds, reptiles, amphibians, and fish. The invertebrates include animals like sand dollars, insects, clams, worms, corals, and sponges.

People who study parasites classify them into two broad groups: parasites that live inside their host and parasites that live outside. Parasites living inside their host are called endoparasites. Endoparasites are divided into two large groups: protozoans (microscopic, single-celled animals) and worms (roundworms, flatworms, thorny-headed worms, and tapeworms). Parasites that live outside their host are called ectoparasites. Ectoparasites are divided into several large groups: mites, ticks, mosquitoes, and flies.

CLASSY PARASITES

ACTIVITY
ONE

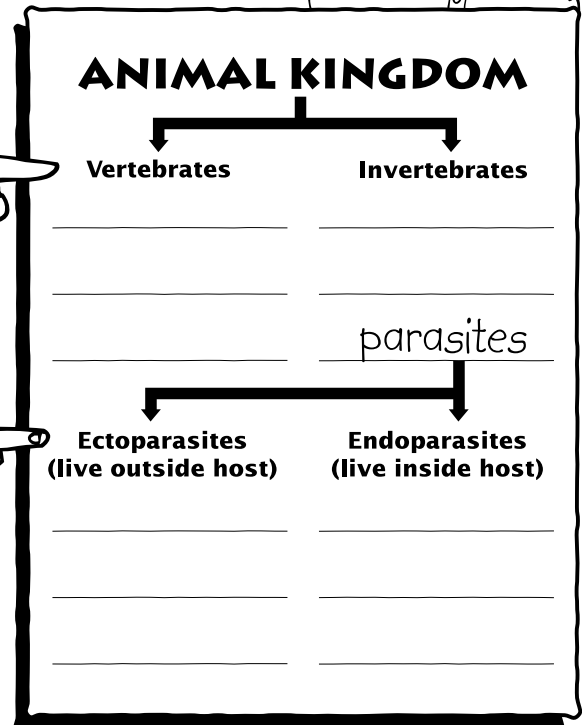
Part One: How Is Classification Done?



1 Watch the video of Judy Sakanari. Then use the information on page 2 to help you complete the classification chart.

2 Under the heading Vertebrates on the chart, list three examples. Under the heading Invertebrates, list two examples other than parasites.

3 Under the heading Parasite on the chart, list three ectoparasites (those that live outside the host) and three endoparasites (those that live inside).



4 Now you be the scientist. Get a handful of objects from your leader. In the next three minutes, work with a partner to group or organize the objects according to characteristics, like shape and size, that they have in common. Make as many groups as you can. Record how you group them in the space below:



Good Job! This is an example of how a scientist uses classification.

CLASSY PARASITES

ACTIVITY
ONE

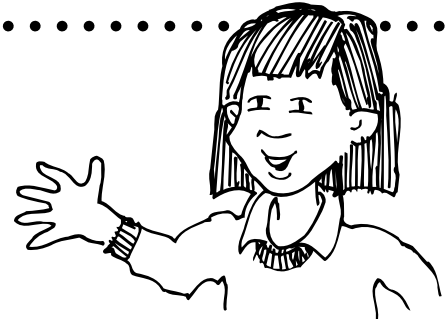
Think It Over

How did classification help you think about objects?

CLASSY PARASITES

ACTIVITY
ONE

Part Two: Parasite Look-alikes

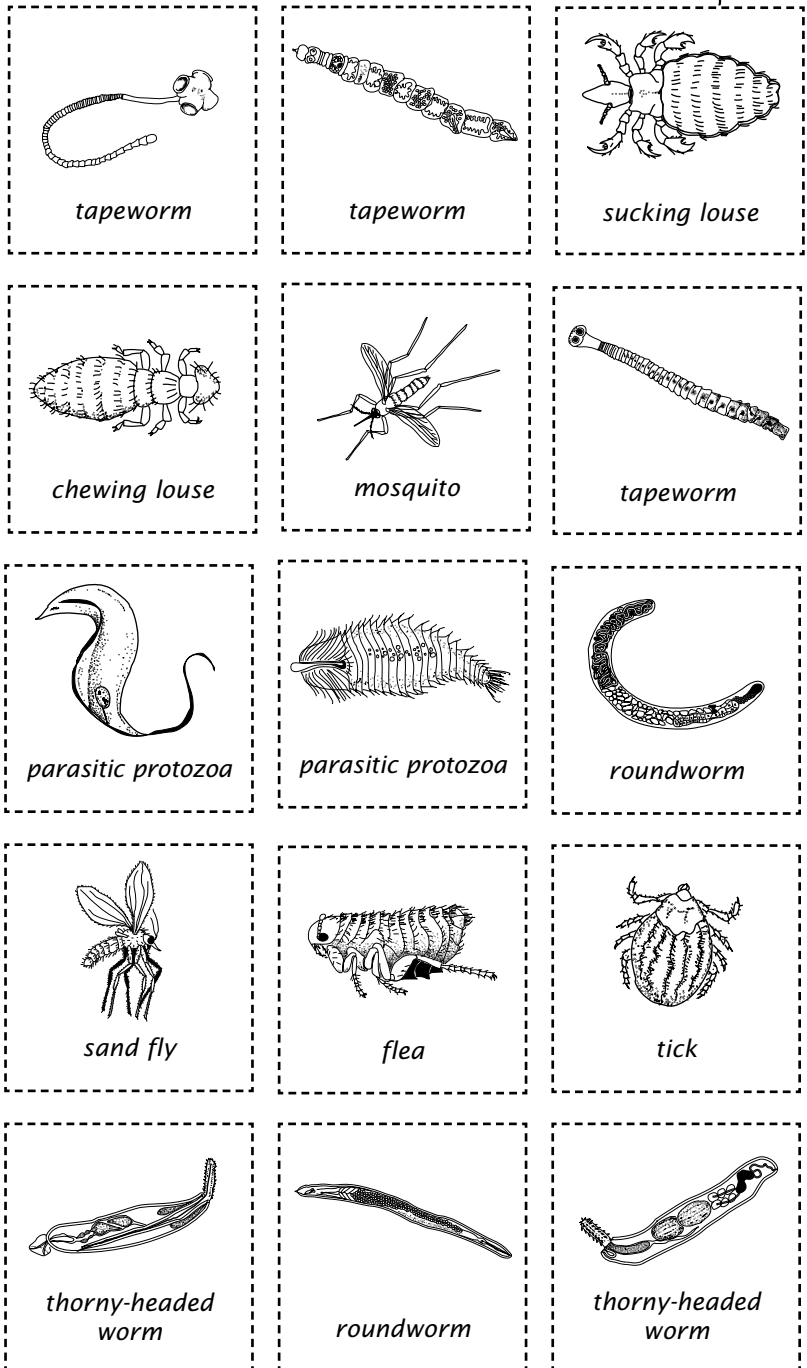


Imagine you were faced with the task of classifying all the animals in the world. Where would you begin? One thing you would want to do is to form groups of animals that look alike. For example, you could put all the animals that have wings into one group and all the animals that are the same shape in another group. You could put all the animals with the same number of legs into yet another group. No matter how you did it, each animal would eventually fall into one of your groups unless it was completely different from all the rest.

Follow these directions to classify the parasites pictured to the right:

- 1 Cut out the parasite pictures and lay them upright on your table.
- 2 Begin sorting them into groups by similar characteristics. Make as many groups as you can.
- 3 Glue each group onto the next page. Give each group a name and a number. Some examples of groups might be:

Group A: Parasites with wings
Group B: Parasites with multiple body parts



CLASSY PARASITES

ACTIVITY
ONE

Parasite Classification Table

GROUP NAME	GROUP NUMBER	PARASITE PICTURES <i>Glue parasite pictures here. Record a reason for grouping them the way you did.</i>

CLASSY PARASITES

ACTIVITY
ONE

Part Two: Parasite Look-alikes (cont'd)

4 How many different groups of parasites did you form?

5 Judy Sakanari uses characteristics like the ones listed in the table below to classify parasites. Place a check mark next to any characteristics you used when you grouped the parasite pictures.



CHARACTERISTICS	CHECK MARK
Parasite sucks blood	
Parasite lives inside the host (endoparasite)	
Parasite lives outside the host (ectoparasite)	
Parasite has legs	
Parasite has no legs	
Parasite has one body section only	
Parasite has more than one body section	
Parasite is a one-celled animal	
Parasite has more than one cell	

6 Look at **one** of the parasite groups you formed. What characteristics do only some of the parasites in the group share? Break this group into two subgroups.

CLASSY PARASITES

ACTIVITY
ONE

Think It Over

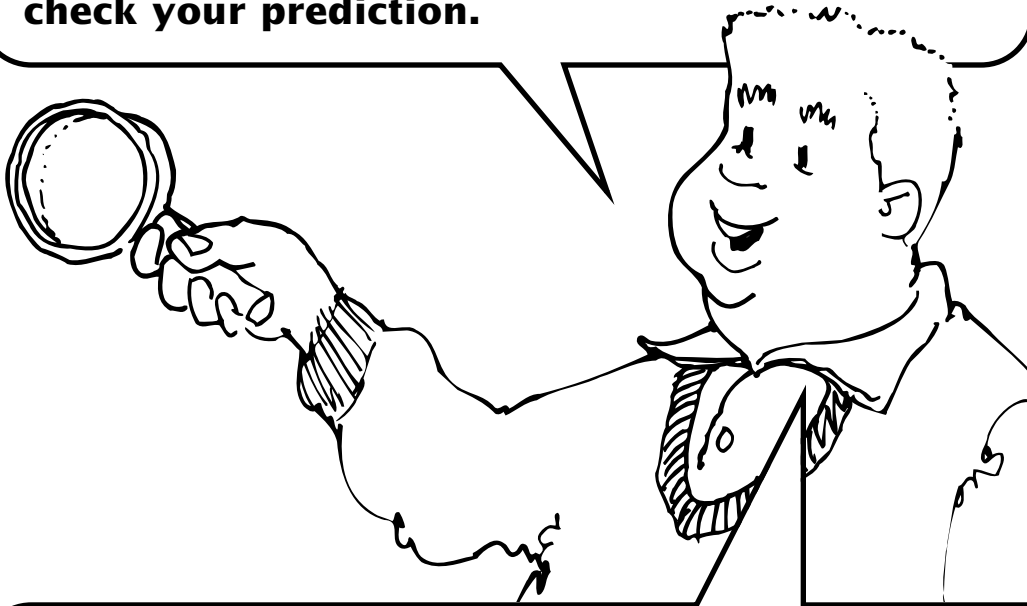


How does classification help us learn more
about animals?

A MODEL PARASITE

ACTIVITY
TWO

Investigate the ascaris worm by making a clay model. Swap worms with another person and predict if the worm is male or female. Then dissect the worm and observe its organs to check your prediction.



Before You Begin

Work as individuals

Length:
Part I - 60 mins.
Part II - 30 mins.

What You Need

For each person:

- a handful of clay (non-hardening modeling clay or Play-Dough)
- dissecting needle or plastic knife
- scissors
- string in one color and thread in another
- tape
- toothpicks
- cardboard or stiff paper sheet, at least 9 x 12 inches.
- plastic bag to store clay
- centimeter ruler

What We Know. Have you ever considered the fact that some animals call another animal's body home? Some animals go so far as to live inside another animal. These kinds of creatures are called parasites. Just as we humans depend on the Earth for food, water, and space to live, parasites take everything they require from their animal hosts.

Parasites are very common. Scientists who study parasites say that there are far more kinds of parasites than other kinds of animals in the world. Each species of animal (such as dogs or cats) can have many parasites that live on or inside their bodies.

Animals do not try to get a parasite on purpose. Any organism, including a plant, can become infected with several different parasites during

its lifetime. Even parasites have other parasites living on or inside them! Ticks, fleas and mites are examples of parasites that live on the outside of an animal. Tape worms and nematodes are examples of parasites that can live inside an animal.

You might wonder if humans get parasites. Yes we can. More than 100 different parasites can call a human home. A common human parasite is a big, whitish worm called ascaris. The eggs of ascaris worms can be found in soil or water that is contaminated with human feces. Humans can become infected if ascaris eggs are swallowed. Kids, especially young ones, who accidentally eat dirt or place dirty fingers or toys into their mouths are the most likely to become infected. That's enough to make anyone squirm!

A MODEL PARASITE

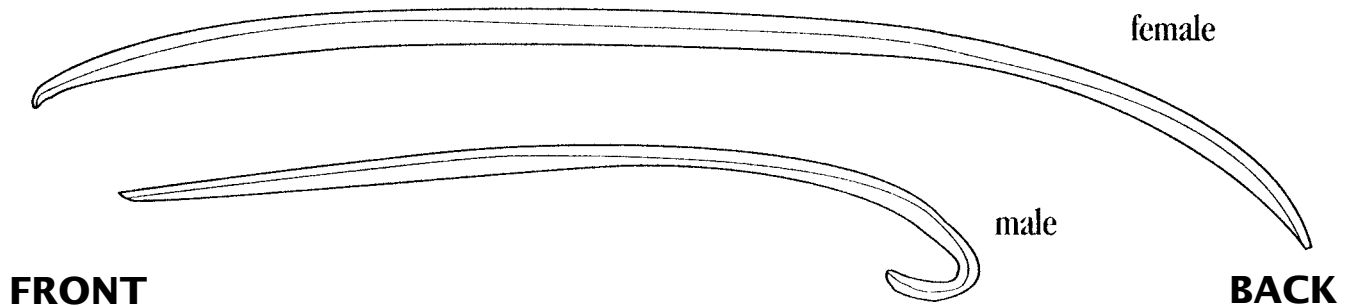
ACTIVITY
TWO

Part One: Make the Worm

Male or Female?

In this part you will compare male and female worms, then build either a male or female ascaris worm model.

- 1 Compare the two drawings of ascaris worms.



- 2 What differences do you notice between the worms?

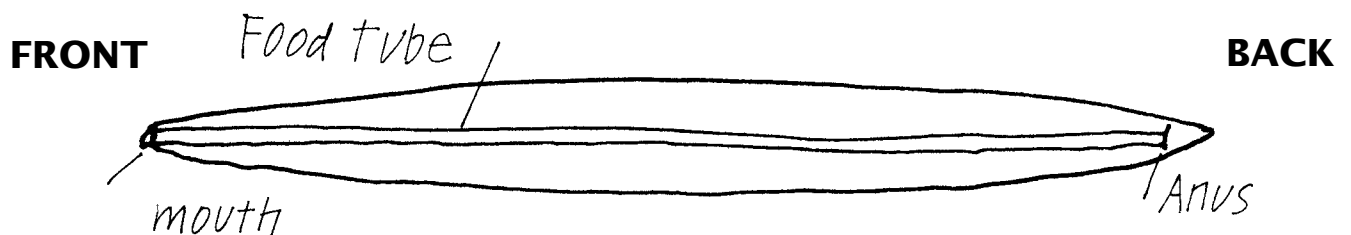
A MODEL PARASITE

ACTIVITY
TWO

Part One: Make the Worm (cont'd)

Worm Works

- 1 Gather the materials you will need. Working on a sheet of cardboard or stiff paper, label the left side "front" and the right side "back."
- 2 Get a handful of light-colored clay for the body wall of your worm. Form the clay into a roll about 1 cm wide. The length of your roll will depend on the sex of your worm. Decide if you are going to make a male or female worm. If you are making a male, stretch the skin so it is 20 to 30 centimeters long. If you are making a female, stretch the skin so it is 35 to 40 centimeters long.
- 3 Slice the worm in half lengthwise and open it up. Next make the food tube by cutting a piece of string that reaches the length of the worm. The food tube starts at the mouth at the front end of the worm and ends at an opening at the back. This opening is called the anus. Make the anus before you lay the food tube inside the worm.
- 4 Make the anus at the back end of the worm by cutting a slit with the tip of the pencil in the body about half a centimeter from the end. Fit the end of the food tube in the slit. Stretch the food tube along the inside of the worm until it reaches the mouth.

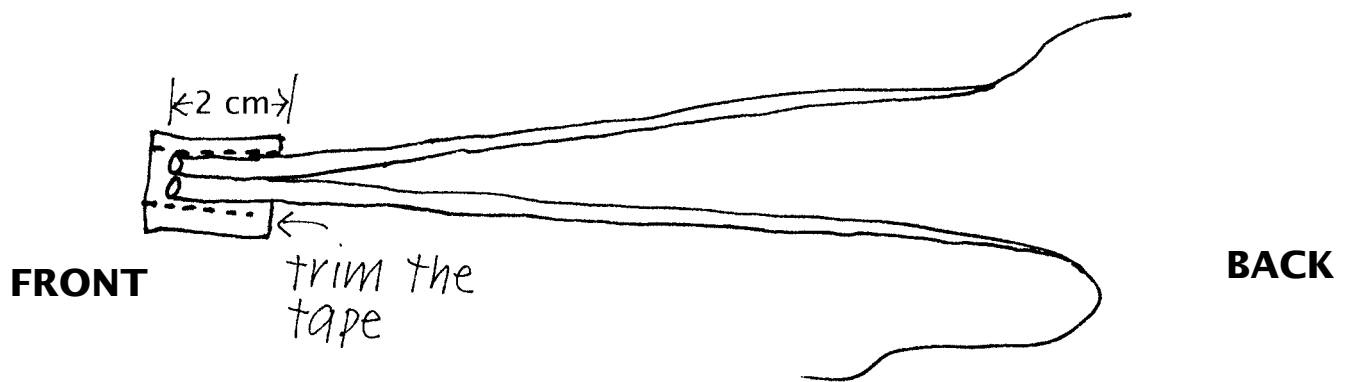


A MODEL PARASITE

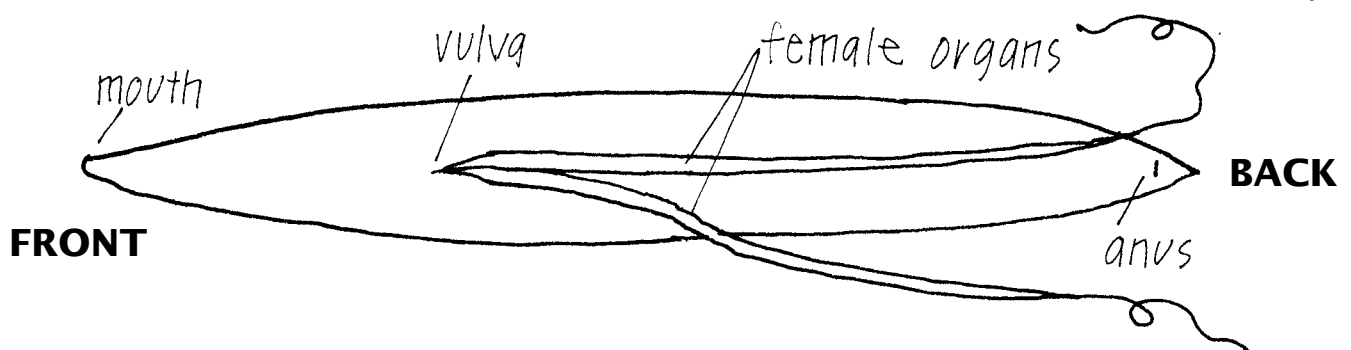
ACTIVITY
TWO

Part One: Make the Worm (cont'd)

5 Male and female worms have reproductive organs that look similar. To make these organs, cut a length of colored thread about one and a half times the length of the worm. Cut another to match. Attach two ends side by side with a 2 cm strip of tape, fold the tape, and trim it. If you are making a female worm, go to 6. If you are making a male worm, go to 7.



6 To make a female worm, make a slit (vulva) about a third of the body length from the mouth end. Insert the joined ends of the reproductive organs into this slit. Stretch the "organs" out, inside the body, wrapping the loose ends around themselves to fit inside.

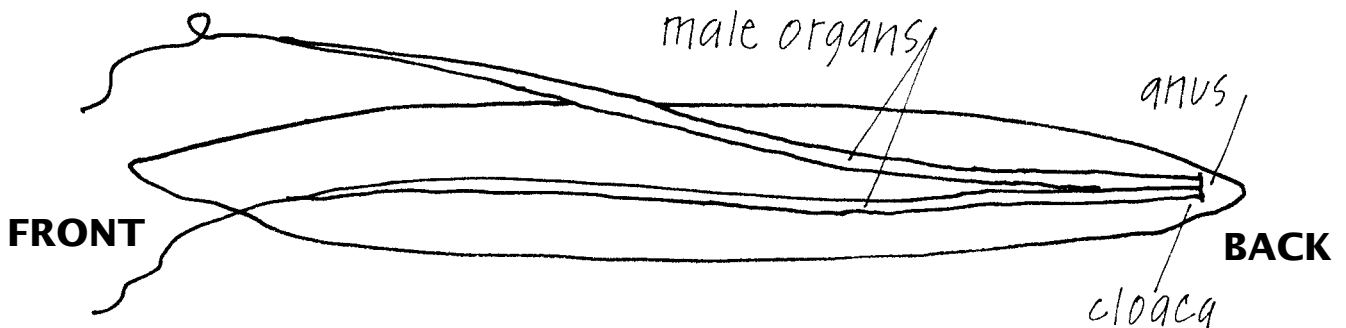


A MODEL PARASITE

ACTIVITY
TWO

Part One: Make the Worm (cont'd)

7 To make a male worm, attach the male organs at the rear end of the body. The joined ends of the male reproductive organ attach at the anus. In the male this joined area is called the cloaca (klo-A-ka). Stretch the reproductive organs out inside the body, wrapping the loose ends around themselves to fit inside.



8 To finish the worm, close the body by pinching the edges together.

9 Create worm lips by making three indents with the tip of a pencil at the mouth end.

10 If your worm is a female, stretch it out again so it is long. If it is a male, bend a small crook in the tail at the rear end (like the worm drawings on p.10). Label the board under the worm front end (mouth) and back end (anus).



Excellent job! Your ascaris is complete.

A MODEL PARASITE

ACTIVITY
TWO

Think It Over

1. Based on the organs you found inside the worm, what can this worm body do?

Check the boxes.

- | | | | |
|---|--------------------------------|------------------------------|------------------------------------|
| <input type="checkbox"/> smell | <input type="checkbox"/> hear | <input type="checkbox"/> eat | <input type="checkbox"/> reproduce |
| <input type="checkbox"/> eliminate wastes | <input type="checkbox"/> think | <input type="checkbox"/> see | |

2. Compared to a human body, what functions are missing?

Part Two: Dissecting Ascaris

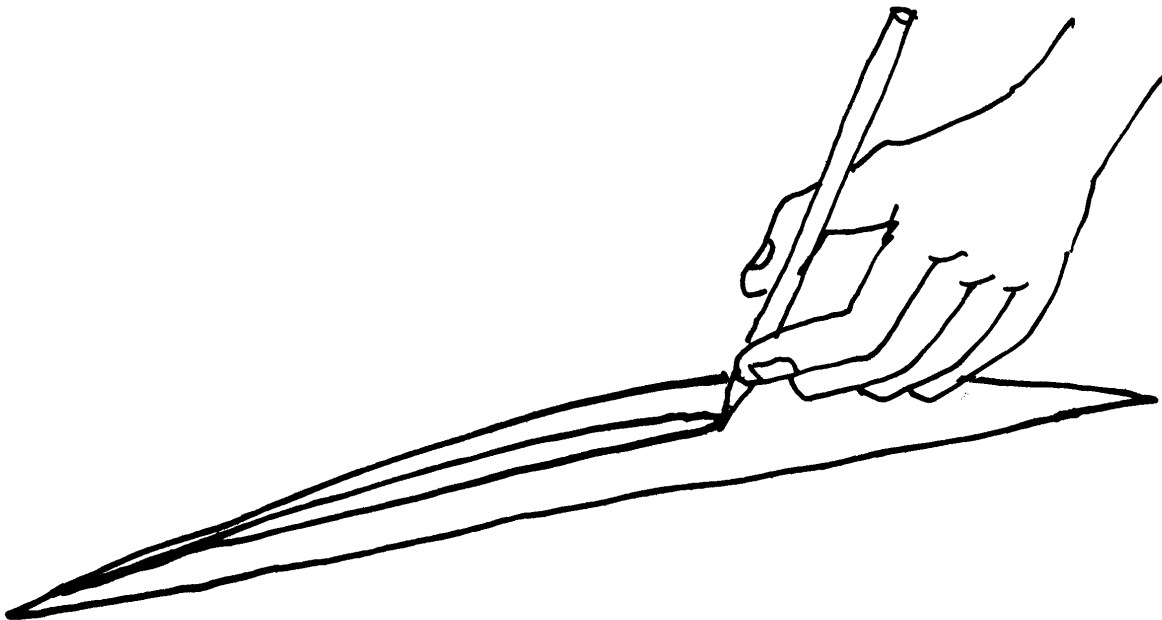
In this part you will predict the sex of an ascaris by observing its surface. Then you will cut it open, label its parts, and verify your prediction.

- 1 Swap your worm model (keeping it on the cardboard base) with another person.
- 2 Place the cardboard base so the front is on your left and the back is on your right. Observe this new worm. Look at the body and predict whether it is a male or female. Explain why you think so.

Predict:

Explain:

- 3 Dissect the worm by carefully cutting along the length of the body with the tip of the knife. Be careful to cut through the skin, but not into the organs.



A MODEL PARASITE

ACTIVITY
TWO

Part Two: Dissecting Ascaris (cont'd)

4 Pull the skin apart to look inside.

Do you see female reproductive organs attached at the body toward the front end of the worm?

___yes ___no

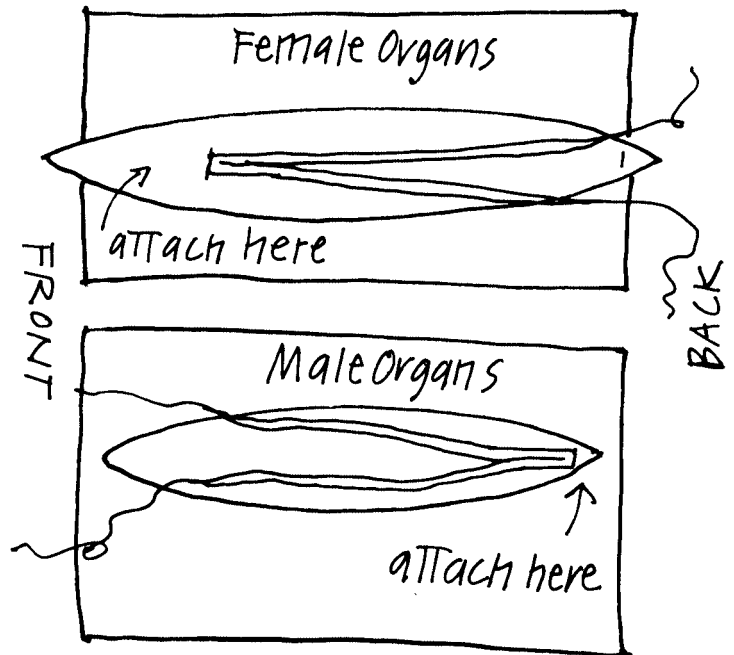
or

Do you find male reproductive organs attached to the body at the rear end?

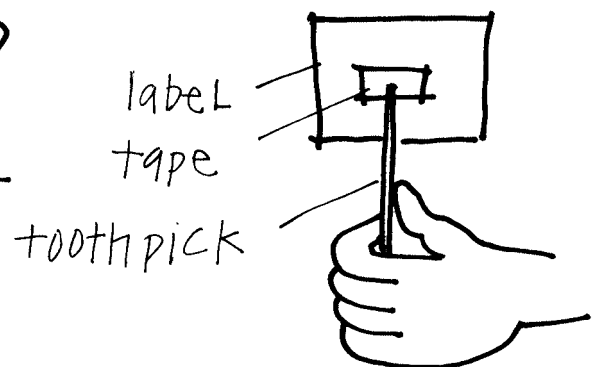
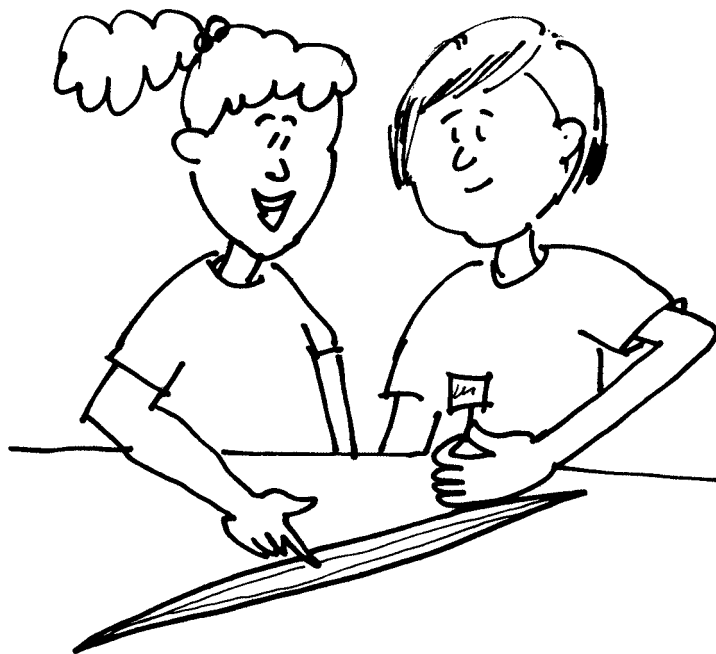
___yes ___no

5 Was your sex prediction correct?

___yes ___no



6 To label the parts of your worm, first cut out the labels on p.17. Tape each label to a toothpick and then stick it into the correct part.



A MODEL PARASITE

ACTIVITY
TWO

Part Two: Dissecting Ascaris (cont'd)

Labels

Mouth

Sucking lips
for feeding on
digested
sugars and
proteins in the
human gut

Gut

The food canal
or digestive
system

Anus

The rear
opening of
food canal
where waste
products leave
the body

Vulva

Entryway to
the female
reproductive
tract

Cloaca

Entryway to
the male
reproductive
tract

Body Wall

Ascaris worms
have no bones,
but they do have
strong muscles
that run the
length of the
body wall.

A MODEL PARASITE

ACTIVITY
TWO

Think It Over

What can you do to avoid becoming
infected with *Ascaris*?

PET PARASITE DETECTIVE

ACTIVITY
THREE

Learn what to look for to keep your pet healthy and ectoparasite-free. Make careful observations and drawings of a tick and a flea.



What We Know. There are practically as many pet owners in the world today as there are people. That is because pets give people companionship, entertainment and love. Dogs and cats make especially good pets because they are social animals and like to be with others.

People talk to their pets, but pets cannot talk back. Your pet cannot say, "Gosh, I don't feel well today." So pet owners like yourself need to watch for signs of illness. These signs can include a sudden lack of energy or loss of appetite, coughing, fever, or even diarrhea. Check your pet for patches of dry skin or itchy, irritated ears. If you notice any of the above symptoms, call your veterinarian and find out what you can do.

Many pet illnesses are caused by parasites. Your pet may have an endoparasite, such as a worm, living in its gut, or an ectoparasite, such as a flea or tick, living on its

skin. Ectoparasites are fairly easy to see. But if your pet has endoparasites, you may not be able to tell. This is why it is so important to look for the symptoms.

You can keep your pet from getting parasites if you think ahead. To avoid endoparasites like heartworms, check with your veterinarian. To avoid ectoparasites like fleas, you should vacuum and wash your pet's sleeping area often. Many pets come into contact with ticks when they are in areas of tall grass and bushes. Ticks crawl up on these kinds of plants and wait for large animals, such as dogs, foxes, deer or humans to pass by. Check yourself and your pet very carefully after visiting such an area. There may be a hitchhiker attached to you! Knowing what to look for and taking the time to check your pet are all part of keeping your animal healthy and happy.

Before You Begin

Teams of 4

Length of activities:

Part I - 30 mins.

Part II - 30 mins.

Part III - 30 mins.

Teams can rotate through Parts I and II, while other teams work on Part III.

What You Need

For the entire group:

⊙ 4 plastic flea combs

⊙ 1 plastic pipet or dropper

⊙ Vials of fleas and ticks

▪ tape

▪ 2 small jar lids (see instructions below)

▪ rubbing alcohol

▪ Adult volunteer with pet dog or cat on a leash and an old blanket or towel

For each team of 4:

⊙ 2 magnifying lenses

▪ centimeter ruler

A single-sided copy of p. 22 of this book sent to adult volunteer ahead of time.

To prepare jar lids:

Use tape to label one lid "flea" and one "tick."

Place one flea in the appropriate lid and one tick in its lid.

Use the pipet to cover them with alcohol.

PET PARASITE DETECTIVE

ACTIVITY
THREE

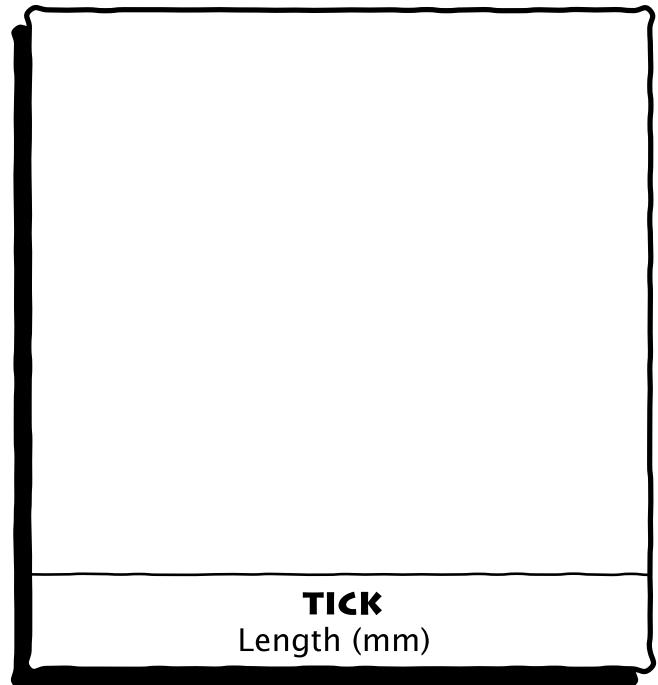
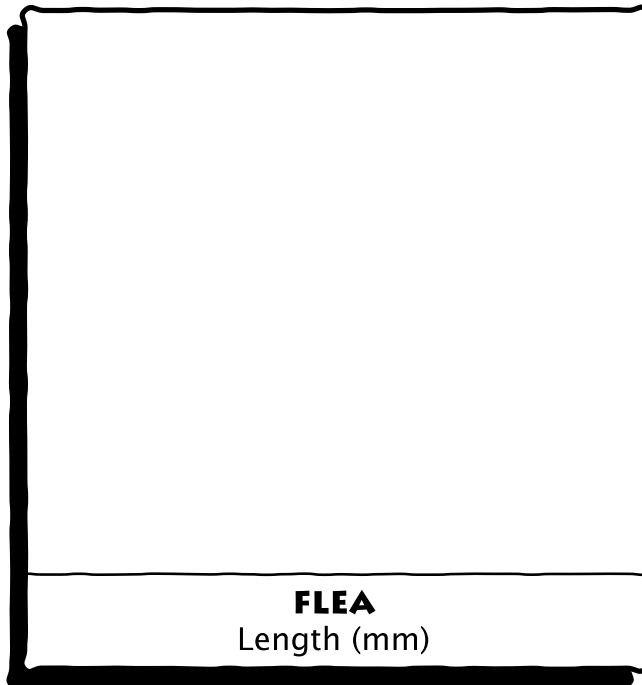
Part One: Flea and Tick Up Close

1 Gather the following materials for your team of 4 kids: 1 tick and 1 flea in separate jar lids with alcohol, 2 magnifying lenses.

2 Use a magnifying lens to closely observe the flea and tick. Look for the head and body parts such as mouth, eyes, and legs.

3 Draw an enlarged picture of each animal parasite below. Include and label as many body parts as you can.

4 Use a centimeter ruler to measure the tick and flea. Record the total length in millimeters.



5 Count the legs on the tick. Is it an insect or an arachnid?
(Hint: Arachnids, such as spiders, have 8 legs.)

PET PARASITE DETECTIVE

ACTIVITY
THREE

Think It Over



Part Two: In Search of Ticks and Fleas

Work in teams of four to examine a guest pet for ticks and fleas. What do you need to consider before you start?

- Make sure the Adult Volunteer has read the directions below.
- Be very careful not to hurt or scare the pet in any way—use soft voices and gentle touches.

When your team is called by the Adult Volunteer, use the chart on the next page to help you examine the pet and record your results. While your team waits to be called, discuss and answer the question in **Think It Over**, on the next page.



(Give one copy of this page to a Parent Volunteer a day ahead of time if possible.)

Directions for Parent Volunteer:

You will work with one team of four at a time. Each team will look for fleas and ticks on the pet's head, body and tail, and list them in the Pet Parasite Exam Table.

1. Obtain 4 flea combs from the leader.
2. Place the pet on a small rug or towel on the floor in an open space.
3. To begin each exam, you will need to show the team how to gently use the flea comb to comb the body parts listed in the table. Each time team members run the comb through the pet's hair, they should check the comb for black pepper-looking flakes (dried blood). If any flakes are found, it tells us the pet may have fleas. Do not confuse these flakes with dry skin, which looks like dandruff on the comb. After checking body parts listed in the table, the team should fill out the chart to show the results of the exam.
4. When you are ready, call the first team up with their activity books and pencils.

PET PARASITE DETECTIVE

ACTIVITY
THREE

Part Two: In Search of Ticks and Fleas (cont'd)

Pet Parasite Exam Table

PLACES TO LOOK	NO PARASITES FOUND (MAKE CHECK MARK)	YES, PARASITES FOUND (MAKE CHECK MARK)	IF YES, WHAT KIND?
Head/Neck/Ears			
Body (Back, Chest) Sides, Under Legs			
Along Tail			

Think It Over

Why is it important to keep your
pets parasite-free?

Part Three: Comic Parasites

Humans and other animals can easily become hosts to ticks and fleas. But how does this happen? Use a piece of blank paper or the squares below to make a drawing or comic strip showing how someone becomes the host to a family of fleas or ticks. Read the facts below before you begin drawing.

Facts about Ticks and Fleas

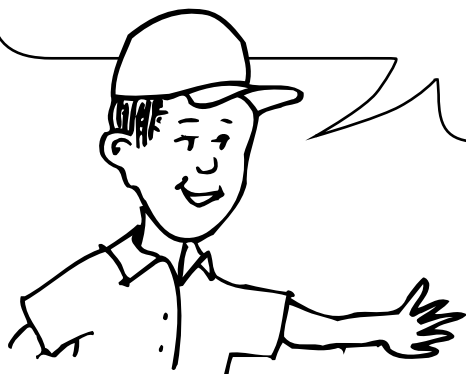
- Animals can get ticks and fleas from each other. The tick or flea actually jumps from one animal to another. Some fleas can jump up to 100 times their own length.
- Ticks and fleas are parasites that attach themselves to the outside of the skin and suck blood.

Facts about Fleas

- Fleas often lay their eggs in bedding or carpet when they are in the mature or adult stage. Then they hitch a ride on any warm or furry body.
- Animals can get fleas by visiting old dens or abandoned buildings once used by wild animals.
- You can prevent your pets from getting fleas by keeping their sleeping quarters clean.

Facts about Ticks

- Ticks hide in bushes and grassy areas. They will latch onto animals or people who pass by.
- If a tick becomes embedded in your skin, use a pair of tweezers to grasp the tick where it is attached. Pull the tick free. Look at the tick to be sure the mouth parts are present and not still in your skin. Wash the area with soap and water.
- You can prevent tick bites by wearing light-colored clothing, tucking your pant legs into your socks, and buttoning your sleeves and collar.



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PET PARASITE DETECTIVE

ACTIVITY
THREE

Think It Over

If you find a flea or tick on your pet, what should you do?

PARASITE SLEUTH

ACTIVITY
FOUR

In this activity you will work with your group to solve a parasite mystery. Discover which parasite caused the main character to become ill.



Before You Begin

Teams of 4

Length:
Part I - 45 mins.

What You Need

For each team of 4:

- glue
- 1 pair of scissors per person
- 1 light-colored marker or highlighter per person

What We Know. Think about the different places around the world where people live. No matter where you live, you can get a parasite. Whether or not you become infected with parasites depends on where you spend your time, what kind of work you do, what kinds of food you eat and how you prepare your food.

Where do parasites live? They live all over the world, from wet to cold to dry regions. But they cannot live alone. Parasites must have a host. A host is another living thing that the parasite either lives inside of or on. For example, ticks live on hosts such as

deer, rabbits and dogs. Parasitic worms live inside hosts such as fish, birds and mammals. Some parasitic worms even live in the roots of plants. By now you may be wondering if there is a place in the world where parasites do not live. There probably is not. As long as there are animals and plants in an environment to act as hosts, there will also be parasites.

Parasitologists are like detectives when they study parasites of humans and the diseases they cause. They search for clues to help them understand how people become infected by parasites.

Part One: Parasite Mysteries

Each team member reads one mystery carefully, using a light-colored marker to highlight clues. The clues should help determine which parasite caused the main character to become ill.



Ryan and Daniel's Mystery

At the end of the summer a little boy named Ryan went on a camping trip with his family to the Black Hills of South Dakota. As soon as they arrived, Ryan and his younger brother, Daniel, scouted out a fort they had built the summer before. They were disappointed to find that the grass around the area was well worn and the fort was in bad condition. By the way it looked, it would take some cleaning up!

Quickly the boys went back to the crowded campground where their parents were setting up camp, picked up their lunches and ran back to the fort. As they sat down to eat lunch, Daniel felt thirsty. They had forgotten to bring something to drink. "Hey," Daniel said, "I'll just get a drink out of the trout stream." The boys ate their lunch in their old fort and spent the rest of the day cleaning it up and building a new roof. During that trip to the mountains, the boys spent a lot of time fishing, lying around in the sun, and eating lunch in their fort.

Soon summer was over and the boys returned to school. Daniel began complaining of severe stomach aches and developed a bad case of diarrhea. He became so uncomfortable that he had to miss school. The boys' parents decided to take both of them to the doctor. The doctor listened carefully as Daniel and Ryan described their symptoms. She asked them questions about where they had gone over the summer and what they had been doing. She told the parents that she would need a feces sample from each boy. The next day Daniel's parents returned with the samples. The doctor examined the samples carefully with a microscope and found signs of parasites. She prescribed a medicine called Flagyl for both boys.

Think about where the boys had been and what they had done that summer. What might the boys have done to get a parasite? What is the parasite that could have caused them to get sick?

See Clue Cards on page 31.

**Who got
sick?**

**(Who is
the host?)**

**What
symptoms
did the
host have?**

**Where did
the story
take place?**

**How did
the person
get the
parasite and
become sick?**

**Parasite
Card**

Part One: Parasite Mysteries (cont'd)



Kelly's Mystery

Kelly was excited when she found out her parents were taking her and a special friend to San Francisco to go shopping for the day. They had wanted to go last week but decided today was even better, because it was Kelly's birthday. After a full day of shopping, they could celebrate together with a fancy restaurant dinner.

Immediately they began planning what they would wear and which stores they would visit. Both girls had saved up money from their babysitting jobs and were eager to buy some new clothes and a favorite CD. The parents were excited, too, and began discussing where they would take the birthday girl and her friend for dinner. They thought it would be fun to take the girls to a Japanese restaurant.

All day long they shopped and by the end of the day everyone was tired and ready to sit down for a nice dinner. It was 6 p.m. and the restaurant was already getting busy, but they were lucky and found a table overlooking the bay. They sat down and began to look at the menu. So many things on the menu were new to the girls. Who had ever heard of sushi or sashimi? Finally they decided to ask a waiter to describe these things. Kelly decided to order sushi. Her friend ordered grilled salmon. Everyone was happy when the dinners were served. Kelly liked the sushi even after the waiter told her it contained raw fish. She felt very grown-up, having tried something new for dinner.

The next evening, when Kelly was setting the table for dinner, she got a terrible stomachache. Her stomach hurt so badly she doubled over in pain. Her parents wondered if she had eaten something bad or had a case of the flu.

Over the next few hours, Kelly seemed to get worse. Her stomachache was not going away. Her parents decided to take her to the hospital emergency room. There, the doctor asked her questions about where she had been and what she had eaten in the last 24 hours. Kelly said she had eaten raw fish at a restaurant the evening before. The doctor diagnosed Kelly with a parasite infection.

Can you determine which parasite made Kelly sick?

See Clue Cards on page 31.

**Who got
sick?**

**(Who is
the host?)**

**What
symptoms
did the
host have?**

**Where did
the story
take place?**

**How did
the person
get the
parasite and
become sick?**

**Parasite
Card**

Part One: Parasite Mysteries (cont'd)



Eric's Mystery

It was 10 a.m. on Saturday and Eric was already bored. He flipped on the radio just in time to hear a commercial. It was from a local grocery store and announced a free Mediterranean cruise. Eric knew it was a long shot, but decided to go to the store and fill out an entry form. Maybe this would be his lucky day.

One week later, the manager of the store called Eric's home and congratulated Eric's family on winning the cruise. They were all very excited. There was only one problem. Eric's mother could not schedule time away from work to take the trip. After talking it over, they decided Eric and his father, Paul, would take the trip together.

Eric and Paul began planning the trip. They decided to combine the cruise with an overland hiking trip along the shores of the Mediterranean. They would depart from the ship at one port, take a public hiking trail east, spend the night, then meet the ship at the next coastal town. For this part of the trip, they would need backpacks, water, dry foods and good walking shoes. The big question was whether to take a tent. At the last minute, with their backpacks already stuffed full, they decided against it. They would sleep under the stars instead.

The first few days of the trip were very exciting and now it was time to hike the trail. Fortunately, the weather was warm. After hiking for a whole day, Eric and Paul ran low on fresh water, their feet were tired and they felt hungry. They decided to set up camp in an open, sandy area with a good view of the night sky.

Unfortunately, the area had many rodent holes. Eric took a stick and began poking in one to see if there was anyone home. As far as he could tell, the hole was abandoned. He used the stick to fill the holes with sand. He smoothed the area where they would be sleeping and set out their sleeping bags. That night Eric awoke to the sound of a fly buzzing around his head. Suddenly, he felt a stinging sensation around his mouth. He reached up to touch and rub the sore area. He felt a small insect but was unable to see what it was. Eric drifted back to sleep.

The next morning they broke camp and hiked to the next port to meet the ship. Only three days remained in the trip. Eric and his dad spent the time sightseeing and resting in the sun on the deck of the big cruise ship. After they returned home, Eric's parents noticed a big sore around Eric's mouth. They immediately took him to the hospital emergency room.

Can you determine what parasite bit Eric and caused his sore?

See Clue Cards on page 31.

**Who got
sick?**

**(Who is
the host?)**

**What
symptoms
did the
host have?**

**Where did
the story
take place?**

**How did
the person
get the
parasite and
become sick?**

**Parasite
Card**

Part One: Parasite Mysteries (cont'd)



Sara's Mystery

It was finally summer and another school year had come to an end. This would be a special summer for the Smith family from Nebraska. They would travel to Cairo, Egypt, located in northern Africa along the famous Nile River. The family set off on their trip in mid-June. The flight was long, and everyone was tired but excited when they arrived. The next day they would begin a two-week boat trip down the Nile River from Cairo to Thebes.

The first day out on the river was like a dream. The kids spent the day fishing and exploring all of the hiding places on the boat. That night the kids agreed they would sleep out on the deck every night, if the weather allowed.

The first night was warm and humid. The sky was filled with stars and, unfortunately, with mosquitoes. As the kids slept in the warm air, they tossed and turned and threw off their covers. The next morning, the kids compared bites. Sara, the oldest, was not happy to find out she had the most. She decided not to sleep out again, unless she could find some bug repellent to put on before bed.

Over the next two weeks the kids spent time sightseeing and fishing. They saw animals they had never seen in the wild before, like storks and crocodiles. Each day the scenery was different as they continued on their way toward Thebes and the ancient ruins.

One night toward the end of the trip, Sara became ill. She had fever and chills and complained of headache and muscle pain. Soon came nausea and vomiting. Her parents thought she must have a terrible case of flu. But when Sara's fever went up to 106 they knew it was something more serious. All through the night Sara was very ill. By morning she felt better and had no fever or other symptoms. Later that same day, Sara became ill again with the same high fever, chills, muscle pain, headache, nausea and vomiting. Her parents ordered the boat to stop at the nearest hospital. When a doctor heard Sara's symptoms, she put her in the hospital and restricted visitors. After running a few tests on her blood, the doctor gave her a medicine called quinine to fight the illness.

Think about what happened along the trip that might have made Sara sick. What caused her illness? What is the name of the disease she has?

See Clue Cards on page 31.

**Who got
sick?**

**(Who is
the host?)**

**What
symptoms
did the
host have?**

**Where did
the story
take place?**







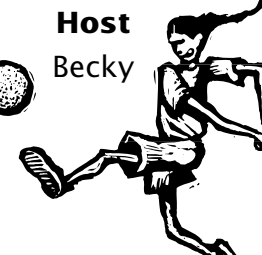







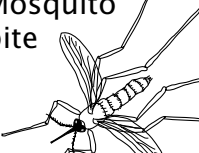
**How did
the person
get the
parasite and
become sick?**

**Parasite
Card**

Part One: Parasite Mysteries (cont'd)



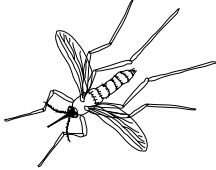

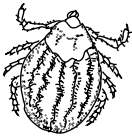

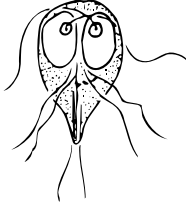

1. Review the clues you highlighted in the mystery. Read the question boxes in the spaces below your mystery.
2. Choose the **Clue Cards** and **Parasite I.D. Card** that best answer each question and best fit the description of the parasite.
3. Place the **Clue Cards** and **Parasite I.D. Card** over the question boxes below your mystery. When you think you have the correct cards in place, glue or tape them down. Make sure the **Parasite I.D. Cards** are folded so the information is on the inside and glued down by one flap only. Each one should open to show the name and picture.
4. Trade mysteries with a member of your group. Have them solve your parasite mystery. Keep the **Parasite I.D. Card** closed until they guess which parasite caused the main character to become ill.

Clue Cards

Symptoms Recurring fever and chills	Symptoms Red swelling rash, joint pain, headache, fever	Symptoms Severe stomach ache, vomiting	Symptoms Open sore on skin	Symptoms Diarrhea and severe stomach ache
Location Northeastern United States 	Location The Mediterranean Sea 	Location Sushi restaurant, San Francisco, California 	Location The Nile River, Egypt 	Location The Black Hills of South Dakota 
Host Kelly 	Host Becky 	Host Daniel and Ryan 	Host Sara 	Host Eric 
How host became sick  Sandfly bite	How host became sick Eating raw fish 	How host became sick Tick bite 	How host became sick Drinking untreated water 	How host became sick Mosquito bite 

Part One: Parasite Mysteries (cont'd)

Parasite I.D. Cards

 <p><i>Parasite</i> Sandfly A small blood-sucking fly that transmits Leishmania</p>	 <p><i>Parasite</i> Liver Fluke Usually infects sheep, cattle, and rabbits</p>	 <p><i>Parasite</i> Anopheles mosquito Transmits Malaria</p>	 <p><i>Parasite</i> Chewing Louse Causes itching and skin irritation</p>
 <p><i>Parasite</i> Black-legged tick Transmits Lyme Disease</p>	 <p><i>Parasite</i> Anisakis (an-eh-sa-kiss) Called the whale or sushi worm</p>	 <p><i>Parasite</i> Giardia (gee-r-dea) A tiny protozoa that lives in streams</p>	 <p><i>Parasite</i> Dog flea Lives on cats and dogs</p>

Good job solving the Parasite Mysteries!

PARASITE SLEUTH

ACTIVITY
FOUR

Think It Over

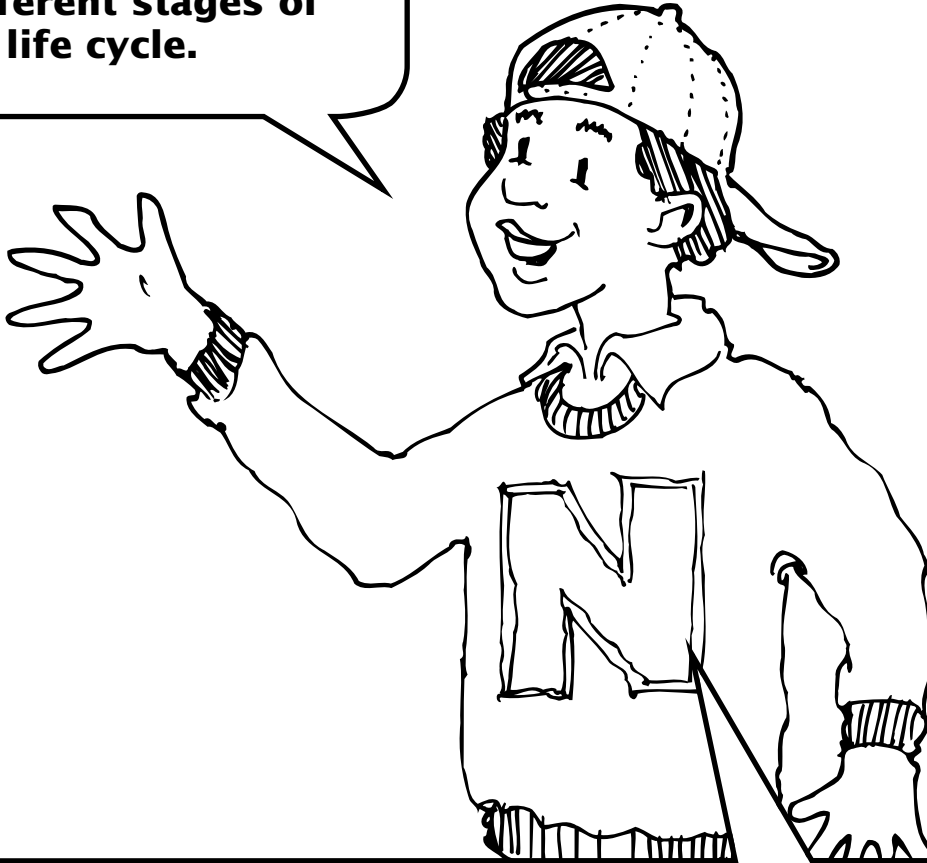
Make a list of factors that influence whether
or not you might get a parasite infection.



TRAVELING TAPEWORM

ACTIVITY
FIVE

Build a life-size model of your digestive tract. Then learn where the beef tapeworm lives at different stages of its life cycle.



Before You Begin

Teams of 4

Length:
Part I - 30 mins.
Part II - 30 mins.

What You Need

For the entire group:

- stapler (1-2 for teams to share)

For each team of 4:

- 1 large poster board
- blue and red pencils or crayons
- 1 large plastic bag
- meter stick
- 1 pair of scissors per person
- glue or glue stick
- tape

1 copy of the Mouth and Esophagus (p.36) on white paper.

1 copy of the Stomach (p.37) on pink paper.

6 copies of the Small Intestine (p.38) on pink paper.

2 copies of the Large Intestine (p.39) on pink paper.

What We Know. Parasites and their hosts share special and unique relationships. A mosquito visits its host, usually a person or another animal, fills up with blood and then flies away. The mosquito does not live on the body of its host but instead is a frequent visitor. On the other hand, a parasitic worm may spend its entire life developing inside the body of its host. The worm depends on the host for food and a place to live.

This is the case with the beef tapeworm. It gets into humans in a sneaky way. If you like to eat your steak cooked very rare, you may be putting yourself at risk of getting the beef tapeworm. Of course, you have to be unlucky enough to eat meat from a cow that was infected with the tapeworm. If the cow is infected, the tiny cyst or larval stage of the parasite may be in the steak. What happens after you swallow the cyst? Find out in this activity, Traveling Tapeworm.

TRAVELING TAPEWORM

ACTIVITY
FIVE

Part One: Just How Long Is It?

Color the digestive tract.

Gather the following materials for your group: blue and red pencils or crayons; a meter stick; 6 copies of the Small Intestine Worksheet; 2 copies of the Large Intestine Worksheet; 1 copy of the Mouth and Esophagus Worksheet; 1 copy of the Stomach Worksheet.

1. Look at the stomach, small intestine, and large intestine sections of the digestive tract.

The system of tubes you see inside are the arteries and veins. The tubes coded “B” are veins. Blood in the veins moves toward the heart and lungs to pick up oxygen. Color all veins blue.

2. The tubes coded “R” are arteries. Blood in the arteries moves away from the heart and is oxygen-rich. Color all arteries red.

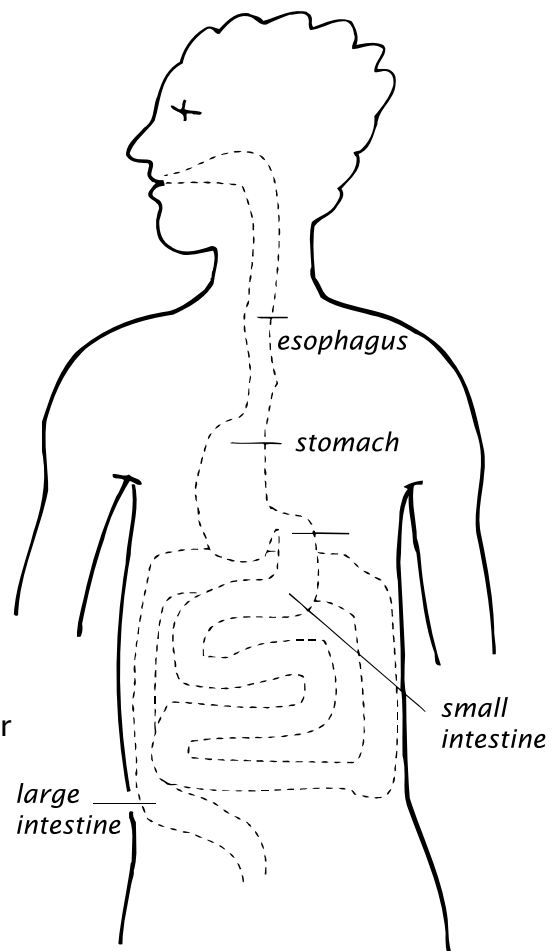
3. Look at your copy of the mouth and esophagus. Color them red.

Put the digestive tract together.

(Use the picture at the right to guide you)

1. Cut out all small and large intestine sections.
2. Glue small intestine sections together, matching arteries and veins. (2 people needed)
3. Glue large intestine sections together, matching arteries and veins. Glue small intestine to large intestine. (1 person needed)
4. Glue mouth and esophagus section to stomach section. (1 person needed)
5. Glue intestines (large and small combined) to lower stomach area. How many meters long do you think the digestive tract is? Look at the length and make your estimate. Write your estimate here: _____.

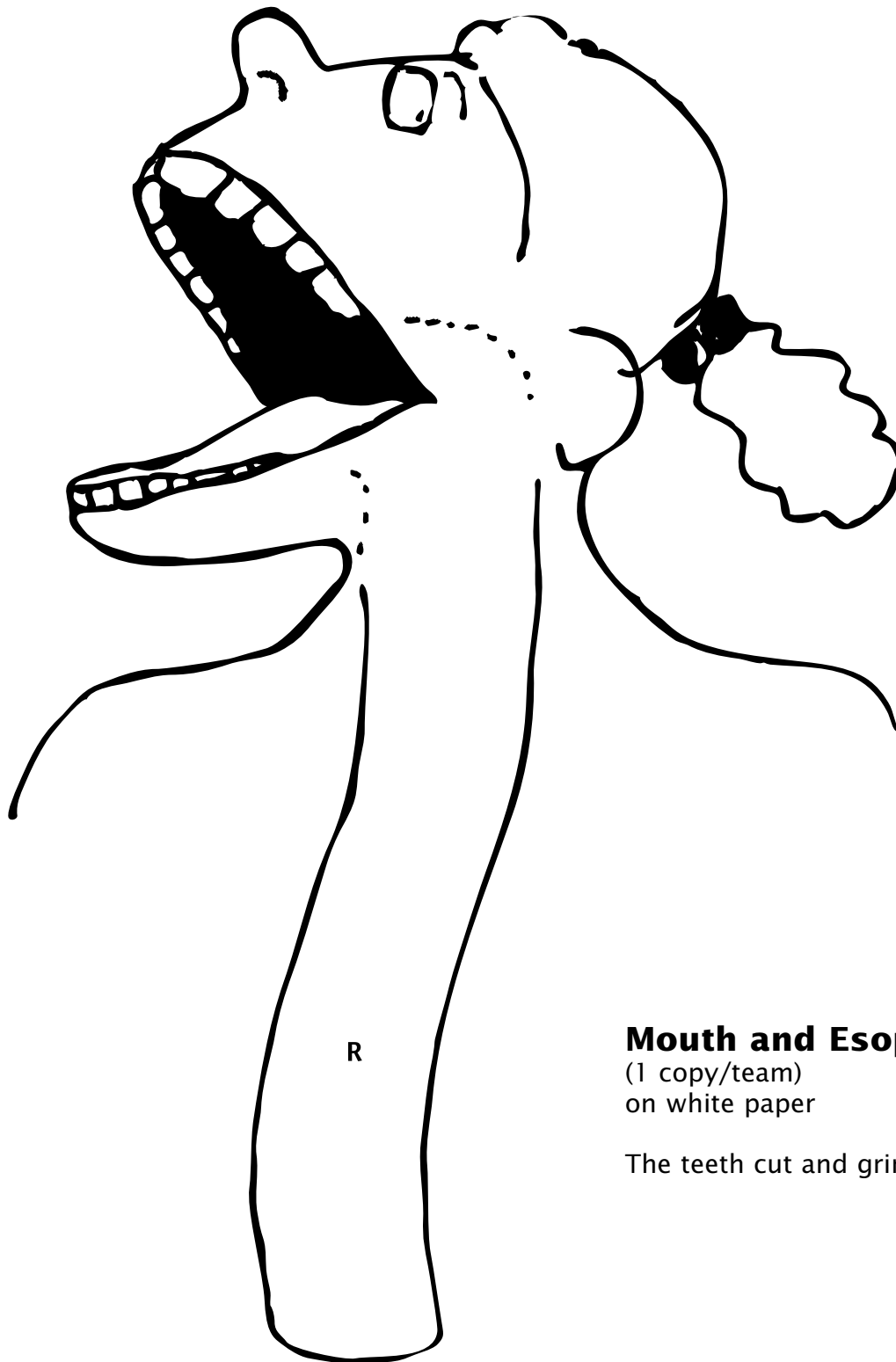
Get a meter stick. Measure the digestive tract. Write actual length here: _____.



TRAVELING TAPEWORM

.....

ACTIVITY
FIVE



Mouth and Esophagus

(1 copy/team)
on white paper

The teeth cut and grind food.

TRAVELING TAPEWORM

ACTIVITY
FIVE

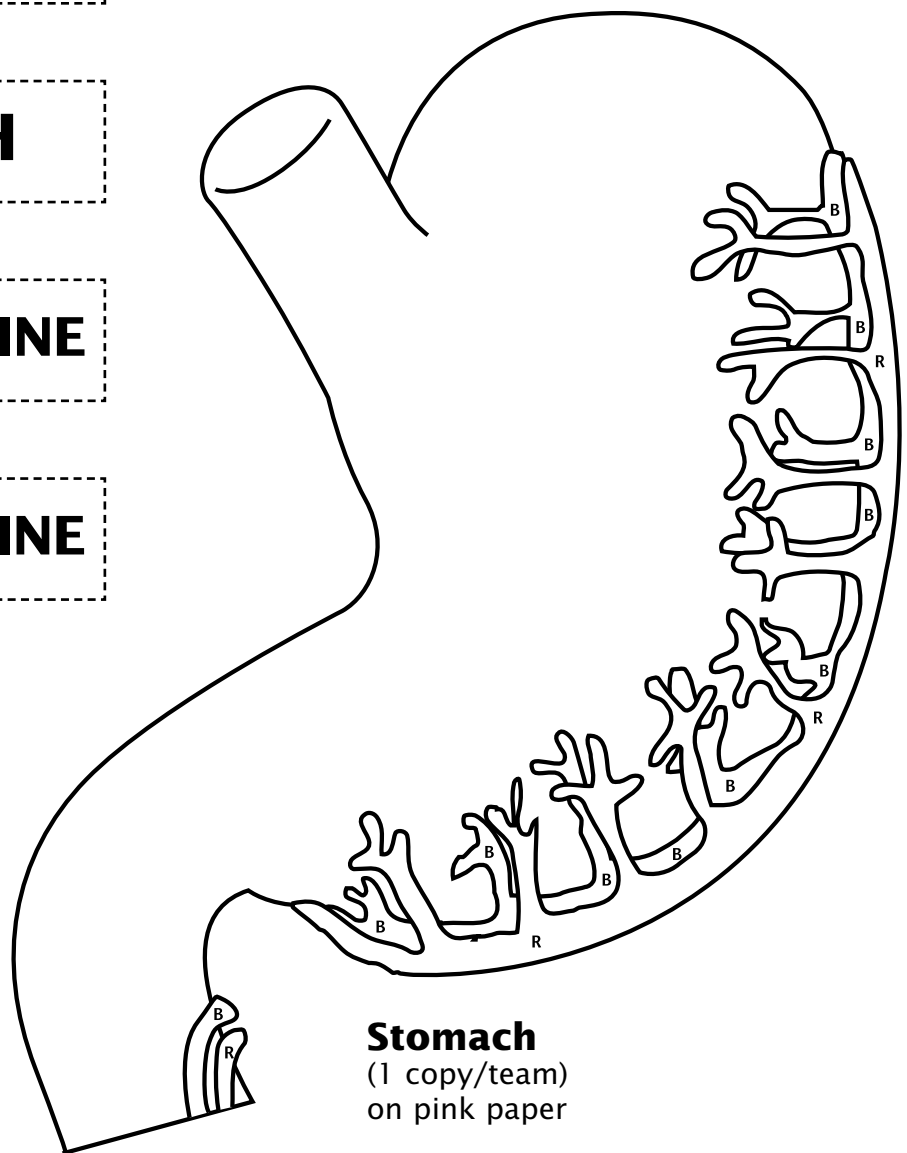
MOUTH

ESOPHAGUS

STOMACH

SMALL INTESTINE

LARGE INTESTINE



Where food goes after it is swallowed.

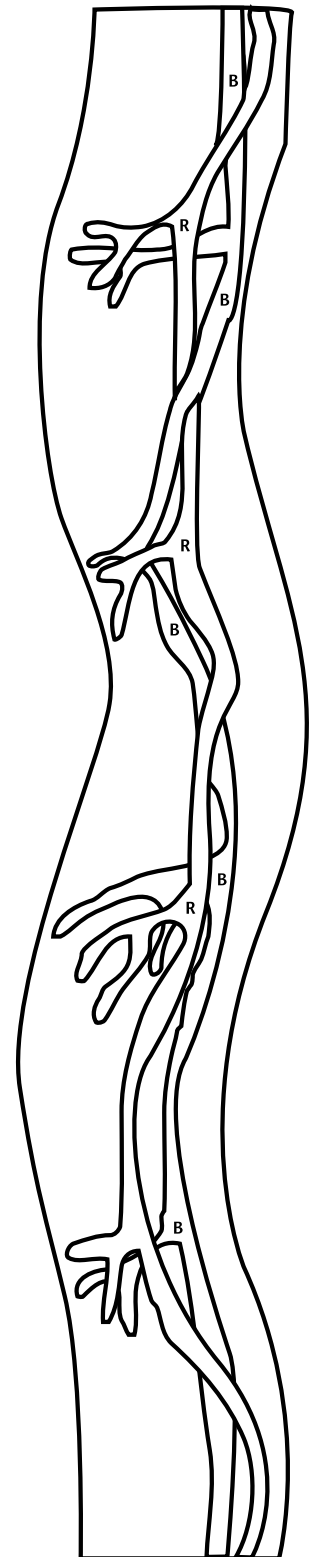
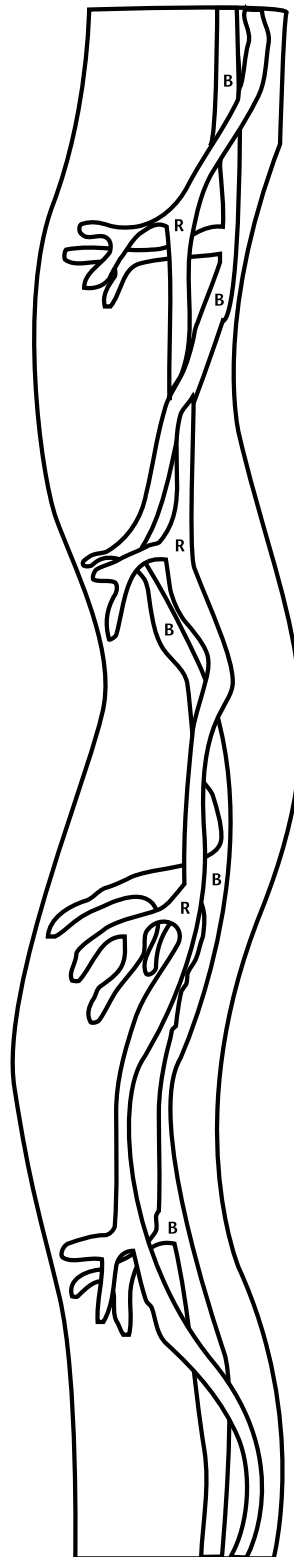
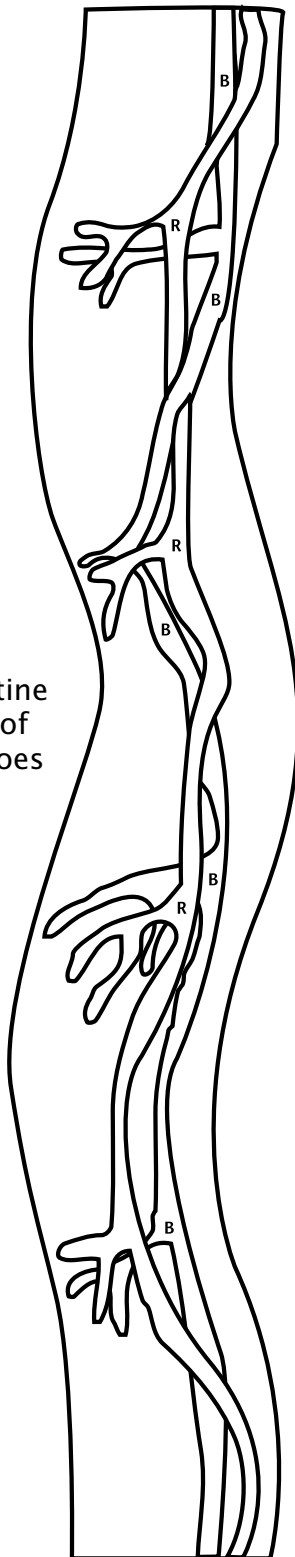
TRAVELING TAPEWORM

ACTIVITY
FIVE

Small Intestine

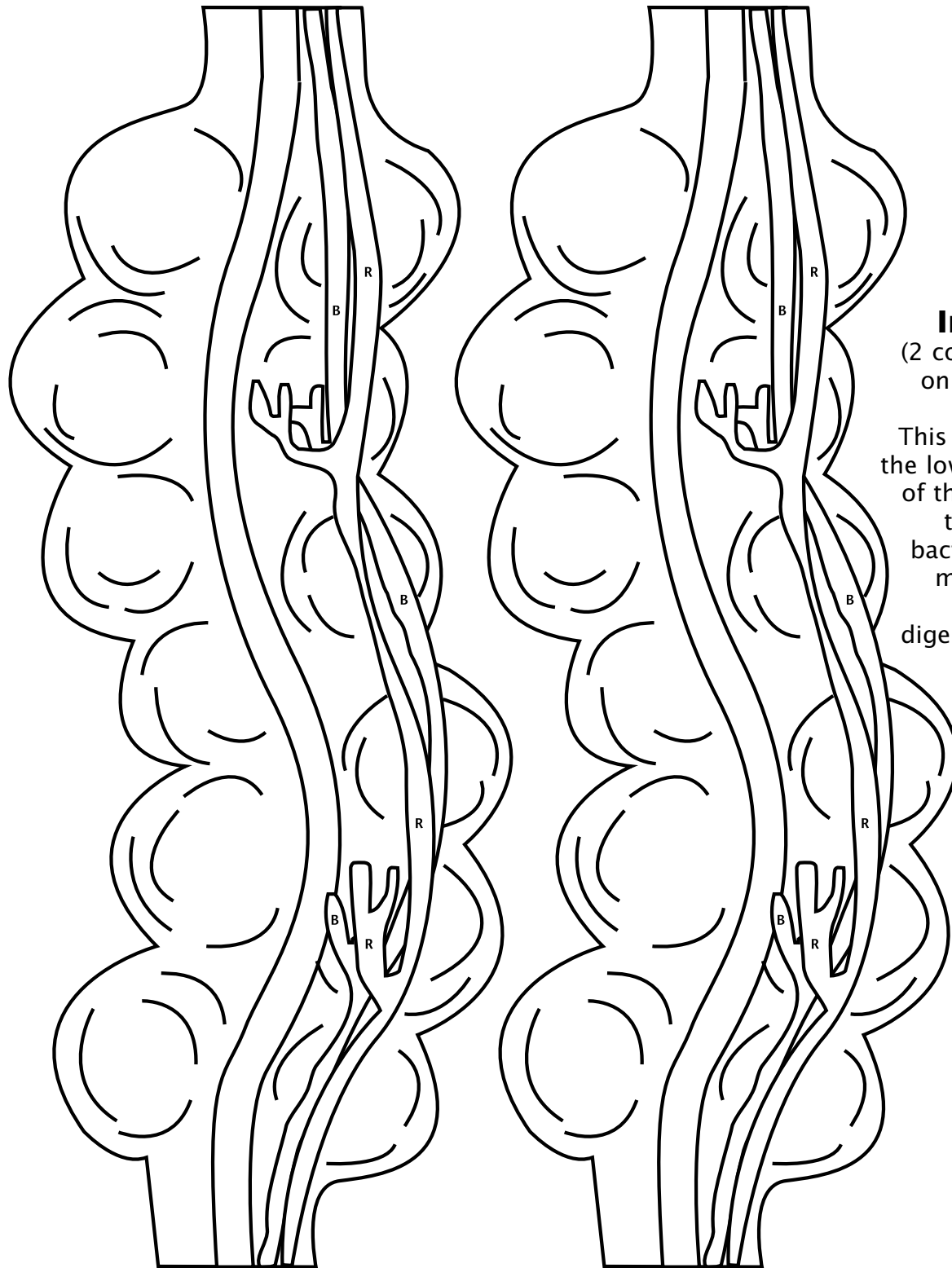
(6 copies/team)
on pink paper

The small intestine is a tube made of muscle. Food goes into the blood from the small intestine.



TRAVELING TAPEWORM

ACTIVITY
FIVE



Large Intestine

(2 copies/team)
on pink paper

This tube forms the lower portion of the digestive tract, where bacteria act on material that escaped digestion in the small intestine.

TRAVELING TAPEWORM

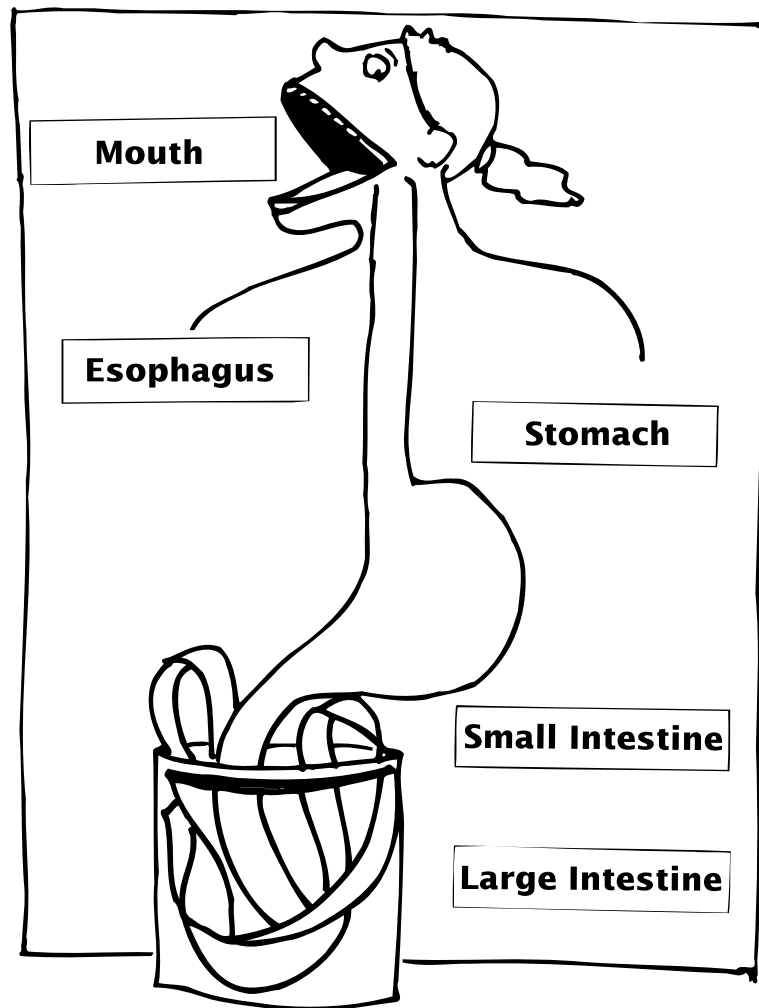
ACTIVITY
FIVE

Part One: Just How Long Is it? (cont'd)

Showing Off Your Digestive Tract

Gather the following materials: 1 large piece of poster board ; 1 large plastic bag; 1 pair of scissors for each person; stapler and staples.

- 1 Attach the digestive tract to the left side of the board by gluing the mouth at the top of the board. Now glue the esophagus and stomach below it. Leave the intestines hanging. Take a look at the picture below. Use it to guide you in creating a display board for your digestive tract.
- 2 Staple a large plastic bag just below the stomach area of the board. Fill it with the intestines. Cut out and glue the labels found on p. 37 in the correct places on your display board. See the picture below.



TRAVELING TAPEWORM

ACTIVITY
FIVE

Think It Over

How do each of the parts of your digestive system help you?"

TRAVELING TAPEWORM

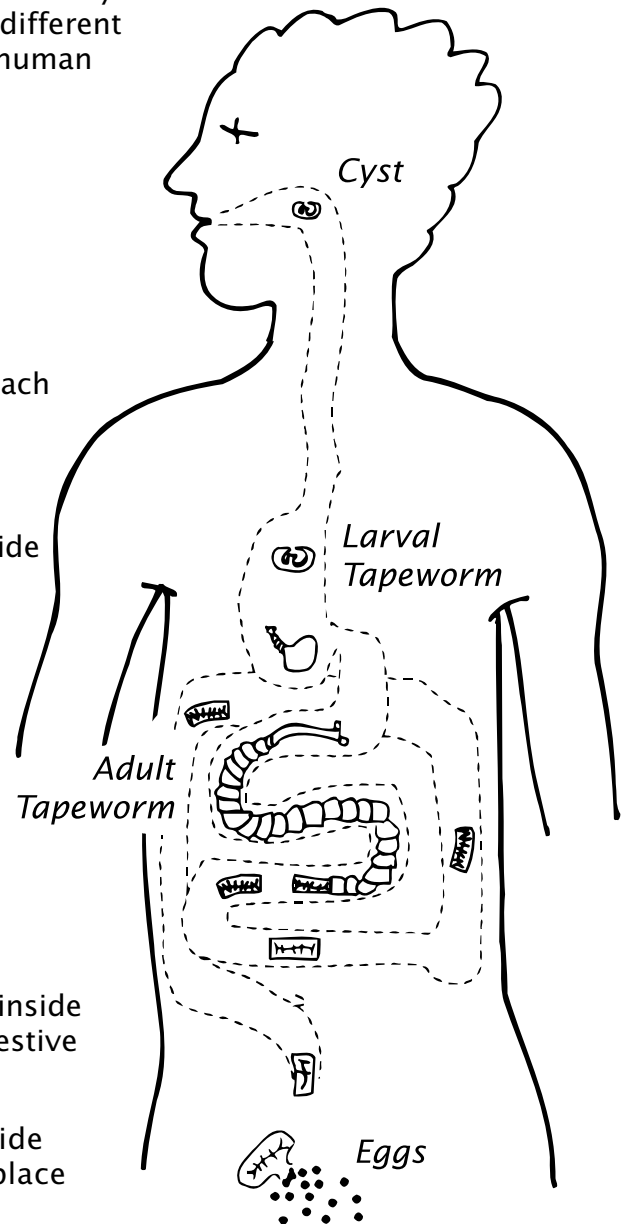
ACTIVITY
FIVE

Part Two: Everything Needs a Home

As strange and grotesque as it may seem, parasites such as tapeworms can develop inside the human body. How does this happen? Find out by placing the different stages of the beef tapeworm life cycle on your human digestive tract poster.

Each team will need **Stages of Tapeworm Development** p. 43.

- 1 Look at the four stages of development.
- 2 Read the names to yourself. You may color each stage a different color.
- 3 Use the diagram to the right to help you decide where to place each stage on the human digestive tract poster board.
- 4 Cut out the cyst, larval tapeworm, adult tapeworm, and eggs.
 - a. Where does the cyst enter the body? Tape it in that place on the digestive tract.
 - b. Where does the larval tapeworm develop inside the body? Tape it in that place on the digestive tract.
 - c. Where does the adult tapeworm live inside the human body? Tape it together and place on the digestive tract.
 - d. Where do the eggs leave the body? Tape them in place.

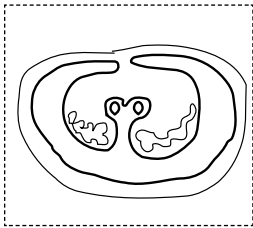


TRAVELING TAPEWORM

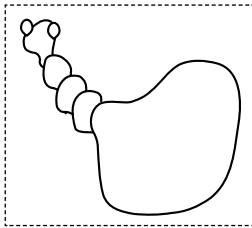
ACTIVITY
FIVE

Part Two: Everything Needs a Home (cont'd)

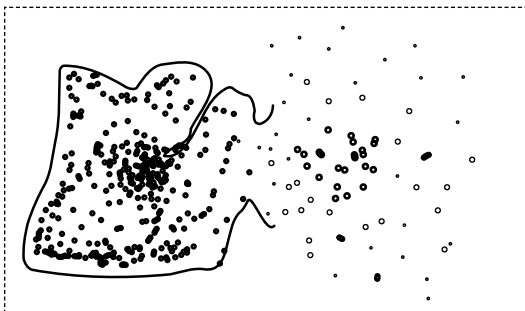
Stages of Tapeworm Development



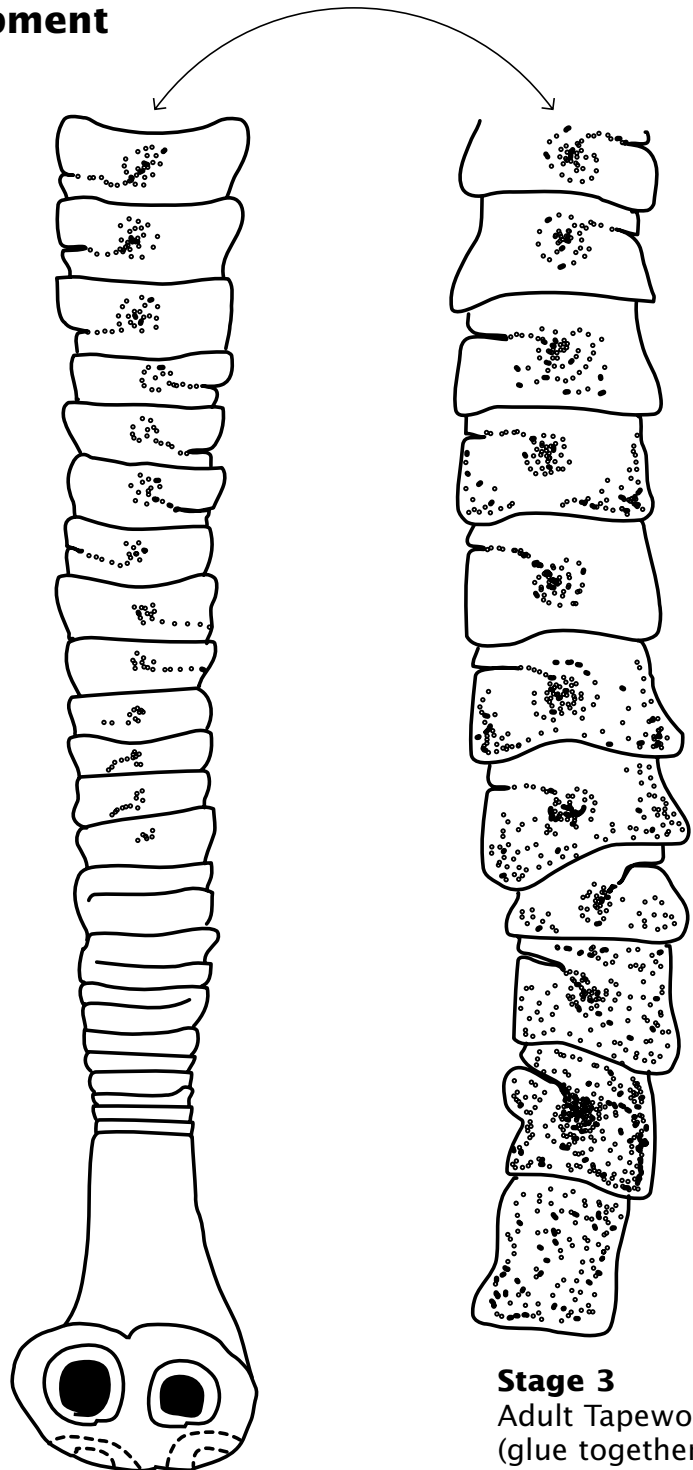
Stage 1
Cyst



Stage 2
Larval Tapeworm



Stage 4
Eggs



Stage 3
Adult Tapeworm
(glue together)

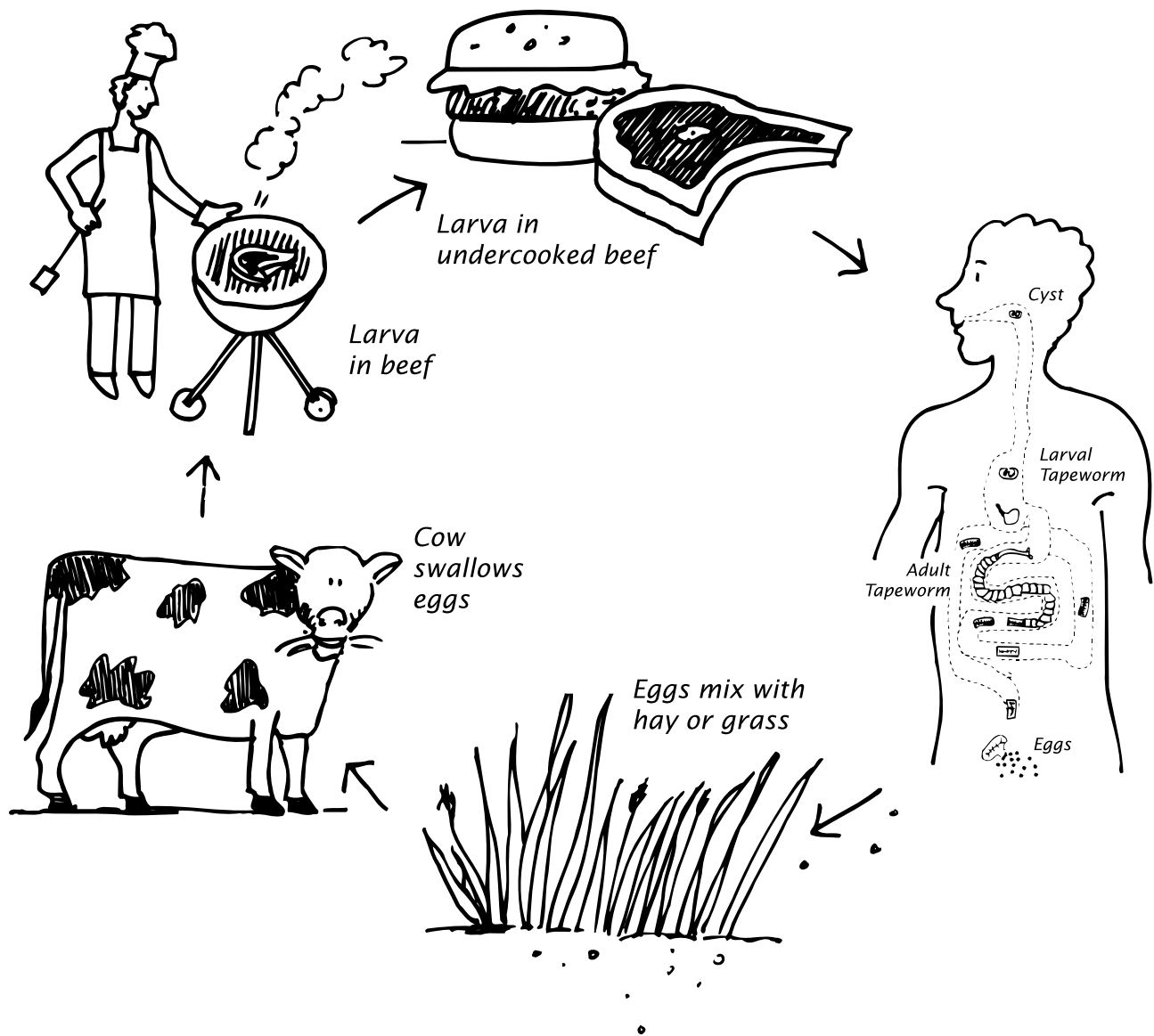
TRAVELING TAPEWORM

ACTIVITY
FIVE

Part Two: Everything Needs a Home (cont'd)

Life Cycle of *Taenia saginata* (the beef tapeworm)

- 1 Look at the diagram below. Discuss in your team how the tapeworm moves from one location to the next.

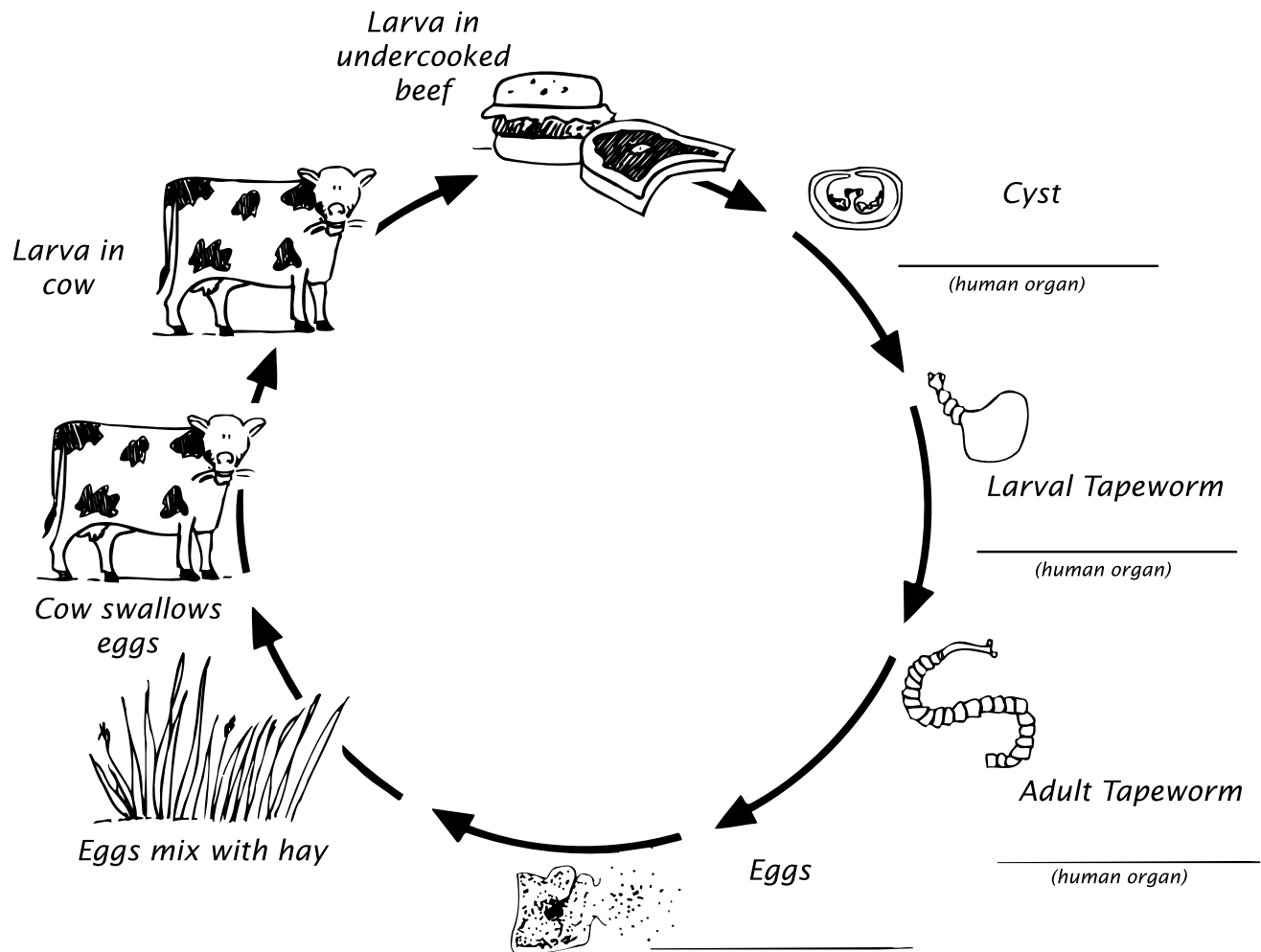


TRAVELING TAPEWORM

ACTIVITY
FIVE

Part Two: Everything Needs a Home (cont'd)

- 2 Use the beef tapeworm life cycle diagram on page 44 to complete the diagram below.
Fill in the names of the organs in the human body in which each of the stages is located.



TRAVELING TAPEWORM

ACTIVITY
FIVE

Think It Over



1. How can you avoid getting the beef tapeworm?

2. What advantages does living in a host give to a parasite?

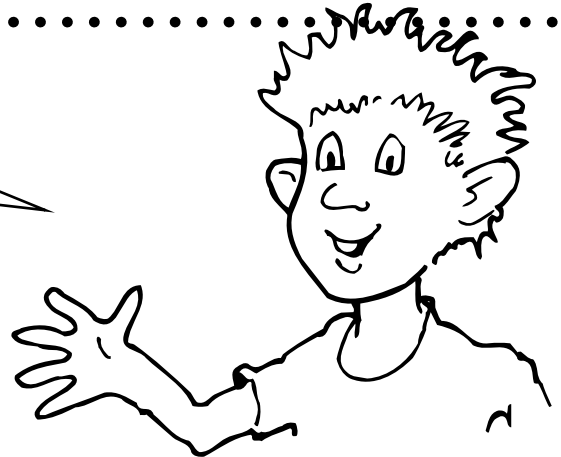
PULLING IT ALL TOGETHER

**Create a story
about a scientist
who works with
parasites.**



NEW WONDERS

Here are some ideas you might like to use for projects or exhibits.



1. Make a digestive tract exhibit like the one in the Traveling Tapeworm activity, but personalize it by adding in the food you ate that day.

2. Make a life cycle chart for the anisakis or sushi worm from the Parasite Mysteries activity. Use the tapeworm life cycle chart from the Traveling Tapeworm activity to give you ideas about how to construct your chart. (Hint: See parasite life cycles on the Wonderwise Web site and CD-ROM.)

3. Go to the fish department in your local market. Find out how often fish parasites are found in fish sold at the store. Ask the butcher if parasites are found in other meats like chicken, pork or beef. If they are, ask what is done with the meat and the parasites.

4. Invite a local physician, veterinarian or public health person to your group to talk about parasitic disease, local infectious diseases caused by parasites, environmental health issues related to parasites, pet parasites and how to prevent them, or common parasite infections.

5. Go to your library and research **one** of the following parasite diseases. Prepare a report or poster for your group.

Malaria - transmitted by the anopheles mosquito

Schistosomiasis - caused by a worm called a trematode that is transmitted by snails in water

River Blindness - caused by a nematode that is transmitted by a black fly bite

6. Conduct a survey to find out how common one of the following parasite problems is in your community. Use as many resources as possible.

Pinworms

Lyme disease

Giardia

7. Go fishing. Carefully open the gut or intestines of the fish you catch. Look for worms inside. Check for ectoparasites like copepods on the gills of the fish.