# Integrating Literacy and Science Practice Skills via Investigating the Effect of Honey Phenomenon in *Dr. Rosie Helps the Animals (K, 1, 2)*

Teacher Lesson Plan

## Lesson Summary

This two-day lesson is based on the book *Dr. Rosie Helps the Animals.* The first day consists of reading and processing the story, focusing on the various remedies Rosie uses. On the second day, students employ science practice skills while investigating the effect of honey phenomena. This experience gives students a foundational understanding of the importance of a controlled experiment as well as osmosis.

### Day 1: Literacy Skills (Common Core)

**Kindergarten**: CCSSELA-Literacy.SLK.1 Participate in collaborative conversations with diverse partners about *kindergarten topics and texts* with peers and adults in small and larger groups.

**Grade 1**: CCSS.ELA-Literacy.SL.1.1 Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.

**Grade 2**: CCSS.ELA-Literacy.SL.2.1 Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.

**Grades 1- 2** R.I.1.1. Ask and answer questions about key details in a text. (1-LS1-2), (1-LS3-1)

### Day 1: Cultural and Linguistic Practices

Note: *Dr. Rosie's* story provides several examples of natural remedies. This provides an authentic opportunity for students to share remedies they have learned about or experienced from their culture. From: Cultural and Linguistic Practices

★ Connect the book's content to your students' cultural and linguistic backgrounds.
★ Ask students to connect to the remedies in the story by relating them to their cultural experiences.
★ Ask relevant and inclusive questions that connect to all students from various backgrounds

### Day 2: Standards-Aligned Science Practice Skills

#### Kindergarten

**Analyzing and Interpreting Data**

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1)

#### First Grade

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions

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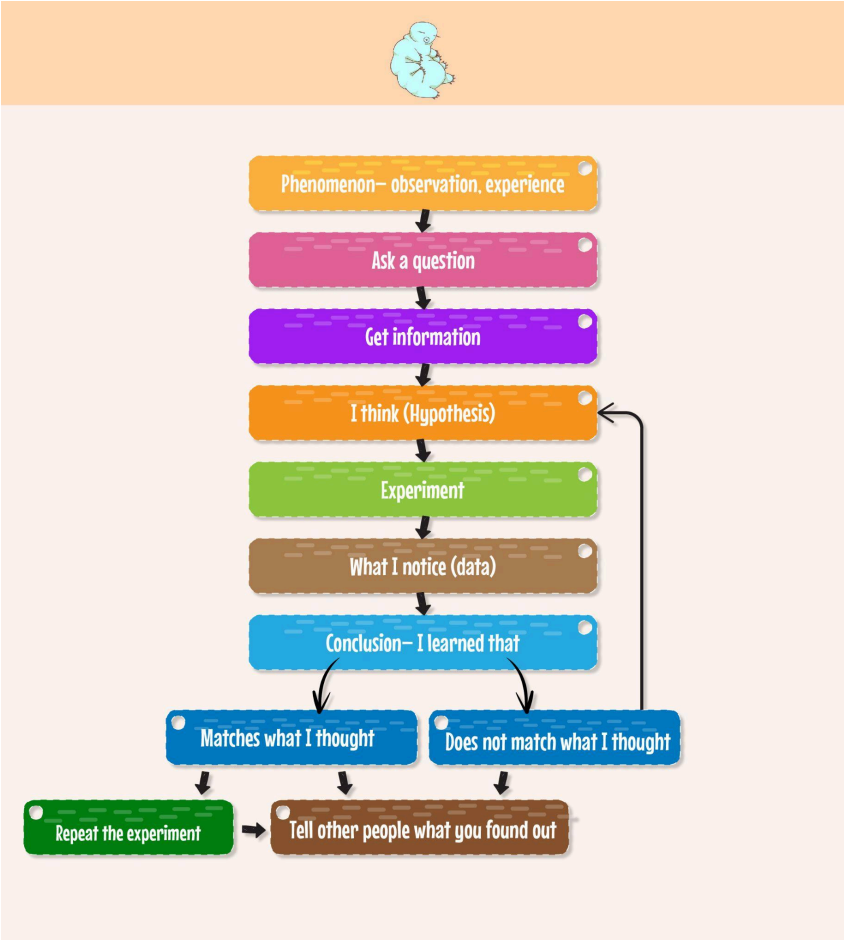
| | **Second Grade**<br>**Developing and Using Models**<br>Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.<br>• Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)<br><br>**Planning and Carrying Out Investigations**<br>Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.<br>• Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1) |
| **Phenomenon-based learning is included in the Next Generation Science Standards (NGSS)** |  |

# Day 1: Read and Process

| **Grade Levels**: K-2 | **Topic**: *Dr. Rosie Helps the Animals* (Read and process) | **Materials**<br>• *Dr. Rosie Helps the Animals* Book or Reading by Rozillia<br>• Remedies Phenomena Pupil Page: Manuka honey |
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## Lesson Objectives/Learning Goals:

- ★ Students will be introduced to veterinary medicine as a STEM profession through an engaging informational fiction story
- ★ Students will be able to identify the remedies Rosie used for each affliction.
- ★ Students will be able to compare and contrast Rosie's remedies with their own experiences.

| Time | Activity | Teacher Actions | Student Actions |
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| _____ minutes | Introduction to the *Dr. Rosie* story | **Questions**: *Have you ever been sick? What helped you get better?*<br>Today, you're going to meet a young person who helps animals get better! Listen to find out who *Dr. Rosie* meets and how she helps each animal. | Reply to the questions |
| _____ minutes | Story Reading and Scaffolded note taking (Remedies Phenomena Pupil Page) | Give each student a copy of Remedies Phenomena Pupil Page Manuka Honey<br>As you read the story, pause with each remedy. Ask kids if they have had that affliction and what remedies have they used at home. Ask students to match the affliction and remedy on the pupil page. | Listen to the story and match the animal with the remedy |


**and resume on day 2**

# Day 2: The effect of Manuka honey phenomenon-based guided-inquiry science lesson

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| **Grades levels** K-2 | **Topic**: Effect of Manuka Honey Phenomenon | **Materials**:<br>• (per group or as a demo) at least four condiment cups with double-strength plain gelatin in them (see prep directions below), toothpick, Manuka honey (ideally) but other kinds of honey can be tested, plastic spoon<br>• Effect of Manuka honey phenomena pupil page |

## Lesson Objectives/Learning Goals

- Students will utilize a variety of science practices to investigate the effect of Manuka honey on the growth of microbes on scraped gelatin (simulating a cut)
- Students will make connections between how Manuka honey prevents germs from growing on gelatin with the use of Manuka honey to kill germs on real cuts.

**To the teacher:** *This lesson provides a foundational understanding of how to set up a controlled experiment, a higher-grade NGSS skill standard. Content that is both general and specific to this guided inquiry is provided below.*

## Background Relating to this Investigation

*(The following summarizes key ideas from a transcript of a lecture on the use of medical-grade Manuka honey in veterinary medicine. The detailed transcript is found at the end of this lesson.)*

Honey has been used in food and medicines in many cultures for thousands of years. It has been used successfully to treat burns, ulcers, and infections in humans and animals, and it has a soothing effect on wounds. It is also non-toxic. As concerns about antibiotic resistance grow, natural infection-fighting products like Manuka honey are increasingly mainstream. Unlike antibiotics, the use of honey doesn't appear to lead to antibiotic-resistant bacteria.

Medical-grade Manuka honey is not off-the-shelf grocery store honey. It is from Australia and New Zealand. It can be eaten, but it is also used to treat traumatic wounds in veterinary medicine by applying it directly to wounds. It is most beneficial in the early stages of wound healing. Manuka honey is called a hyperosmotic agent because it quickly draws fluid away from a fluid-filled object. Other substances that have a similar effect are hypertonic saline, sugar, or dextrin-soaked dressings. A hypertonic solution has a high solute (what is mixed in like salt or sugar) and low water concentration (it is thick) compared to fluids in the body. Because of this, the net movement of water will be out of the body and into the solution. The effect of this is to dehydrate microorganisms and inhibit their growth. The hyperosmotic effect also cleans debris out of the wound and can reduce surrounding tissue edema. Honey is beneficial in the early stages of the healing process, but doesn't seem to show much benefit once the healing stages progress. Honey has enhanced antimicrobial effects that can't be explained by hyperosmolality alone. Honey produces hydrogen peroxide that is not as strong as store-bought peroxide which is why it is not as damaging to healthy tissue. It also has the presence of phytochemicals which are complex, non-peroxide, anti-microbial substances as well as having an acidic pH of 3.2-4.5. Other beneficial properties include the reduction of inflammation because of antioxidant contents.

### Summary of Benefits

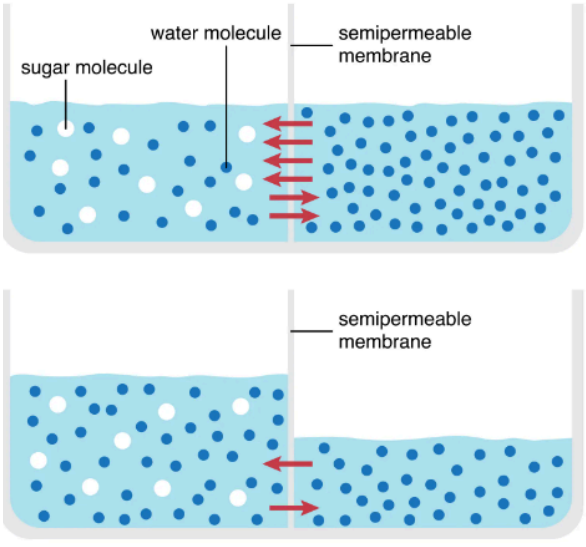
- Protects wounds and prevents contamination and infection
- Has a pH of 3.2-4.5 (acidic) which inhibits the growth of microbes
- Helps wounds heal
- Removes dead and dying cells and tissues
- May reduce reliance on antibiotics
- Safe and non-toxic—easy to apply
- Used topically so it is non-systemic

## Why Manuka Honey?

Manuka honey is a monofloral (the bees only get nectar from one kind of flower) honey originating in New Zealand from the flowers of *Leptospermum scoparium* trees. Manuka honey has high levels of an antibiotic substance called methylglyoxal (MGO), or unique manuka factor (UMF). Methylglyoxal has broad-spectrum antimicrobial activity. It has been effective against various organisms, even methicillin-resistant strains such as *Staphylococcus aureus, Pseudomonas, and Salmonella*. Other honey varieties such as kanuka contain MGO but not at the levels found in Manuka honey. Additionally, Manuka honey has been irradiated, not pasteurized, because heat destroys important chemical compounds. Store-bought honey is pasteurized. It kills yeast cells that can cause unwanted fermentation.

## Science Content Directly Related to this Investigation

Manuka honey has many properties that kill germs and prevent them from growing. Some of these properties are fairly complex, but one that kids can notice is that when Manuka honey is put on top of the gelatin, it becomes more watery over time. This means that water flows out of the jello into the Manuka honey due to osmosis (the flow of water from an area of greater concentration to an area of lesser concentration). At first, the Manuka honey is very thick (not a lot of water). Over time, it becomes more watery from water flowing out of the gelatin. This hyperosmotic property of Manuka honey is one way germs are killed or inhibited from growing because it dehydrates them. In this way, it acts like salt water– drawing water away from cells and thereby killing them.

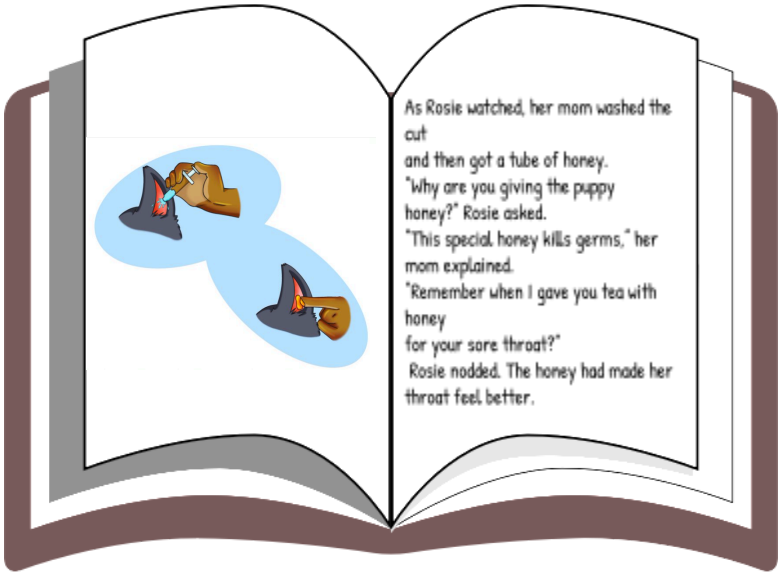


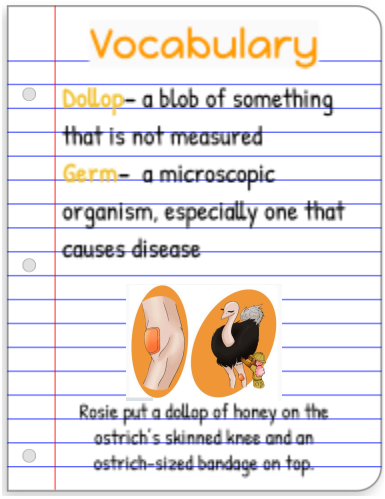


This shows the osmotic effect of Manuka Honey on wounds. Water moves out of the wound and into the honey because of osmosis, which is the movement of water across a semipermeable membrane from an area of high concentration to an area of low concentration.

# Pedagogy Style: Phenomena/Guided Inquiry

## Excerpt from Dr. Rosie Helps the Animals




## Experiment 1: The effect of Manuka* honey on the growth of germs (* Regulate honey can be substituted)

Note to the teacher: *Before starting the experiment, here are some possible questions to ask students:*

1. What do you think will happen to germs on a pretend cut if Manuka honey is put on them? What about a bandage and Manuka honey (like Rosie did for the Ostrich)? What about just a bandage?
2. What do you think will happen to germs on a pretend cut if nothing is done?


*Note the teacher:* You will need to do some prep before this experiment.

1. Make fake ballistic gelatin and put it into four condiment (or small dixie) cups (four cups per demo or lab group)
2. Follow the instructions below to make ballistic gelatin.
    a. Put two packets of plain gelatin and one cup of water into a microwaveable bowl.
    b. Whisk or use a fork to remove lumps.
    c. Microwave for 30 seconds.
    d. Use a measuring spoon to put the same amount of liquid gelatin into condiment cups. Two packets of plain gelatin and one cup of water can make about 12 small cups of gelatin.
    e. Put the cups with liquid gelatin on a tray and into the fridge. They will be ready within a half hour.

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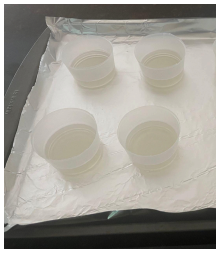
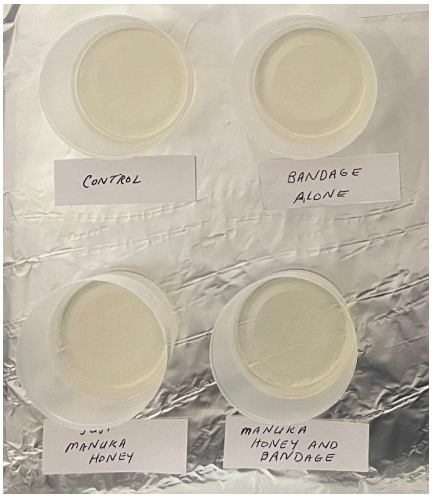
|  Two packs of plain gelatin from the store plus one cup of water |  |  |
|  |  |  |

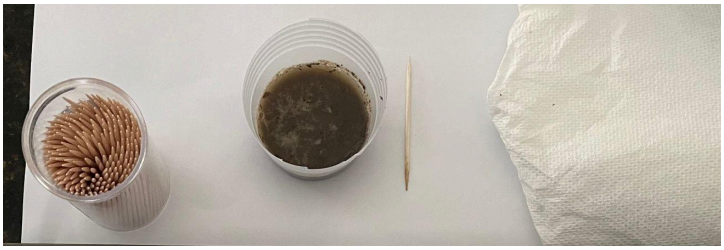
**Materials for the Manuka investigation:**
(Per demo or lab group)

- Four condiment cups with gelatin
- Toothpicks
- Muddy water
- A paper towel
- A tablespoon of Manuka honey*
- Two bandages large enough to cover the top of the condiment cups
- Small papers for labels
- Effect of Manuka honey pupil page

**Procedure:**

1. Tell students to pretend that the gelatin cups are like the skin on knees.
2. Instruct students to dip a toothpick into the muddy water and then wipe it off.
3. Use the "dirty" toothpick to put scrapes in the gelatin of one of the cups.
4. Label that cup: Control
5. Repeat steps 2 and 3 with a second cup. Label that Just Bandage
6. Repeat steps 2 and 3 with a third cup. Label that Just Manuka honey.
7. Repeat steps 2 and 3 with the fourth cup. Label that Manuka honey and Bandage
8. Put a bandage on the second cup.
9. Spread Manuka honey on the third cup.
10. Spread Manuka honey on the fourth cup and cover with a bandage.
11. Put the four cups in a warm place out of the sun. After 1 day, cover the cups with plastic wrap and secure the wrap with an elastic band. Finally, put the lids on each cup (over the plastic wrap).



## Extension Number 1

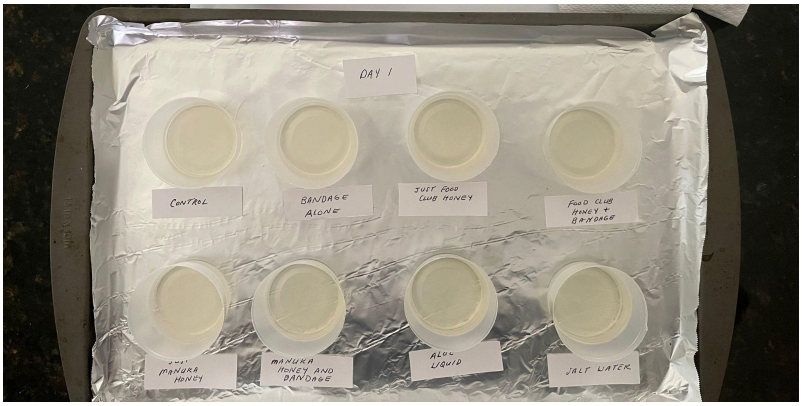
As an interesting extension, you can have more gelatin cups and kids can test the various substances that are mentioned in the book.

## Extension Number 2

Have an open-ended investigation with kids trying different things of interest-hand sanitizer, soap. Rubbing alcohol, etc.

## Extension Number 3

Rosie's mom says "This special honey kills germs." She is alluding to Manuka honey although it is not stated. Is Manuka honey special? Kids can test different kinds of honey to see how they affect the growth of microbes.




**Sample Results of Testing the Substances Used by *Dr. Rosie***

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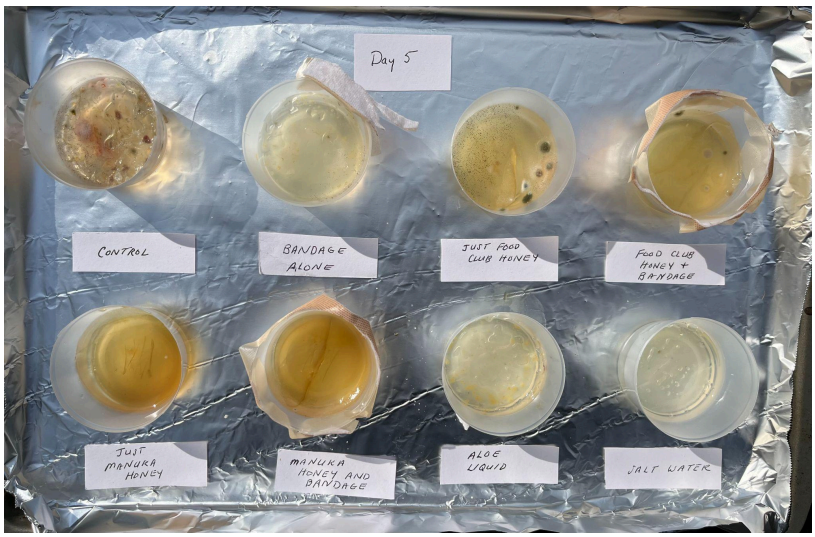



## Making Connections:

1. What happened to the fake skinned knee that had nothing on it? What about the skinned knee with just a bandage? What about the skinned knee with just Manuka honey? And what about the skinned knee with both Manuka honey and a bandage?

# Experiment 2: The effect of Manuka honey on the size of a shell-less swollen egg

Note to the teacher: *Before starting the experiment, here are some possible questions to ask students:*

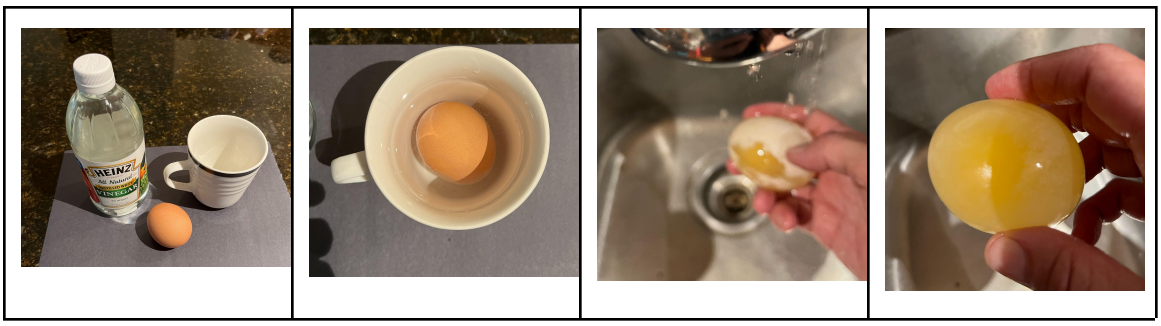
1. What do you think will happen to the size of a shell-less swollen egg when Manuka honey is put on it? Will it stay the same? Will it get larger? Will it get smaller?

**Materials for the Experiment:**

- One raw egg (if this is done as a demonstration) or several raw eggs (if kids, lab groups, etc. each get one)
- Vinegar
- Bowl
- Manuka honey
- Cup to put the egg in once it has no shell


*Note the teacher:* You will need to do some prep before this experiment.

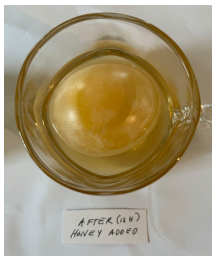
1. Put vinegar in a bowl. Put a raw egg in it. Let it stand for two days. The vinegar and calcium carbonate of the shell react with each other (creating calcium acetate), so the shell seems to disappear.
2. If, after two days, some shell is still on the egg, carefully rub the egg under running water so the shell comes off completely and exposes only the egg membrane.



3. You will notice that a shell-less egg is a lot larger than when it has a shell. This is because vinegar is mostly water–(4-7% acetic acid and 93-96% water) so, through osmosis, water moves into the egg once the shell is off.
4. Dry off the shell-less egg with a paper towel and put it in a cup.
5. Have students or you put Manuka honey on top of the egg (and put some under the egg if possible)
6. Let the set-up alone. Observe what happens over time.
7. Students can start working on the Pupil Page.


The shell-less egg on the right is swollen because water moved into it through the process of osmosis

The swollen shell-less egg should be carefully dried off before Manuka honey is put on it. This way, any water that appears on the outside is due to water moving out of the egg.




Over time, the thick Manuka honey will become more watery. This is the water that moved out of the egg due to osmosis. The egg is also smaller due to the water loss.


The Manuka honey egg is smaller due to the loss of water.

**Making Connections:**

1. What happens to the size of a swollen egg when Manuka honey is put on it? Why?
2. You can pretend that the swollen egg is like a germ. When Manuka honey is put on the egg, water leaves the egg. Remember that living things need water. If the egg is like a germ, can you explain how and why Manuka honey kills germs?

**Safety Concerns**: Once all of the test substances are on each of the condiment cups, allow them to sit out in the open at room temperature for a few hours. Then, cover each one with plastic wrap, an elastic band to hold it in place, and finally, the condiment lid. This way, any microorganisms that grow (mainly on the control) will be contained but kids can still see them. Some students may be sensitive to mold spores so covering the cups will contain the spores as well.

Off-the-shelf honey is often pasteurized to prevent possible contamination by Clostridium botulinum spores and to kill yeast that might undergo unwanted fermentation. If you use off-the-shelf honey, use raw hone. Manuka honey is irradiated to make it sterile.

Some people are sensitive or allergic to specific components in honey, particularly bee pollen. Although rare, bee pollen allergies can cause serious reactions. This application of honey in this lab can be done as a demonstration or the results can be shown to students.

## Technical information about the use of Manuka Honey in veterinary medicine
## Complete transcript from a lecture by Dr. Tiffany Stockman on October 22, 2023

Medical-grade Manuka honey is often used on traumatic wounds. Manuka honey is not your off-the-shelf grocery store honey. Medical-grade Manuka honey is from Australia and New Zealand and while it can be eaten, in the medical field we see the most benefit from application directly onto wounds. Manuka honey is considered a nonenzymatic debridement dressing that is used in the treatment of traumatic wounds particularly early on the healing stages. Other hyperosmotic agents that fall into this category would be hypertonic saline, sugar, or dextrin-soaked dressings. Because these agents are hyperosmotic, they dehydrate microorganisms and have an inhibitory effect on their growth. The hyperosmotic effect also draws exudate and accompanying debris out of the wound and can reduce surrounding tissue edema. Honey is beneficial in the early stages of the healing process, but doesn't seem to show much benefit once we start seeing the healing stages progress. Honey has enhanced antimicrobial effects that can't be explained by hyperosmolality alone. Honey produces hydrogen

peroxide which is released from the action of glucose oxidation. It has a much lower dilution of hydrogen peroxide compared to your store-bought peroxide which is why it is not as damaging to healthy tissue. It also has the presence of phytochemicals which are complex, non-peroxide, anti-microbial substances as well as having an acidic pH of 3.2-4.5. Other beneficial properties include reduction of inflammation because of antioxidant contents and facilitation of wound healing by stimulation of B and T lymphocyte proliferation, phagocytic activity, and cytokine release from monocytes. That was a lot of information about medical-grade Manuka honey and its use in the treatment of traumatic wounds in the veterinary field. I hope you find this beneficial and thank you for listening to me.


**Sources**

Educational rap on osmosis:

The Use of Medical-Grade Honey in Veterinary Medicine

Manuka Honey

Why Use Manuka Honey?

Use of honey for sore throats

Use of Manuka Honey-Dr. Karol Mathews, Ontario Veterinary College- (caution- graphic wound on dog images)
https://www.youtube.com/watch_popup?v=bYQYlWSwLmQE

Dr. Courtney Campbell
https://www.youtube.com/watch_popup?v=N9-ub5FMI-4

Further Reading About the Use of Manuka Honey in Humans

Hospitals Could Use Honey and Vinegar as Antibiotics for "Low Cost" Wound Care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