

3. What makes your throat feel sore when you throw up?

Draw the Vomit Machine from the Grossology exhibit.

2. How long does it take for your body to digest food?

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1. Name four things that can cause vomiting.

and Look Inside.

Find the answers to these questions at the exhibits called Vomit Center, GI Slide

# Investigations in Grossology

4. How long a path does food take from your mouth to your anus?

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5. How much food does the average American eat in a lifetime?

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6. What can you do to avoid food poisoning?



# GROSSOLOGY™

## Feelin' Queasy

What is the most disgusting thing your body does? Most people think vomiting is the most disgusting thing their body does. You vomit because your body is trying to get rid of stuff that might be dangerous to you. Vomiting is so important that there's a part of your brain (called the vomit center) to control it.

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# vomit

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## In the Classroom

### owl pellets

Owls eat small rodents, reptiles, and birds. They swallow their prey whole. An owl's stomach acids aren't strong enough to digest bones or hair. Owls vomit up the indigestible stuff about 24 hours after they eat. If you want to look for owl pellets, look under the tree where an owl roosts during the day.

#### What you need (per group):

- Owl pellet (you can order these through scientific supply houses)
- Water
- Toothpicks
- Bone identification chart

#### What to do:

1. Inspect the pellet. Note the size and any features that might help you figure out where it came from.
2. Soak the pellet in water.
3. Very gently, pull apart your pellet.
4. Use the toothpicks to separate the bones from the fur and feathers.
5. Roll the last bits of fur between your fingers to find tiny bones or teeth that may have been overlooked.
6. Try to lay out or reconstruct the skeletons of the animals you found. How many animals in each pellet? Can you identify the animals?

### vomit

#### Investigations in Grossology

##### Answers:

1. Motion, too much sugar, pregnancy, food poisoning, bacteria ...
2. 24 hours.
3. Acids and enzymes from your stomach.
4. 7.9 meters or 26 feet.
5. 30 000 kg or 66 000 pounds.
6. Clean your utensils, don't let meat sit out.

reverse peristalsis—throwing up  
vomit center—part of brain that controls puking

bile—helps digest fats

gall bladder—makes bile

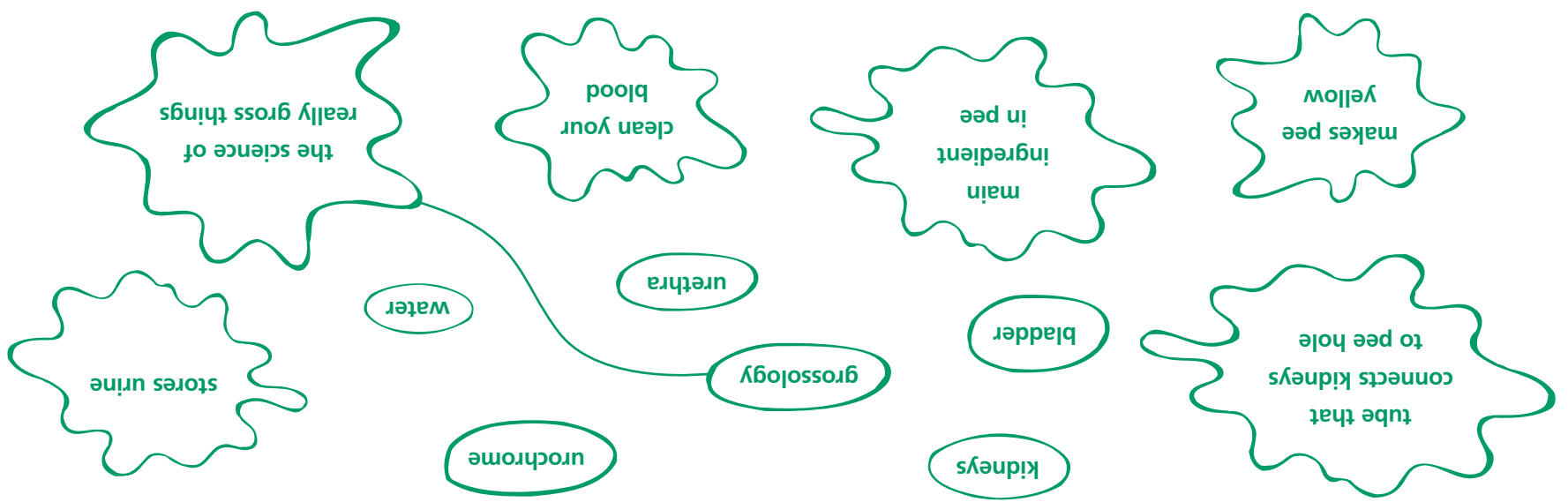
salmonella—cause of food poisoning

grossology—the science of really gross things

## Further Gross Research

**Do a survey at your school.** What causes people to throw up? If you decide to make a poster showing the results of your survey, remember that even thinking about vomiting makes some people queasy.





How about lots of asparagus?

3. How much urine do you make each day?

6. What might happen to your pee if you ate lots of beets?

5. Why don't you make as much pee while you're sleeping?

2. How much can your bladder hold?

4. How often do your kidneys produce a drop of pee?

1. What's in pee?

Find the answers to these questions at the exhibit called *Urine the Game*.

## Investigations in Grossology

Draw an interesting toilet or bathroom you have used.

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## I Gotta Go!



**Why do I pee?** Your blood is full of waste materials (like sodium, potassium and urea) which come from food you eat. An excess of these materials can harm your body. Your kidneys are blood scrubbers that clean the waste from your blood. They drip the waste materials into your bladder. The waste is washed away in the form of urine. The main ingredient in pee is water. Your body gets rid of extra water because it slows down important chemical reactions in your body.

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# pee

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## In the Classroom

### toilet tank survey

Have your students try this at home.

#### What to do:

1. Have an adult turn off the water supply to the toilet. This is usually a tap attached to the wall under the toilet tank.
2. Flush the toilet. All the water will leave the toilet tank.
3. Measure how much water it takes to refill the tank and the toilet bowl to their usual levels. Record this amount.
4. Turn the water supply back on.
5. Leave the paper and pencil near the toilet. Ask people to make a slash mark on the paper every time the toilet is flushed.
6. After three days count up the marks. Multiply the number of marks by the amount of water it takes to fill the toilet to find out how much water the toilet uses every three days. How much water does it use in a year?

#### What's going on?

We use a lot of water every time we flush a toilet. Some people put a brick or a rock into their toilet tank so it takes less water to fill it up.

#### What you need:

- Toilet
- Big measuring cup or bottle
- Paper
- Pencil

### Investigations in Grossology

#### Answers:

1. *Water, urea, vitamins, and coloring pigments.*
2. *About 2 cups or 500 ml.*
3. *1–2 liters or 1–2 quarts.*
4. *Every 15 seconds.*
5. *Your body's chemical activity slows down.*
6. *Beets—pink, asparagus—funny smell.*

*kidneys—clean your blood*

*bladder—stores urine*

*water—main ingredient in pee*

*urochrome—makes pee yellow*

*urethra—tube that connects*

*kidneys to pee hole*

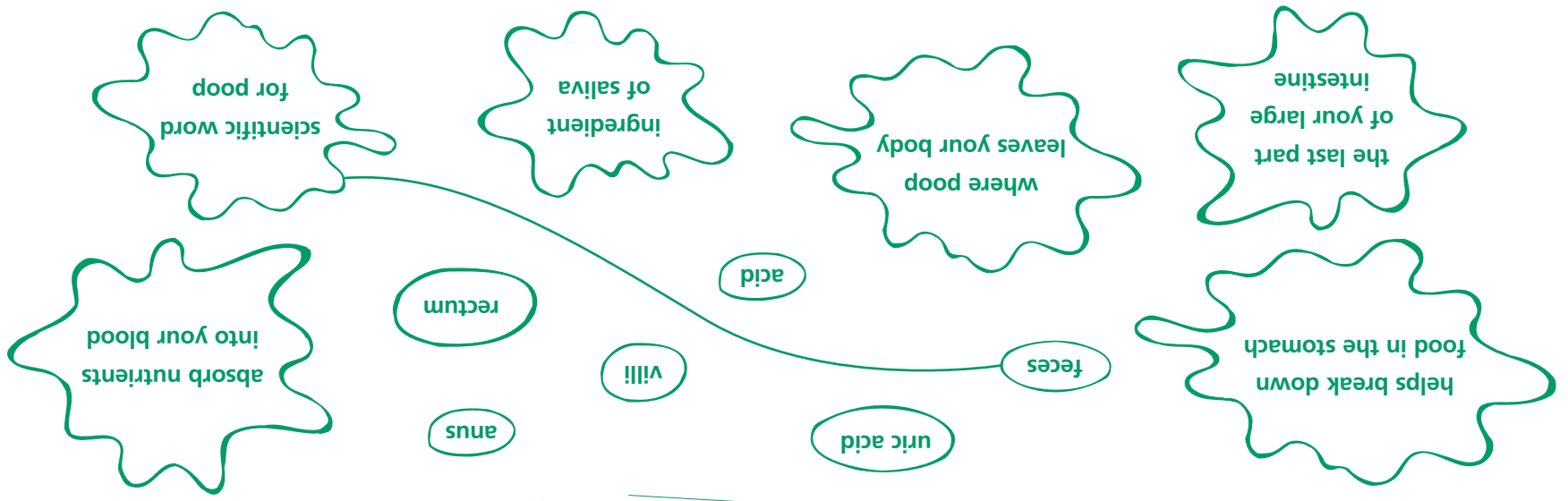
*grossology—the science of really gross things*

## Further Gross Research

**Generally, girls get potty trained at a younger age than boys.** Is this true at your school? Have other students ask their parents how old they were when they were potty trained.

Investigate how medical clinics test urine for diseases or drugs.





3. How long does it take to digest food?

4. Waste is pinched along by your intestines. What's this called?

7. Your small intestine is longer than your large intestine. How did it get its name?

2. How long are your intestines?

6. What makes poop brown?

1. List four things that are in poop.

5. When your rectum is full of poop, and you've GOT TO GO, it's called a ...

Draw two foods that make your mouth water.

Find the answers to these questions at the exhibits called *GI Slide and Look Inside*.

## Investigations in Grossology

# GROSSOLOGY™

## In One End and Out the Other

How does food turn into poop? Digestion breaks food down into molecules that your body can use. It starts when enzymes in saliva break starch molecules and turn them into short sugar molecules. It ends when the undigested food is clumped together into poop and exits from your anus.



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## In the Classroom

### spit test

**What you need (per group):**

- A spoonful of cornstarch
- Two crackers (unsalted is best)
- Tincture of iodine (you can buy this at the drug store in the first aid section)
- Two glass bowls or small cups

**What to do:**

1. Iodine turns dark bluish black when it touches starch. Prove this to yourself by adding a couple of drops to some cornstarch.
2. Break up one cracker into bits and put them into one bowl.
3. Chew up the other cracker. Don't swallow it. Keep chewing until the cracker is all mushy.
4. Spit the cracker mush into the other bowl.
5. Put a few drops of iodine in each bowl. Is there a difference?

**What's going on?**

The enzymes in saliva break long starch molecules and turn them into short sugar molecules. This is the first step in digesting food.



### Investigations in Grossology

**Answers:**

1. Undigested food, plant fiber, water, salt, skin cells, bacteria, bacteria wastes.
2. 7.9 m or about 26 feet.
3. 24 hours.
4. Peristalsis.
5. Peristaltic rush.
6. Bile being decomposed by bacteria.
7. It's narrower.

feces—scientific word for poo

villi—absorb nutrients into your blood

uric acid—ingredient of saliva

rectum—the last part of your large intestine

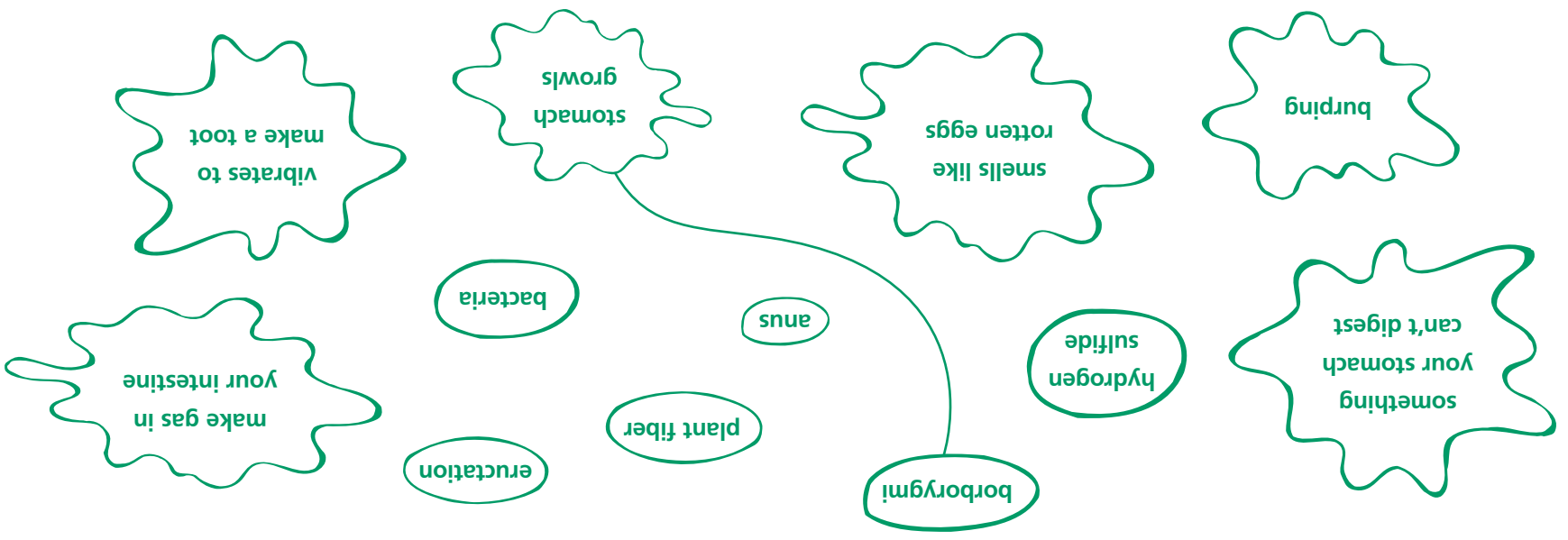
anus—where poop leaves your body

acid—helps break down food in the stomach

## Further Gross Research

**How is sewage treated in your town or city?** Find out from your city or town hall. Maybe you could even take a class tour!





3. What are the stinky gases in toots?

Draw a lunch that would give you lots of gas.

2. People pass gas about \_\_\_\_\_ times a day.

5. How long does it take for air to travel through your digestive system?

6. Find two ways gas gets into your stomach.

1. Name four foods that can cause toot gas.

4. What is in plant fiber that bacteria use to make gas?

Attack, Listen to Your Body and Toot Toot.

Find the answers to these questions at the exhibits called Burp Machine, Gas

# Investigations in Grossology

# GROSSOLOGY™

# gas

## It's a Gas



**Why do I burp and toot?** There's always a little bit of gas in your stomach. When you eat and drink, you swallow air, which adds gas. When the stomach digests, it adds acid to the foods and creates gas of its own. If you take antacid or sodium bicarbonate for an upset stomach, these chemicals react with your stomach acid and create even more gas. When the gas pressure gets too great, gas escapes—BuRRRRRRP! A toot is not a backward burp. Bacteria in your large intestine produce gas as they break down food. This gas escapes from your anus in a toot.

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# gas

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## In the Classroom

### model a belch

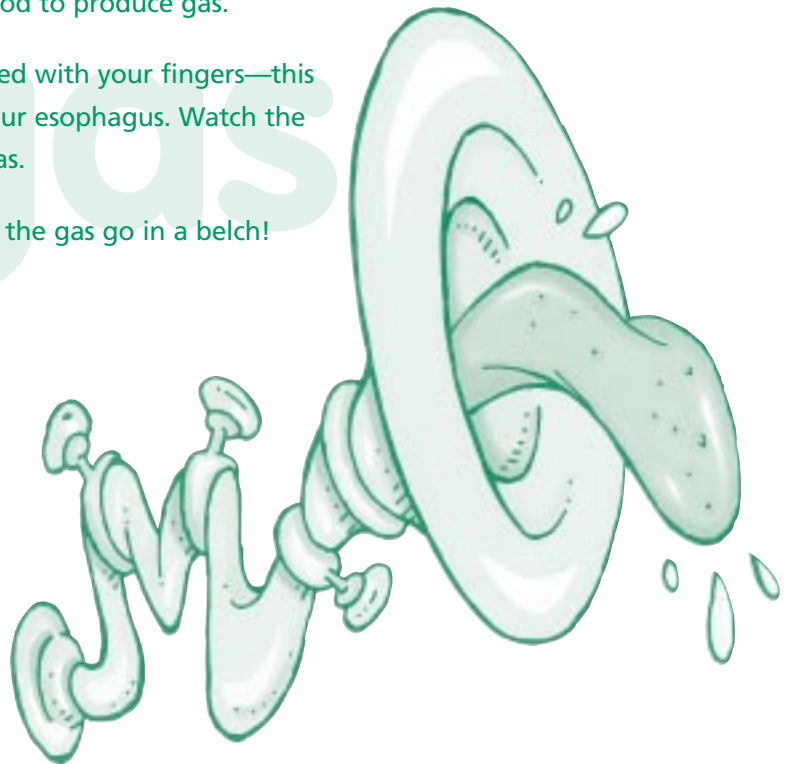
#### What to do:

This experiment is messy! Do it over a sink or a washtub.

1. The balloon represents your stomach. Put some vinegar into the balloon to represent stomach acid.
2. Use the funnel to add baking soda. The reaction represents what happens when your stomach acids react with food to produce gas.
3. Pinch the balloon neck closed with your fingers—this represents a sphincter in your esophagus. Watch the balloon stomach fill with gas.
4. Release the sphincter to let the gas go in a belch!

#### What you need (per group):

Vinegar  
Baking soda (sodium bicarbonate)  
Large balloon  
Funnel  
Spoon



### Investigations in Grossology

#### Answers:

1. Onions, garlic, cabbage, eggplant, mushrooms ....
2. 14.
3. Indole, skatole, hydrogen sulfide.
4. Complex sugars.
5. 30 minutes.
6. You swallow it, comes from acid digesting food, antacids.

borborygmi—stomach growls  
eructation—burping  
bacteria—make gas in your intestine  
hydrogen sulfide—smells like rotten eggs  
plant fiber—something your stomach can't digest  
anus—vibrates to make a toot

## Further Gross Research

When your stomach is too acidic, it can hurt or feel upset. Antacids react with the acid to neutralize it. Watch the neutralizing power of antacids in action.

#### What you need:

Purple cabbage  
Kettle  
Vinegar  
Three clear plastic or glass cups per group  
Several kinds of antacids (Tums, Rolaids, Alka Seltzer)—one dose of each per group

#### What to do:

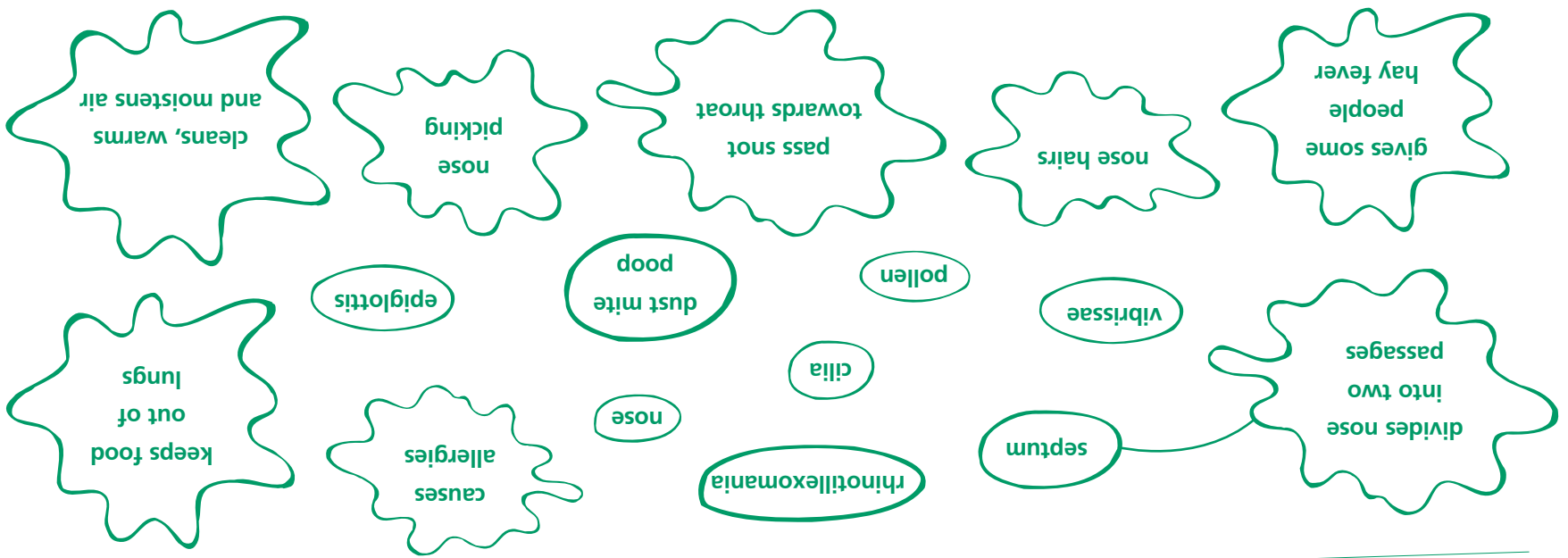
**First, make an indicator solution.** Chop up two cups of purple cabbage and pour about four cups of boiling water onto it. Let it sit for about half an hour. You should get a dark purple liquid. Purple cabbage contains a chemical that changes color depending on pH. In an acid it turns red. In a base it turns blue or green. In a neutral solution it stays purple.

**Now test some antacids.** Pour about 1/2 cup of water into each cup. Add 3 teaspoons of vinegar to each. The vinegar represents stomach acid. Add enough cabbage juice to each cup to make a bright red color. Leave the first cup alone.

Add a Tums or Rolaids tablet to one cup. Watch what happens. The fizzing is a reaction between the "stomach acid" and the calcium carbonate in the tablet.

Add Alka Seltzer to another cup. Watch what happens. Alka Seltzer contains sodium bicarbonate and citric acid, which react with each other and with the vinegar.

Compare the color of the vinegar-only cup to the cups that have been treated with antacid. Did the antacid neutralize the acid?



3. Name three things that can cause a runny nose.

6. How fast is a sneeze?

2. What parts of your body make mucus?

5. How often does your nose make a new batch of snot?

1. What's in snot?

4. Most snot doesn't drip out of your nose. Where does it go?

*Nose and Up Your Nose.*

Find the answers to these questions at the exhibits called *Nose Plumber, Tour du*

# Investigations in Grossology

Draw your nose. Draw a friend's nose.

# GROSSOLOGY™

# snot



## The Nose Knows

**Why does my nose make snot?** One of the important things your nose does is to keep junk from reaching your lungs. It does this in lots of ways. You have nose hairs or vibrissae (vye BRIS ee) which trap dirt and dust. Snot, made of mucus and special bacteria-killing chemicals, coats the nose hairs to help the dirt stick. Tiny hairs called cilia swish the mucus (and the trapped dirt and germs) to your throat. You swallow the dirty snot and the junk is destroyed in your stomach. Your nose-cleaning crew does such a good job that your nasal area is actually one of the cleanest parts of your body.

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# snot

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## In the Classroom

### tissue testing

#### What to do:

The absorbancy test

1. Fold one tissue from each brand in half, then in half again.
2. Put the folded tissues on top of a piece of colored construction paper.
3. Use the dropper to put one drop of water on each tissue.
4. Check the paper under the tissue to see if any water leaked through.
5. Repeat steps 3 and 4 until the tissues leak.
6. The brand that holds the most drops of water before leaking is the most absorbent.

The strength test

1. Take one tissue and wet the center with two drops of water.
2. Have a friend hold the tissue up by the edges.
3. Put one nut (or bolt) on the wet spot. Does it rip?
4. Add nuts or bolts one at a time until the tissue rips.
5. Repeat with the next brand.
6. The brand that holds the most weight without ripping is the strongest.

#### What's going on?

Tissue manufacturers make lots of claims about their product. These are two scientific tests you can do to see how true the claims are. You could display the results with the cost per tissue to show which brand was the best value.

#### What you need (per group):

Several brands of tissue  
Colored construction paper  
Nuts and bolts  
Dropper  
Water  
Cup

### Investigations in Grossology

#### Answers:

1. *Mucus and a bacteria-killing chemical.*
2. *Nose, throat, lungs, stomach, large intestine.*
3. *Colds, allergies, crying, cold weather ...*
4. *Your stomach.*
5. *Every 20 minutes.*
6. *160 km/h or 100 mph.*

*cilia—pass snot toward throat*

*septum—divides nose into two passages*

*epiglottis—keeps food out of lungs*

*rhinitis—means nose picking*

*dust mite poop—causes allergies*

*nose—cleans, warms and moistens air*

*pollen—gives some people hay fever*

*vibrissae—nose hairs*

## Further Gross Research

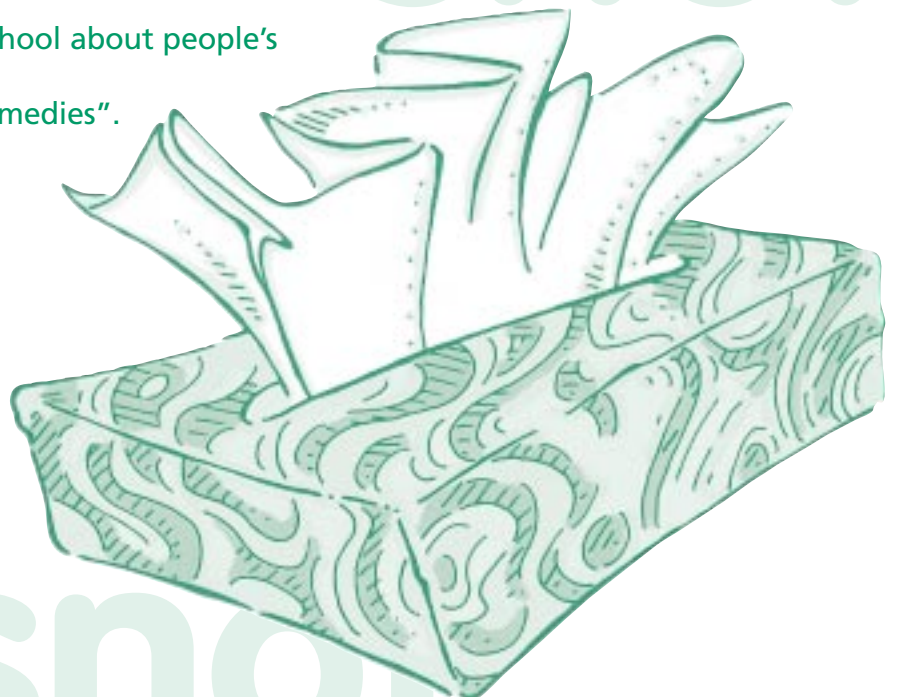
**What medication gets rid of a cold?** No medication “gets rid of”

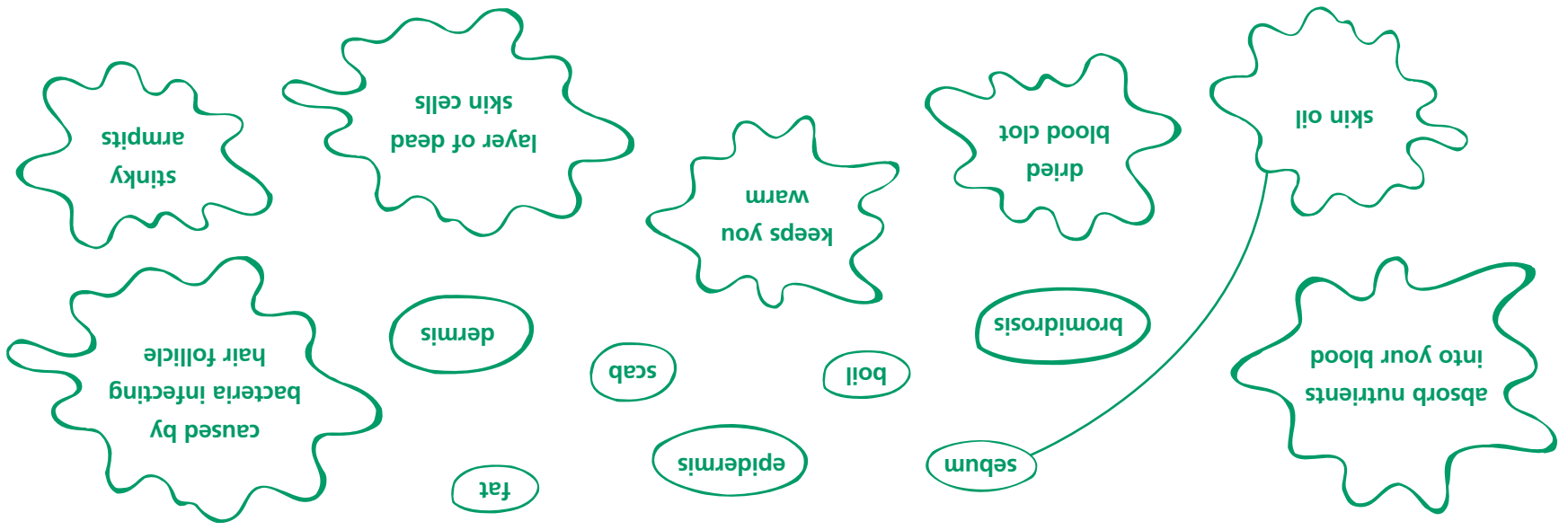
a cold. Colds are caused by viruses, which are not affected by antibiotics. Cold medicine helps relieve symptoms—it might suppress coughing, clear your sinuses of congestion, or soothe your sore throat, but it doesn't kill the virus.

When you get a cold, your best bet is to rest and drink lots of fluids. Take a

survey at your school about people's

favorite cold “remedies”.





3. What's the largest organ of the human body?

Draw a hair follicle.

4. Which parts of your body don't produce oil?

7. What's pus made of?

2. You grow a whole new layer of skin every \_\_\_\_\_ days.

6. What causes warts?

1. Where can you find keratin in your body?

5. Which parts of your body have the most sweat glands?

Find the answers to these questions at the exhibits called *Climbing Wall* and *YU Stink*.

# Investigations in Grossology

# GROSSOLOGY™

# skin

## Your Birthday Suit



**What's the largest organ of the human body?** The skin! Your skin probably weighs about 7 pounds (3 kg) altogether. It's alive and constantly changing, as you shed flakes of skin and grow new skin cells. You get a whole new layer of skin every 28 days. Tiny pores in your skin contain oil and sweat glands to keep your skin elastic and cool, and to protect you from bacteria.

# skin

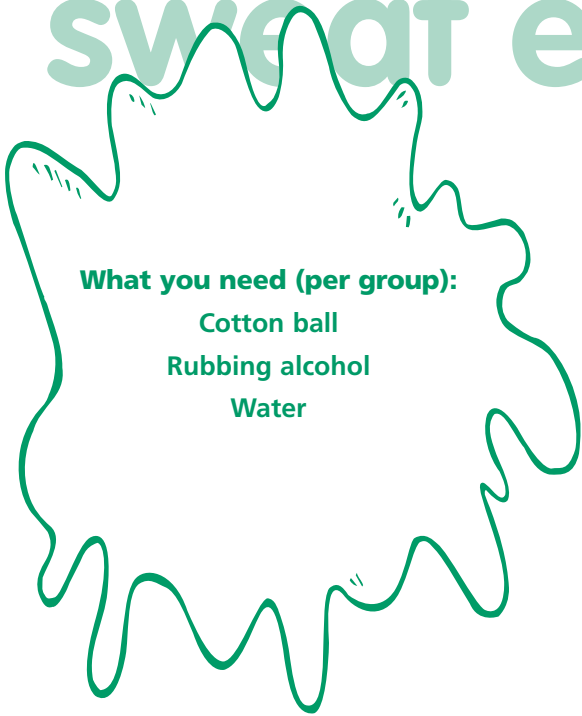
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## In the Classroom

### sweat equity

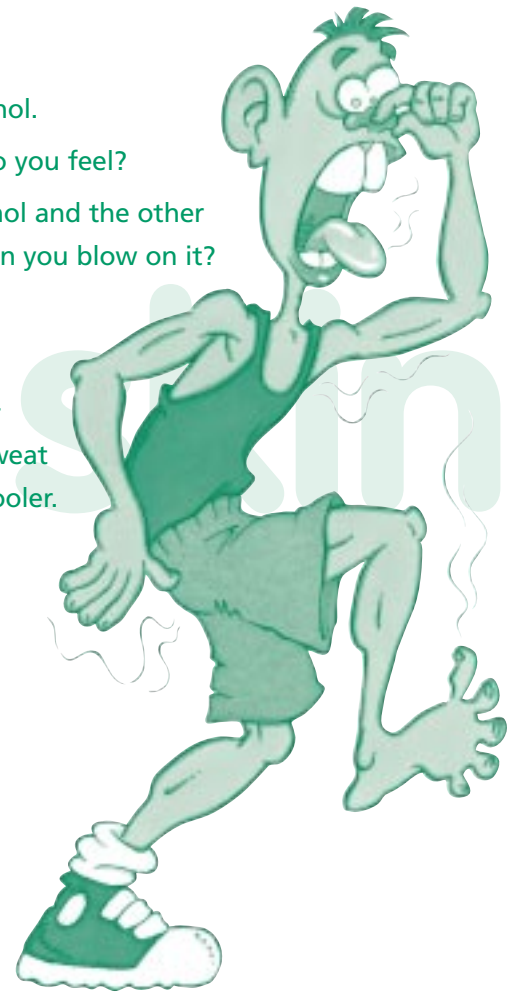


**What to do:**

1. Get the cotton ball wet with rubbing alcohol.
2. Swipe your forearm to get it wet with the alcohol.
3. Blow on the wet part of your forearm. What do you feel?
4. Try this with a friend: swipe one arm with alcohol and the other with water. Which feels cooler to your friend when you blow on it?

**What's going on?**

When alcohol or water evaporates, it takes heat from your arm. Rubbing alcohol evaporates faster than water, so it takes away heat more quickly. Sweat works the same way—as it evaporates, you feel cooler.



### skin

#### Investigations in Grossology

**Answers:**

1. Hair, soles of feet, palms of hands.
2. 28.
3. The skin.
4. Hands, feet, lips.
5. Palms and soles of feet.
6. A virus.
7. Body fluids, dead bacteria, dead fighting cells.

sebum—skin oil

boil—caused by bacteria infecting hair follicle

epidermis—layer of dead skin cells

dermis—layer of living skin cells

fat—keeps you warm

scab—dried blood clot

bromidrosis—stinky armpits

## Further Gross Research

Your students might want to try the oily skin test.

**Each student will need:**

- Washcloth and soap
- Rubbing alcohol
- Cotton ball
- Small square of tissue paper
- Clock

**What to do:**

1. Scrub your forehead with soap and water using the washcloth.
2. Swab your forehead with rubbing alcohol using the cotton ball.
3. Wait four hours. Do not touch your forehead during this time.
4. After four hours, smear the tissue paper across your forehead.
5. If more than half the paper has an oily mark, your skin is oily.
6. If a light oil smudge is on the paper, your skin is normal.
7. If there is no oil smudge, your skin is dry.

### skin

### skin