TRANSMISSIONS: GONE VIRAL *Supplemental Resource Guide*

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Transmissions: Gone Viral is an online interactive comic book designed to support young people (ages 10 – 14) in the development of scientific inquiry skills (i.e., collecting and understanding evidence, forming hypotheses, and using scientific tests to confirm their theories) and understanding that all animals, including humans, are related and share diseases. The e-book is comprised of five chapters and tells the story of a group of young people who investigate a series of crow deaths in their urban neighborhood. Working with a zoo scientist and a mosquito hunter, the young detectives collect and analyze evidence and eventually identify the disease and stop it from spreading.

The comic book and embedded interactives allow readers to join the characters in making sense of information and invite them to construct their own explanations about the events in the story. Major themes that can be explored through the use of *Transmissions* include: scientific evidence, mapping information to reveal patterns, the nature of scientific investigation, biomedical careers, homologous structures and disease transmission.

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STANDARDS ALIGNMENT

Transmissions can help middle school students build towards Next Generation Science Standards Performance Expectation.

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarities or differences of the gross appearance of anatomical structures.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions *Constructing explanations and designing solutions in 6 – 8 builds on K – 5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles and theories.* *Apply scientific ideas to construct an explanation for real-world phenomena, examples or events. (MS-LS4-2)*	**LS4.A: Evidence of Common Ancestry and Diversity** *Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)*	**Patterns** *Patterns can be used to identify cause and effect relationships. (MS-LS4-2)* **Connections to Nature of Science** ***Scientific Knowledge Assumes an Order and Consistency in Natural Systems*** *Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1), (MS-LS4-2)*

***Transmissions* also aligns to the following Common Core ELA/Literacy standards.**
Common Core State Standards Connections: ELA/Literacy

RST.6-8.1 *Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-LS4-2)*

WHST.6-8.2 *Write informative/explanatory texts to examine a topic and convey ideas, concepts and information through the selection, organization and analysis of relevant content. (MS-LS4-2)*

WHST.6-8.9 *Draw evidence from informational texts to support analysis, reflection and research. (MS-LS4-2)*

SL.8.1 *Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts and issues, building on others' ideas and expressing their own clearly. (MS-LS4-2)*

SL.8.4 *Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning and well-chosen details; use appropriate eye contact, adequate volume and clear pronunciation. (MS-LS4-2)*

ABOUT THIS GUIDE

Transmissions can be used in a variety of contexts, including but not limited to schools, libraries and out-of-school-time programs. In this guide, you will find:

- Chapter Overviews — To provide brief snapshots of the key concepts and ideas highlighted in each chapter.
- Discussion-Based Activities — To scaffold students experience reading and interpreting an interactive comic, and to support or extend understanding of concepts highlighted in the book.
- Materials-Based Activities — To give students hands-on opportunities to explore science concepts and practices in more depth.
- Guiding Questions — To push students' thinking and support student discourse.

CLASSROOM MANAGEMENT TIPS

Accessing the Interactive Digital Comic

This digital comic requires access to computers or tablets. Students can access the comic individually, or work in pairs or in small groups. If you do not have a class set of devices, some accommodations are listed below. You can use a combination of these strategies, as well as your own, in order to give students the opportunity to take full advantage of the interactivity of the comic book.

- Have students take turns accessing the comic online: If you have a few computers, you may play around with sequence so that some students work on the interactive portions of the comic, while others work on supplemental activities.
- Print the comic: While this is not preferable, printed documents would allow students to work through the story without a computer and then access the interactives at home or at another time.
- Project the digital comic on a whiteboard and work through the story as a whole class.
- Bring students to a computer lab.

Timing and Pacing

The time it takes to fully engage with *Transmissions* will vary based on your teaching setting and your learners, but it is suggested that you allot 10 – 12 hours, or about two or two-and-a-half hours per chapter of the comic. This estimate includes time for students to read through and make sense of the comic, as well as time for one or two supplemental activities per chapter.

Keeping Track of Information and Updating Absent Students

Just like the characters in the comic, learners are encouraged to keep track of information and ideas as the story progresses. This not only helps students build on their thinking over time, but can also be used to empower learners to take on the role of updating students who may have been absent from previous class periods or program sessions.

In addition to keeping paper portfolios, the following two options can also support students in keeping track of information.

Evidence Board — Use a chart paper or whiteboard to collect, document and display information, and be sure to put it in a place that makes it easy to add to as the story progresses. This can be done as a whole class or in groups. This technique works especially well for drop-in programs or other contexts where student attendance at each session is not guaranteed.

Digital Portfolios — Digital portfolios allow students to quickly record their ideas and incorporate digital photos, diagrams, etc. Some digital portfolios you can use include:

- *Evernote: Accessible on any device, including smartphones. Evernote.com*
- *Google Sites, specifically Googlio: This works especially well for schools where students have a Gmail account already set up. sites.google.com/site/googlioproject/home*
- *Weebly: education.weebly.com*
- *Mahara: mahara.org*

Flipping the Story

Depending on where and how you are using the comic, you may ask students to read the comic as homework or outside of group time, and use class time for discussion, exploration of the interactives, etc.

Chapter 1

Overview

In Chapter 1, we are introduced to the three central characters: Maria, her brother Eduardo, and their friend Rani. The children are on their way to the Metro City Science Center when they encounter a dead bird, and decide to collect water samples, and take pictures.

At the Science Center, they explore an exhibit related to the similarities between the physical structure of humans and non-human animals. They run into a veterinary pathologist named Terry who gives them insight into the exhibit, and when Terry accidentally leaves her ID behind, the kids make a plan to return it to her at the zoo where she works. They finish the day back at Rani's house where she uses her new microscope to examine the water samples she collected, discovering mosquito eggs that she hadn't noticed before.

Key concepts in this chapter include:

- Introduction of characters.
- Homologous structures.
- Partial mosquito life cycle.

Discussion Activity

How Do I Read This Comic Book?

Although many of your students may be familiar with comics or graphic novels, it is helpful to provide some orientation to how to read and interpret the panels of the *Transmissions* comic.

Provide students with pages from a few different comics. Be sure to include a mix of pages with text and those with just images. After students have had time to review the different pages, engage in a class discussion. Be sure to touch on the following key points.

- Ask students about what they were able to learn from pages with just images. Remind them that comics provide information via text and images. It is important to take time to review the details of the pictures as well as the words.
- Vocabulary: Panel = A single frame of a comic.
- Ask students to identify a panel that includes a word balloon and one that includes a speech bubble. How can they tell the difference? What is the purpose of each?
- The order in which you read can vary, but in general, in Western comics you read left to right, top to bottom, unlike Manga, which is read right to left. If you encounter a page that you're not sure how to navigate, try reading it in a few different sequences to see if you can find a flow that makes sense.

Additional Resources

Understanding Comics by Scott McCloud
Maus by Art Spieglman
Spectra: The Original Laser Superhero by Rebecca Thompson-Flagg
Tetris: The Games People Play by Box Brown
(H)aftrocentric by Juliana "Jewels" Smith

Discussion Activity

Create Your Own Character Cards

Each character in *Transmissions* has their own character card that provides details about the character's personality and ways of approaching the world around them. The three young protagonists — Rani, Maria and Eduardo — all have different personality traits that allow them to look at the central mystery from different perspectives.

- Rani: Collects evidence, uses her microscope, organizes details, and likes to understand how things work.
- Maria: Blogs, documents via pictures, and is interested in "the facts."
- Eduardo: Thinks outside the box, and considers alternative ideas.

These different perspectives all represent important facets of a scientific mindset, and when combined, ultimately help the characters figure out what is happening.

In order to support learners in considering how each character's "special talents" play an important role in the story, and to help learners think about their own "special talents," you can have learners create their own character cards that add to the character cards already featured in the comic. Students can add detail to each card as the story progresses, add new cards as new characters enter the story, or even create character cards for themselves as they follow along to help solve the mystery.

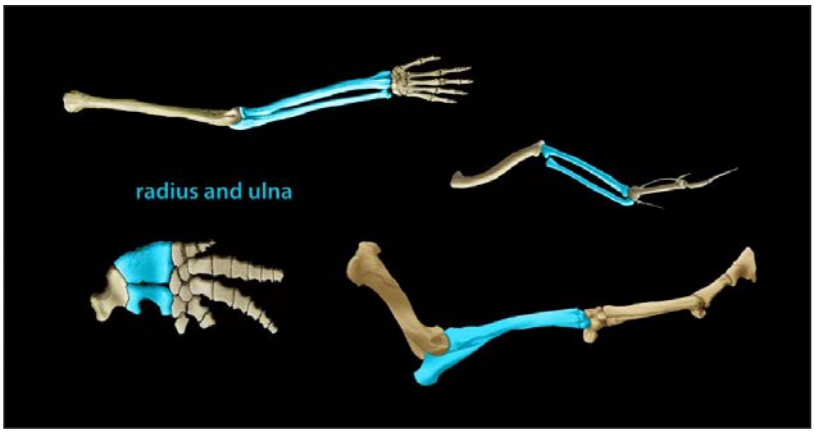
These cards can also be a useful formative assessment tool, helping you to understand how students are interpreting the story and providing insights into areas where they might need support in making sense of what's going on in the comic.

To get students started, pause after students have read through page 4. If they haven't already, ask them to explore the character cards for Rani, Maria and Eduardo, and then return to the main comic. Ask them following questions:

- Why do you think Maria is collecting water? A mosquito?
- Why do you think Rani is taking so many pictures? What do you take pictures of? Why?

Material Activity

Homologous Structures Sort



The *Build a Body Interactive* on page 10 allows students to explore similarities and differences in the skeletal structures of humans and non-human animals. This concept of similarity in structure due to common ancestry is called homology and is central to the *Transmissions* story.

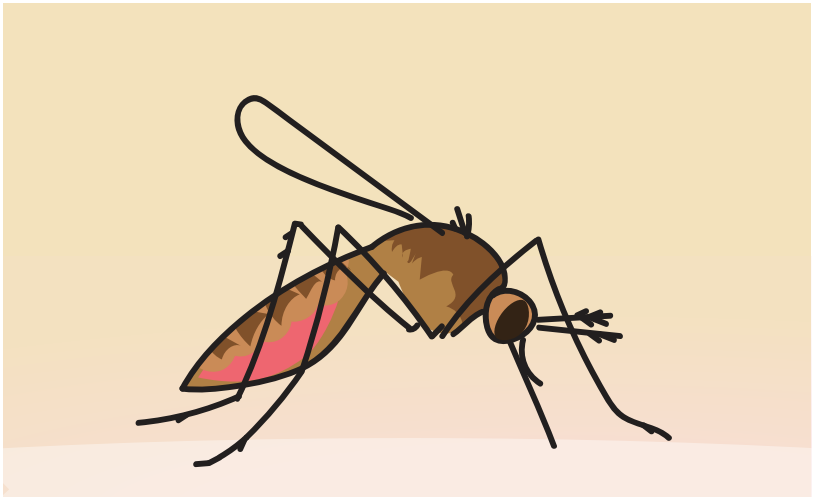
To deepen students understanding of this concept, you can use the activity below, either before or after the *Build a Body Interactive*.

1. Split students into small groups and pass out the set of skeletal pictures to each group. Ask groups to sort the cards based on similarity.
2. After students have had time to sort, ask them to share their card groupings as well as their rationale for each grouping.
3. Have students set aside the skeletal cards, still keeping them in piles based on similarity.
4. Next, pass out the sets of cards that show the external features of animals and again have students sort based on similarities.
5. Have groups share out their groupings and rationale.
6. Now, reveal the names of the animals for each of the skeletal cards. Ask students how did their groupings compare? Did they sort the same animals into the same categories for both the external and skeletal cards?
7. Wrap up by informing students that the similarities in the bones of the forelimbs of vertebrates, like those on the cards, are due to a shared common ancestor. This is called homology. Although the animals on the cards may look different on the outside, looking inside can reveal similarities. Bones are not the only place we see homology in nature. Ask students what other things they think might be homologous?

Additional Resources
evolution.berkeley.edu/evolibrary/article/0_0_0/homology_02

Discussion Activity

Bzzzzz: Insect Life Cycles



Rani's discovery of mosquito eggs on page 13 of the comic is a great place to assess students' prior knowledge about insect life cycles. While you don't want to give anything away, the idea that mosquitos lay eggs in water will play an important role in the story, so it is helpful to support students in attending to the eggs Rani finds in her water sample.

As a quick formative assessment, ask students why they think Rani found eggs in her water sample. Then ask them to quickly draw and label what they think the life cycle of a mosquito looks like. You can return to these drawings later on in the story and compare them to the mosquito life cycle graphic on page 43.

Additional Resources
epa.gov/mosquitocontrol/mosquito-life-cycle

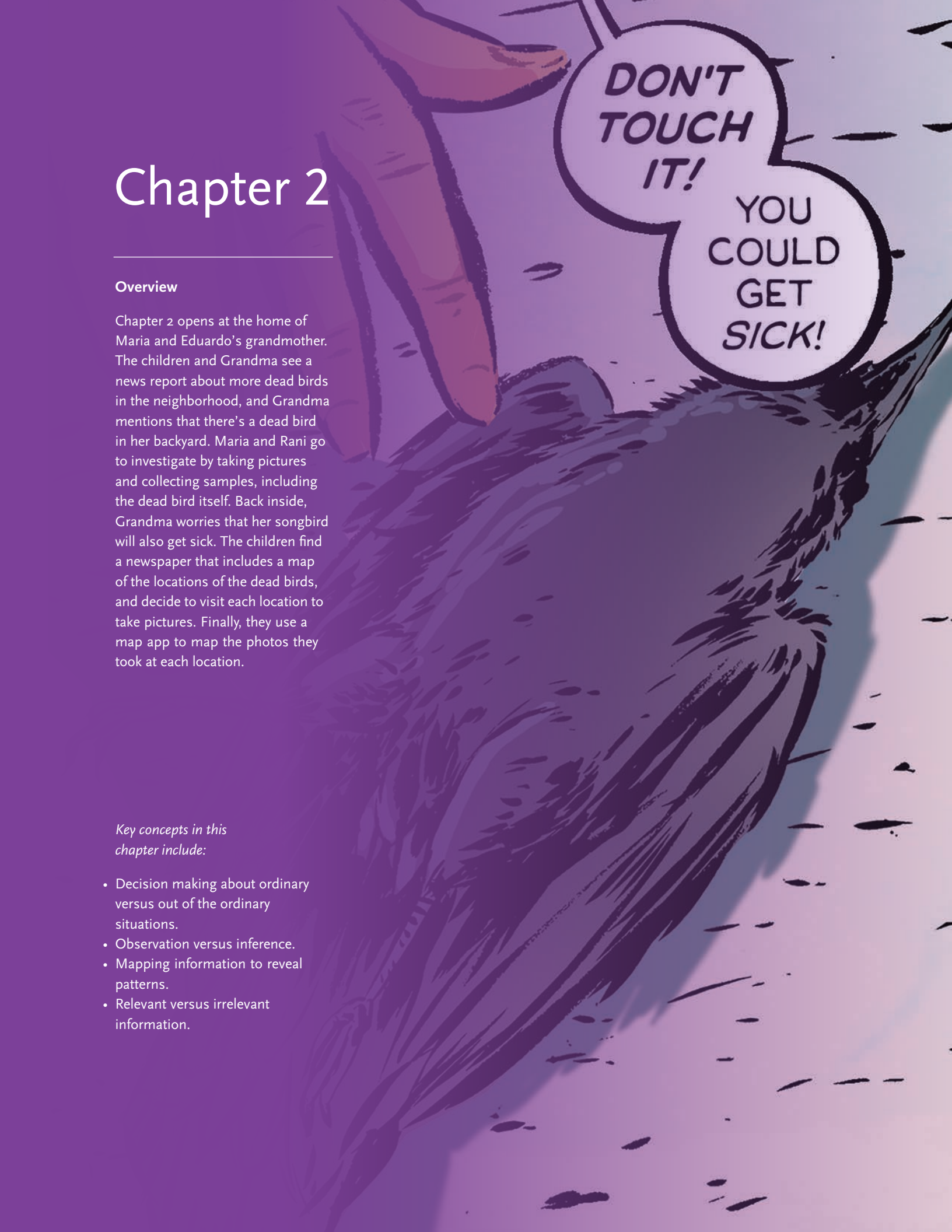
Chapter 2

Overview

Chapter 2 opens at the home of Maria and Eduardo's grandmother. The children and Grandma see a news report about more dead birds in the neighborhood, and Grandma mentions that there's a dead bird in her backyard. Maria and Rani go to investigate by taking pictures and collecting samples, including the dead bird itself. Back inside, Grandma worries that her songbird will also get sick. The children find a newspaper that includes a map of the locations of the dead birds, and decide to visit each location to take pictures. Finally, they use a map app to map the photos they took at each location.

Key concepts in this chapter include:

- Decision making about ordinary versus out of the ordinary situations.
- Observation versus inference.
- Mapping information to reveal patterns.
- Relevant versus irrelevant information.



Discussion Activity

Something Strange Is Going On — Kinesthetic Class Discussion

After students have had a chance to read through page 18, ask them "What is the problem or mystery that the characters have discovered?" After students have had a chance to respond, follow up with some of the following questions.

- Why do the characters see this as a mystery?
- Have you ever seen a dead bird in your neighborhood? Did you think it was strange? Why or why not?
- How many dead birds does there need to be to indicate that something big is happening? Does the whole class agree on this number?

Designate one area of the room "ordinary" and one "really out of the ordinary" and delineate a line between the two areas. Then, present some of the following scenarios. For each scenario ask students to get up and move to where they think that scenario fits on the line between ordinary and really out of the ordinary. For example, if they think something is pretty ordinary, they would place themselves on the line closer to that area of the room. After each scenario, invite some students to share their rationale for picking one area of the room versus the other. *Note: These scenarios will lead to different discussions depending on your context. For example, if you live in an area with lots of rain, the first scenario may seem more ordinary, while in arid areas, it may seem unusual. Feel free to create your own scenarios based on the experiences of your students.*

1. It rains heavily five days in a row.
2. On Monday, Tuesday and Wednesday, it takes you 30 minutes to get to school, and on Thursday and Friday, it takes you 45 minutes.
3. You watch traffic for 10 minutes, and you notice three white cars go by in that time period.
4. You're at a party with 25 people and there are three people with glasses.
5. You're at a party and there are no people with brown hair.
6. You don't see cats or dogs in your neighborhood two days in a row.

As an extension, see if students can come up with their own scenarios. Wrap up by noting that it is our experiences that influence what we consider to be a threshold between "normal" and out of the ordinary. While some variation might not make us think twice, big deviations from an average indicate that something out of the ordinary is happening. In the case of the comic, the neighborhood doesn't usually see so many dead birds at once. That's why the characters are paying attention to the birds.

Material Activity

Mystery Bags: Inference Versus Observation

PART 1

Before students arrive, place several different objects into brown paper bags to create "Mystery Bags" (one object per bag). Try to use objects with different textures, weights, etc.

Begin by asking students "What is an observation?" Use their responses to create a working definition for observation. In general, observations are information we collect using our senses.

Tell students that they will be practicing their observation skills, but with a twist — they will not be using their sense of sight. Pass out one bag per student, and ask them to try to figure out what is in their bag without looking in the bag. Ask them to not only think about the object, but to pay attention to how they are figuring out what is in the bag.

After students have had 1 – 2 minutes to figure out their object, tell them they can look inside the bag to see if they were correct. Tell them not to shout out their object or to remove it from the bag. Then, have them trade bags with someone on the opposite side of the room and repeat the process. You can do two or three rounds of this so students have the opportunity to engage with multiple "Mystery Bags."

After you are done, ask students to share some of the objects they had. Which ones were easy to figure out? Hard? Why? What information were students using to figure out what was in each bag?

Ask them "What is an inference?" If needed, tell them that inferences are explanations for observations. In this case, we made observations that helped us infer what was in the bag. For example, if we felt that the object in the bag was heavy and rough, we might infer it was a rock. We wouldn't know for sure until we looked, but we used the evidence available to us to make an inference.

PART 2

Tell students that they are now going to continue practicing their observation skills, this time with their sense of sight. Inform them that you will be showing them an object. *You could also use a photo, live animal, exhibit area, etc. It is best if your provide an object or image that is somewhat familiar to students.* They will have one minute to write down as many observations as they can on a sticky note (one observation per sticky note).

After a minute has passed, have them bring their sticky notes together and ask them to see if they are all observations. There will probably be at least a few notes that are inferences. Use these to engage in a class discussion that reinforces the difference between observation and inference.

Wrap up by asking students why they think it might be important for the characters in the story to focus on observations before jumping to inferences.

Material Activity

Litter Bug Mapping Activity

We suggest completing this activity just prior to engaging with the *Transmissions Map Interactive* as a way to probe student thinking about why we might want to map information.

HOW TO:

1. Point out that Eduardo doesn't know why Rani and Maria want to map the location of the dead birds. Ask students why they think a map might (or might not) be helpful for what the characters are trying to do? What does location have to do with anything? Does the locations of where dead birds are found matter? Why or why not?

2. Tell students that they will be taking a quick break from the *Transmissions* story to look at another group of students. Read or pass out the following story:

The City Council has a budget surplus of $200,000. The council has a plan to use the money to build new playgrounds and fix up existing basketball courts and baseball fields. This morning, the editors of a local newspaper wrote a scathing editorial calling the plan "frivolous," and calling the city's kids and teens "irresponsible" and "ungrateful." The article claims that the local youth don't appreciate the playgrounds and sports facilities that they already have — stating that every afternoon when the editor drives home from her office, she passes a number of playgrounds and parks covered with litter and trash. "Why should the taxpayers pay for new playgrounds when these teenagers are treating the existing ones like garbage dumps?" The editor recommends the money be spent filling in potholes in streets.

One group of eight graders was outraged! They insist that they do not litter in the playgrounds. One eighth grader said "Yeah, the trash is there, but we don't put it there. We hate it. We have to kick it off the basketball courts when we want to play, otherwise we'll trip over it. Yuck. It's not our fault, and it's a BAD reason not to build new playgrounds. We need more places to play and hang out."

3. Pause and ask students what claim the editor is making about the teenagers and the playgrounds. Based on the information in the story, what evidence supports the editor's claim? What are some things the eight graders could do to provide evidence that does NOT support the editor's claim (counterevidence)?

4. Continue reading:
The eighth graders decided to do some research. They traveled around the neighborhood marking off some important data. They rode buses to get around. The first piece of data that you have is the bus routes they traveled. The second piece of data is all of the playgrounds and sports fields they saw. The third piece of data

is which, of those, were covered in litter and trash. Along the way the students bought food from street vendors, and recorded the locations of the food carts.

5. Working together in groups, pass out the *Map Files* handout. Introduce each layer one by one, and ask students what they think is happening after each new layer is added. For example, after adding the second layer, they might think that the litter is coming from bus riders.

Or you can give different groups different layers, and ask them to share their ideas about where the litter is coming from. They'll have different ideas based on the data available to them. Then, ask the class to combine their map layers to see if that changes their perceptions.

6. Wrap up by asking students the following questions:

> Based on this information, what claim can you make about who is littering? What evidence supports that? *The most likely answer is that the litter seems to be tied to the location of food vendors. No matter the claim, be sure to push students to back their ideas up with evidence from the map.*

> What does mapping the information reveal? How did adding different layers to the map change your ideas about what was happening? What patterns were revealed?

> Based on your claim, can you think of a solution that would help with this litter problem. *For example, add in more trash cans near food vendors.*

Guiding Questions

Chapter 2 Wrap-Up Discussion

Ask students to take a close look at the photos the characters have taken on page 21. Ask "Why do you think kids took pictures of a rat poison sign? The donut shop? What do these have to do with the question they are trying to answer?"

- How do we decide what information relates (is relevant) to the mystery we're investigation?
- What do you think is killing the birds? What can help us figure out why the birds are dying?
- What is the difference between information and evidence? *In general, evidence is information that is used to answer a specific question or support a specific conclusion.*
- What are some ways we can decide what information is related to the question we are trying to answer (what is killing the birds)? For example, would the fact that Grandma has a hat with feathers on it be relevant? Why or why not?

Chapter 3

Overview

The three children are at the Metro City Zoo to return the ID Terry dropped at the Science Center. After passing the empty flamingo exhibit, they find Terry in her lab about to necropsy a flamingo that died unexpectedly. She invites the kids to follow along with the dead crow they had collected from Grandma's yard.

While at the zoo, the kids receive a phone call informing them that Grandma is at the hospital with a high fever, and they learn that area hospitals are filling up. They wonder if there is a connection between the dead birds and the sick people. Based on the necropsy, Terry and the kids find evidence of infection in the brains of both the flamingo and the bird from Grandma's yard, but a blood test reveals that the infection is not bird flu. The chapter ends with the arrival of a mystery character carrying the even more mysterious "the thing."

Key concepts in this chapter include:

- Lab practices, such as necropsy and microscopy.
- Antibodies and immune system responses.
- Scientific explanations.
- Scientific versus colloquial language.
- Relevant versus irrelevant information.

Material Activity

Lab Practices and Antibody Activity

In this chapter, Terry guides Maria, Rani and Eduardo in a number of lab practices. You can start this activity by asking students about the types of labs they might have seen in pop culture (for example, CSI, NCIS, etc.). What techniques are used? For what reasons? Who works in these labs?

Then, return back to the comic and ask your students to review Chapter 3 to recall the different tests and procedures performed in Terry's lab. Help them think about the reasons for each test.

- Necropsy — This dissection of the dead birds allowed the characters to compare the anatomy of the dead birds with the anatomy of a healthy bird.
  > What did the characters see in the dead birds that meant there was some sort of infection? How did they know? *They saw swelling and blood, which was different from the picture of the healthy bird.*

- Creating, staining and examining microscope slides — The microscope allowed the characters to observe the presence of immune system cells, indicating that these cells were fighting some sort of infection.
  > Why did we add stain to the slide? *The stain helps more clearly visualize specific cells or parts of cells.*

- Antibody blood test — The first two tests indicated the presence of an infection and the blood test allows Terry and the kids to test for the presence of a specific virus that they think might be causing the infection.
  > What are antibodies? *Antibodies are chemicals produced by immune system cells.*

After reviewing the purposes of the different tests, engage students in a discussion about how the characters are behaving like scientists, using the following questions to guide you. It is important for your students to understand that they are capable of acting like scientists, and that practice is how we get better at using this equipment AND thinking scientifically. Help them see that science isn't just about equipment but is a way of thinking and investigating things systematically.

- What do you think about the kids following along with Terry as she performs these lab procedures?
- Which character(s) is acting the most like a scientist in this chapter? What are they doing that the others aren't?
- How have you been acting like a scientist (in this program, at home, etc.)?

Depending on the equipment and materials available to you, you can then have your students participate in any of the activities described in this chapter (dissections, microscopy, investigating antibodies). We've include the following antibody activity and additional resources as starting points.

Antibody Activity

Before students arrive, prepare the "blood sample" test tubes. Each pair of students will need three samples labeled:

"Known — Bird with Bird Flu": mixture of water and milk, red food coloring
"Known — Healthy Bird": water, red food coloring
"Unknown — Blood from Dead Crow": water, red food coloring

Each group will also need a small bottle with vinegar labeled "Antigen." Also, while not necessary for this activity, if available, you can also have students wear goggles and gloves to reinforce good lab practices.

Tell students that they will be doing a very simplified simulation of the blood test the characters performed. Ask them to carefully read each of the test tube and bottles labels, and review each label if necessary.

Tell them that in this activity, they will be adding "antigens" to the blood samples. Antigens are substances that stimulate an immune system response. Antigens stick to, or bind with, specific antibodies. So in this case, a positive test result, which will indicate the presence of bird flu, will look like small clumps have formed in the "blood." A negative result will leave the "blood" in the tube looking the same.

Ask students what should we expect to see when we add the "antigen" to the "blood" in the "Known — Bird with Bird Flu" tube? Students can now add "antigen" to the test tube "Known — Bird with Bird Flu." What do you observe? *The clumping we see is a positive reaction indicating that there is the presence of flu here, just like the label tells us.*

What should we expect to see when we add the "antigen" to the "blood" in the "Known — Healthy Bird" tube? Students can now add "antigens" to the test tube "Known — Healthy Bird." What do you observe? *The lack of clumping you see is a negative reaction indicating that there is no evidence of bird flu here, just like the label tells us.*

Now, we come to our unknown. Students can now add "antigen" to the "Unknown — Dead Bird" tube. What do we see? What does this mean? *There is no clumping, which is a negative result indicating that there is no evidence of bird flu in this blood.*

Although the real blood tests scientists use to identify the presence of specific viruses is more complex, the basic idea is the same. They are looking for the antibodies that immune cells create in reaction to the virus. A positive test result shows the antibodies are present in the blood, and a negative result shows they are not.

Additional Resources

Antibodies and Blood Tests:

biobest.co.uk/diagnostics/techniques/elisa-how-does-the-test-work.html

hhmi.org/biointeractive/immunology-virtual-lab

discoveryeducation.com/teachers/free-lesson-plans/operation-antibody.cfm

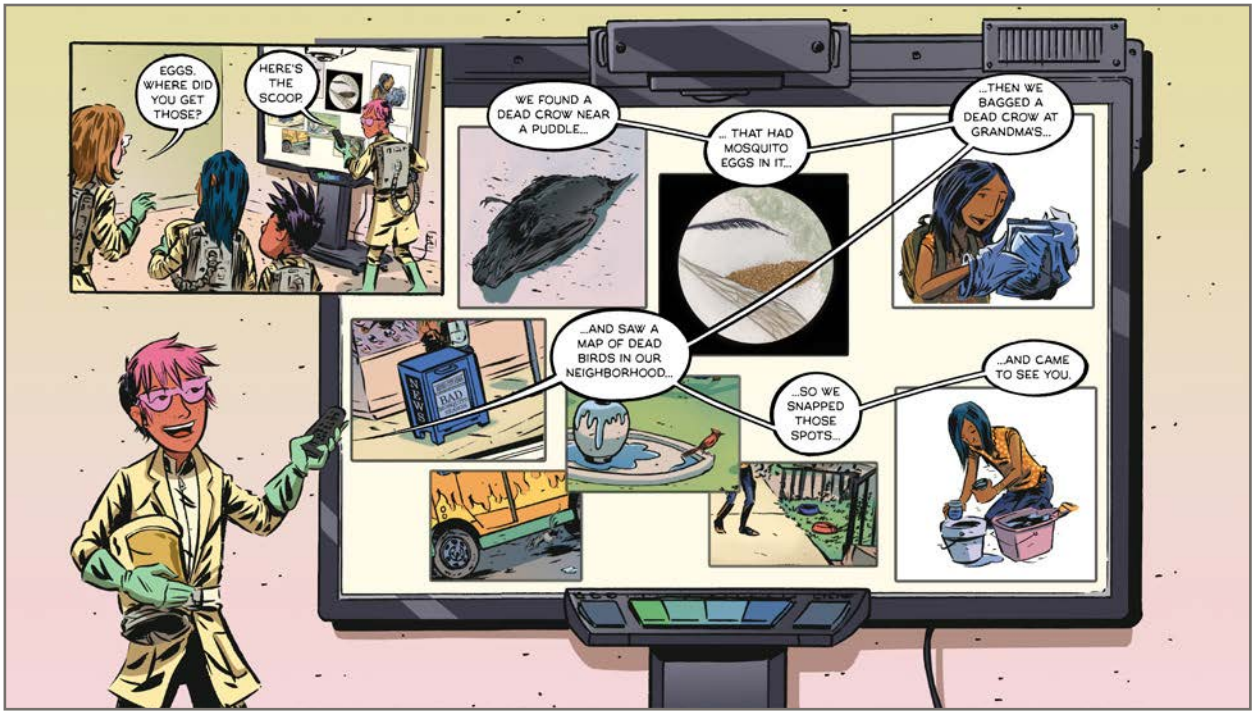
Sheep's brain dissection:

exploratorium.edu/memory/braindissection/

Creating and staining microscope slides:

carolina.com/teacher-resources/Interactive/make-microscope-slides-for-science-fair-projects/tr10768.tr

serc.carleton.edu/microbelife/research_methods/microscopy/index.html



Discussion Activity

Review the Evidence Explanation Tool

After your students have read all of Chapter 3, return to page 30. If your students have been taking notes or if you have a whole class "evidence board," compare their ideas with the ideas the characters are presenting to Terry on page 30. Ask them if they think the characters missed anything.

Then, split students into three groups. Each group will be responsible for taking on the role of one of the three children: Maria, Eduardo or Rani.

Working with their team, students should complete the first part of the Explanation Tool, thinking about how their character would interpret the events of the story up to this point. Then they should complete the second section, thinking about whether or not they agree with their character's interpretation and coming up with their own claim and supporting evidence.

This activity will give you an idea of how students are interpreting the story and encourages learners to do a closer reading of the text. It also gives students practice creating a scientific explanation (which differs from explanations they may have created in ELA classes). This is a skill that they will develop over time, so it is expected that their explanations might be incomplete, particularly if this is their first time engaging in this practice.

- **What do you think your character thinks is causing the birds to die?**

- **What are two pieces of evidence from the text that make you think your character thinks this way?**

- *Now, write your own claim about what is causing the birds to die and support your claim with evidence from the text and scientific reasoning.* **Claim: The birds are dying because...**
  they are sick from drinking dirty water.

- **Evidence: What are the science observations or information that support your claim?**
  The necropsy showed a bloody brain.
  Maria took many photos of water at the site of dead birds.

- **Reasoning: What science concepts connect your evidence and claim?**
  A bloody brain is a sign of infection and is not found in healthy bird brains.
  The map showed a relationship between the dead birds and water.

- **Scientific Explanation: Now, put it all together.**
  My claim is that the birds are dying because they got sick from drinking dirty water. The necropsy showed the dead bird brains were bloody, which is a sign of infection. Also, Maria took many pictures of water, and the map showed that there was water at almost every location where a dead bird was found.

YOUR NAME

YOUR CHARACTER'S NAME

- **What do you think your character thinks is causing the birds to die?**
- **What are two pieces of evidence from the text that make you think your character thinks this way?**

- *Now, write your own claim about what is causing the birds to die and support your claim with evidence from the text and scientific reasoning.* **Claim: The birds are dying because ...**

- **Evidence: What are the science observations or information that support your claim?**
- **Reasoning: What science concepts connect your evidence and claim?**

- **Scientific Explanation: Now, put it all together.**

Discussion Activity

Scientific Versus Colloquial Language

Start by encouraging students to think about the type of language they use when texting or posting on social media. Is it the same as the language they use with their parents? At school? How does the language we use change depend on the context we're in?

There are some words that have one meaning in science contexts and a totally different meaning in everyday usage.

For example, on page 34 it is helpful to review the usage of "negative" and "positive" as they relate to antibodies. In this case, a negative test result means no virus was detected. A positive result would have meant virus was detected.

To further reinforce the idea that context matters when thinking about scientific versus non-scientific usage of words, have students create word concept maps or comparison charts for some common science terms that have a different meaning in colloquial language. Depending on the needs of your students, you can scaffold this by providing access to an online dictionary and thesaurus, or you can prefill the science meanings so that students are just filling in the colloquial in order to make comparisons.

Remind students that although these differences might seem confusing, just like we practice using scientific equipment or using scientific practices, we can practice using scientific language.

Suggested Resources
visualthesaurus.com/cm/lessons/science-words-with-multiple-meanings/sciencewords.pdf
southernfriedscience.com/the-importance-of-word-choice-terms-with-multiple-meanings-for-scientists-and-the-public/
blogs.agu.org/mountainbeltway/2011/10/17/words-matter/

Discussion Activity

Scientific Versus Colloquial Language

On page 27, the kids in the story wonder if there is a connection between the dead birds and sick people. In this activity, the students in your class will have the chance to debate the question: "Is there a connection between the dead birds and sick humans?"

For some students, this may be the first time they have been asked to engage in an argument from evidence. Students' argumentation skills will develop over time, so the focus for this activity should be on encouraging students to support their claims with evidence, not crafting a perfect argument.

Begin by asking your students to generate some rules for a respectful debate. These might include "focus on the evidence, not anything personal," "don't interrupt," "be kind," etc.

Then, designate one area of your room for students who believe there is a connection and one for students who do not. Or, you can choose to split your students evenly between the two groups.

Here is one way you can structure the mini-debate:

- Give each group 10 minutes to prepare their argument and remind them to use specific information from the text to support their ideas.
- Each group gives a two-minute presentation of their argument.
- After each group has had a chance to present, each group receives an additional one minute to respond to their opponents' presentation.
- Wrap up by asking if anyone has changed their mind based on the presentations. If so, what changed their thinking?

Suggested Resources
web.archive.org/web/20060503194518/http://w3.tvi.edu/~cgulick/roles.html
educationworld.com/a_lesson/lesson/lesson304b.shtml

Chapter 4

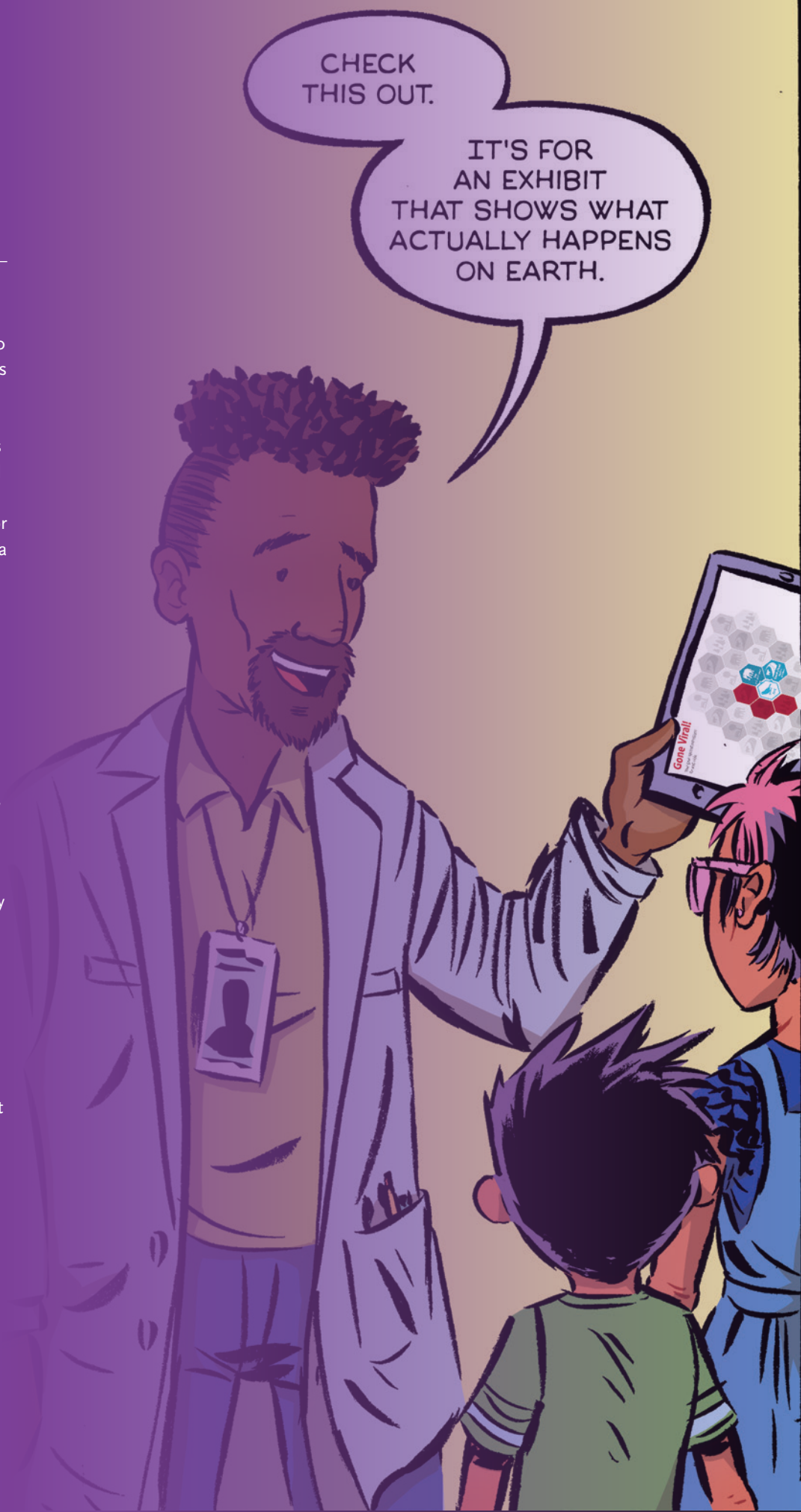
Overview

The mystery character is revealed to be Zip, Terry's tech expert. He invites the children to play a computer game in which they learn how viruses spread via vectors. The kids receive a video call from Maria and Eduardo's mom, who is at the hospital with Grandma and a doctor named Madu. It turns out Grandma has encephalitis, just like the birds.

Madu has been visiting the homes of people with the same symptoms as Grandma, and has discovered standing water and mosquitoes at each location. The kids remember the connection between humans and non-human animals that they learned about at the science center, leading the group to think the birds and people are being affected by the same illness, one that is spread by mosquitoes. They initially think the sickness is St. Louis encephalitis (SLE), but rule it out because SLE does not affect birds. They learn the city is planning to cancel the Big Parade because they don't know why people are getting sick. Now the group is racing to save the parade by figuring out what the illness is and proving that it is spread by mosquitoes so that the city can spray insecticide.

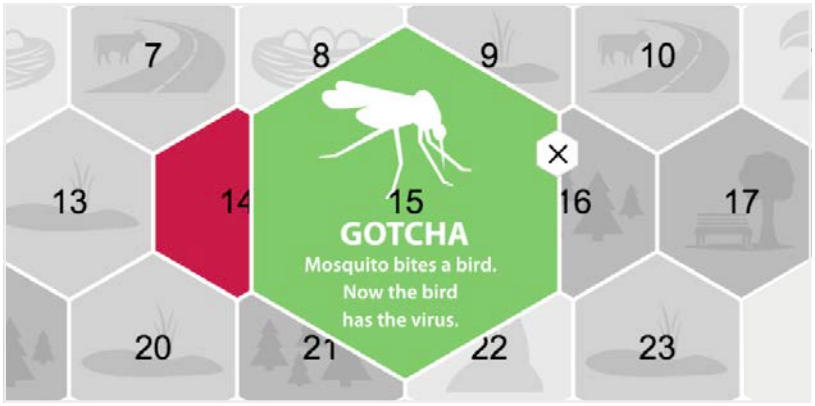
Key concepts in this chapter include:

- Virus transmission.
- Mosquito bite mechanism.
- Collecting evidence systematically.



Guiding Questions

Virus Interactive In Depth



The *Virus Interactive* allows students to take a closer look at how viruses spread. First, students choose either a bird or mosquito as host. Then, they make choices about where the host will travel with the goal of infecting as many tiles in the interactive as possible.

Students should start to notice some of the following:

- Differences in host — it is possible for the virus to kill its host bird, but it does not kill the host mosquito.
- Importance of water for mosquitos.
- Immunity — Some organisms, like specific birds or people, as well as mosquitoes, can resist the infection.

To help students think more deeply about their choices in the game, have students play the interactive in small groups. This encourages students to voice their ideas about what effect their choices will have in order to come up with a group strategy. It is also helpful if you give students time to play the interactive multiple times, so they can try out different tiles and ideas.

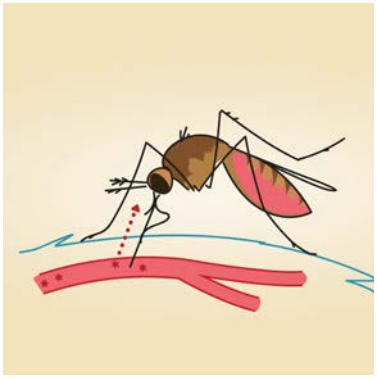
Here are some discussion questions to guide students' thinking.

- Describe the strategy your group used to make decisions about which tile to pick.
- Do you notice differences in playing as a bird as a host and a mosquito as a host?
- How did your choice of host affect your decisions while playing?
- Can you make any general statements about the rules of the game? (i.e. areas with more people seem to lead to more infected tiles, etc.)
- Were you surprised about the outcome of any of your choices? Why or why not?

Material Activity

Mosquito Bites

Although most students are aware that mosquitoes bite, causing an itchy bump, they are probably not aware of how a mosquito bite can spread infection. In this simple activity, students learn about the mechanisms of mosquito bites. Have students complete this activity after they have seen the mosquito life cycle graphic on page 43. If you had students complete activity 1.4, this is also an ideal time to return to the drawings they made.



First, show students the following short video (or something similar): youtube.com/watch?v=rQV5hHwzj4Y

Then, provide students with paper, scissors, markers, tape and a pipette. Tell students that they will be creating their own mosquitoes using these materials. The pipette will serve as the body, and the paper will be the wings, legs and antennae. If you have a short amount of time for this activity, or if your students struggle with fine motor skills, it isn't necessary to add the details of wings, etc. You can encourage students to make Culex pipiens mosquitoes (the specific species featured in the story), which have stripes, or show them images of other mosquito species.

Additional Resource
youtube.com/watch?v=rD8SmacBUcU

After students have had a chance to create their mosquito, show them how to use the pipette if necessary. Then, present them with a cup of water with red food coloring and one with plain water. Tell them the first cup represents a bird with a virus. Ask them to "take a blood meal" from this bird, filling up their pipette. Then, ask them to take a second blood meal from the clear cup, which represents a bird not infected with a virus. What happens? Students will notice that in the process of "taking a blood meal," some of the virus infected the second bird.

Guiding Questions

Evidence Board Recap

Page 44 is a good place to pause to recap what has happened in the story so far. Encourage your students to reference their notes or class "evidence board" as well as the *Map Interactive* from Chapter 2.

- What additional evidence has been added in this chapter?
- Why do the characters think the mystery illness might be St. Louis encephalitis (SLE)? (SLE shares many of the same symptoms as Grandma and the other infected people.)
- Why do the characters think it can't be SLE? (SLE doesn't kill birds.)
- Why would the city cancel the parade?

Material Activity

Collecting Evidence

Ask students "Have you ever used evidence to prove something? What about to prove that something is wrong?" Ask a few students to share. "What is proof? What does good evidence need to be if it is going to prove something?"

Tell students that you will now be asking them to collect evidence to answer a central question. The question you ask will vary depending on your context. For example, if you are in a library setting, you could ask a question about the level of engagement in certain areas of the library.

Provide students time to gather evidence around the central question. Then ask:

- Are there different ways we could categorize the evidence we collected? *If there is time, you can have students actually sort their pieces of evidence into categories that they create. For example, evidence that is a concrete measurement versus evidence that is more descriptive.*
- What is one piece of evidence that may prove (that the computers are the most engaging area of the library)? Sample response: The most people visited the computers.
- What is one piece of evidence that suggests (the computers are not the most engaging area of the library)? Sample response: People spend the longest amount of time reading magazines.
- If I had asked you to simply prove that (computers were the most popular area of the library), what would you have missed?

Be sure to emphasize that gathering evidence in science is not about simply "proving" or "confirming" ideas, it is about collecting information systematically. If we only collect evidence to support one idea, we might miss something important.

Chapter 5

Overview

The kids recap what they have discovered so far, and by researching this information, Maria thinks the mystery illness is West Nile Virus. Although West Nile has never been reported in the Western Hemisphere, the characters think back to the virus game that Zip shared and realize that diseases can spread geographically. The team splits up — some characters test the blood of the birds and the sick people to look for evidence of West Nile Virus, some take pictures of the birds' brain cells to look for West Nile Virus, and some head to the Mayor's office. They confirm that it is West Nile Virus, alert the Mayor, and the parade is saved. Grandma begins to recover, and the kids are able to wear the costumes she made to the parade.

Key concepts in this chapter include:

- Disease transmission across large geographical distances.
- Quality versus quantity of evidence.

Material Activity

Collecting Evidence

Although the *Virus Interactive* in Chapter 4 demonstrates how viruses are transmitted via vectors, it is helpful for students to think about additional factors that allow viruses to be spread across large geographical distances.

PART 1

Ask students: "Does it make sense that a bird from another country could bring a disease here to the United States? What are some ways that could have happened? What could happen if a mosquito then bit that bird?"

Ask students to examine the *Real Deal: West Nile Virus Outbreaks* on page 52. What are some questions they have about these outbreaks? If there's time, encourage students to use outside resources to answer these questions.

PART 2

This a modification of the popular Patient Zero activity.

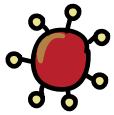
Before class, prepare test tubes filled halfway with water for each student. One of these should also have several drops of vinegar added. Be sure to keep track of this tube and give it to a student in the Africa group.

Split students into four groups, each representing a different geographical area featured in the Real Deals — Asia, Africa, Europe and North America.

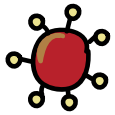
Once students are in groups, each team should draw one of the *Transmission Cards* and all the members of the team should follow the instructions on the card to determine who they "interact with." Model for students that "interacting" means pouring some of the liquid from your test tube into another person's test tube, and then pouring some back into your own tube so that the liquids mix.

You can feel free to create additional cards based on the student responses from Part 1 of this activity.

Once all cards have been played, place a few drops of pH indicator solution in each tube to see how the disease has spread across the different locations.



First day of school. Interact with someone from your table.



You work on a bird farm. Interact with someone from your table.

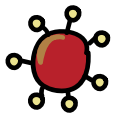
Office party! Interact with someone from your table.

Time for a vacation. Hop on a plane and interact with someone from a different table.

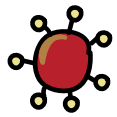
It's the Olympics and people from all over the world have come to celebrate. Interact with one person from EVERY table.

Sneezing on a city bus. Interact with someone from your table.

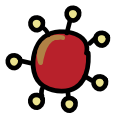
You're a mosquito that bites a bird at an outdoor market. That bird then gets put on a plane to become dinner for someone else. Interact with someone at your table AND then interact with someone at a different table.



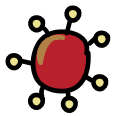
You are a bird that has been smuggled out of the country illegally. Interact with someone from a different table.



You're a mosquito who laid their eggs in a puddle on a shipping container. Interact with someone from a different table.



Stowaway — You're a mosquito that's buzzing around in a truck. Interact with someone from your table.



Stowaway — you're a bird that has accidentally ended up on a boat. Interact with someone from a different table.

You are a bird whose habitat is being destroyed — time to migrate. Interact with someone from a different table.

Material Activity

Quality Versus Quantity of Evidence

As we near the end of the story, stop and ask the students some of the following questions:

- Why couldn't they have stopped the mayor earlier? What did they need to know to stop her?
- Were there any details that the characters used to prove that it was not St. Louis encephalitis that were also used to prove it was West Nile?
- Looking back, particularly at the *Map App*, does it make sense that the birds, mosquitoes and water are all connected? Are there other explanations that still make sense?
- What are the key pieces of evidence that support the idea that the mystery illness is West Nile Virus?
- The characters found rat poison at three of the seven locations they mapped, but what if they had found them at five of the locations? Would this change anything or would you still think the bird deaths were caused by West Nile Virus. Why or why not?
- What about 15 rat poison signs versus a blood test indicating West NileVirus? Does quantity of evidence or quality of evidence matter more in this case?

Additional Resources
TedX Talk by Tracey McNamara, the real life inspiration for the character of Terry Macavoy.
youtube.com/watch?v=qm8NnL582uc

Discussion Activity

Letter to the Mayor

As a culminating activity, ask students to create a letter to the mayor that outlines the key components of the investigation and convinces her not to cancel the parade. To spark students' thinking, you can spend some time recapping each chapter. Be sure to encourage students to use their notes to cite specific evidence from the comic.

As an alternative, you can have students create video messages rather than written letters or invite students' families to a "press conference."